City of Naples

Critical Assets and Facilities Adaptation Plan

August 2024

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Acknowledgements

Project Team

City of Naples: Natalie Hardman and Katie Laakkonen, Natural Resources Division

AECOM

Cella, Molnar & Associates

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Executive Summary

The City of Naples (City) Critical Assets and Facilities Adaptation Plan (Adaptation Plan) is a comprehensive planning document that outlines a suite of strategies to reduce potential impacts posed by the climate hazards of flooding and extreme heat. Although the intensity of extreme weather events and sea levels is projected to increase in the coming decades, climate change is already affecting City residents, businesses, and neighborhoods. Many areas of the City regularly experience the effects of flooding from intense summer rainfall, coastal storm events, and predictable tidal inundation during King Tide conditions. In addition to flooding, the City is also subject to frequent high temperature days, which have cascading impacts to utility demands, use of City facilities, and the health of outdoor workers.

The Adaptation Plan builds on the findings of the City's Critical Assets and Facilities Vulnerability Assessment (Vulnerability Assessment), which was used to identify potential climate hazard susceptibilities to infrastructure, the community, and the environment. Strategies included in the Adaptation Plan were developed to specifically target City infrastructure and facilities identified as having the highest potential risk of damage and impacts to the community. Focus areas include City assets organized around critical infrastructure, transportation, community and emergency facilities, and natural, cultural, and historical resources (Figure ES-1).

Strategy Development and Prioritization

Through a combination of project evaluation criteria scoring, City staff input, and community feedback, a set of 47 ranked strategies were developed to enhance the City's resilience to climate hazards. To provide guidance for prioritizing implementation, recommended strategies were grouped into tiers, based on their evaluation criteria score and priorities expressed by City staff and the community.

Critical Infrastructure

Wastewater Treatment Plant
Wastewater Lift Stations
Sewer Lines
Electrical Substations
Stormwater Pump Stations
Drainage Outfalls

Transportation

Evacuation Routes
Primary North-South and East-West Connectors
Traffic Cabinets
Naples Airport

Community and Emergency Facilities

Community Centers
City Government Buildings
Affordable Housing Areas

Natural, Cultural, and Historical Resources

Parks
Wetlands
Beaches
Historical Buildings

Figure ES-1: Focus areas of Adaptation Plan

- Tier 1 (19 Strategies): Higher Priority
- Tier 2 (12 Strategies)
- Tier 3 (16 Strategies): Lower Priority

Strategies documented in the Adaptation Plan are not intended to be an exhaustive set of measures for enhancing the City's climate resilience or a list of actions the City is committing to implement. Rather, the listed strategies represent options for the City to consider that have been recognized for their ability to reduce identified climate hazard vulnerabilities, support City staff needs to protect managed infrastructure, and ability to provide long-term benefits to the community.

The plan includes a wide range of potential physical and non-physical (policy updates, additional studies, etc.) intervention types (Figure ES-2) to provide holistic climate hazard protection that goes beyond a reliance of adapting physical infrastructure to accommodate future conditions. Strategies also include a mix of low cost (less than $200k) actions that can be carried out promptly and more costly (more than $2M) projects with greater complexity that may require more time and resources to complete (Figure ES-3). This approach provides the City flexibility to consider different adaptation strategies over time.

Next Steps for Implementation

City staff will continue to coordinate and discuss how to move select strategies forward. This includes collaborating with regional partners and stakeholders, looking for opportunities to incorporate strategies into existing or planned City investments, and identifying external resources and funding mechanisms for more extensive projects.

To promote sustained implementation of the Adaptation Plan, the City could also provide annual updates to the community and elected officials on progress with carrying out actions or identify needed strategy modifications due to evolving priorities associated with changing environmental conditions and completion of other parallel planning projects across City departments.

Planning for and adapting to anticipated climate change impacts presents many challenges to the community. However, it also presents an opportunity to reimage how the City operates and can continue to prosper in the future. With ongoing and diligent implementation, strategies outlined in the Adaptation Plan will help to prepare the community for future flood and extreme heat conditions while enhancing the overall liveability of the City.

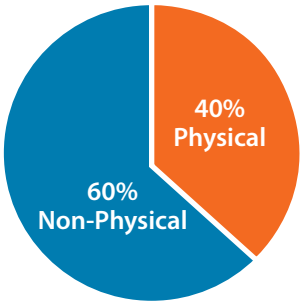

Figure ES-2: Breakdown of strategy types included in Adaptation Plan

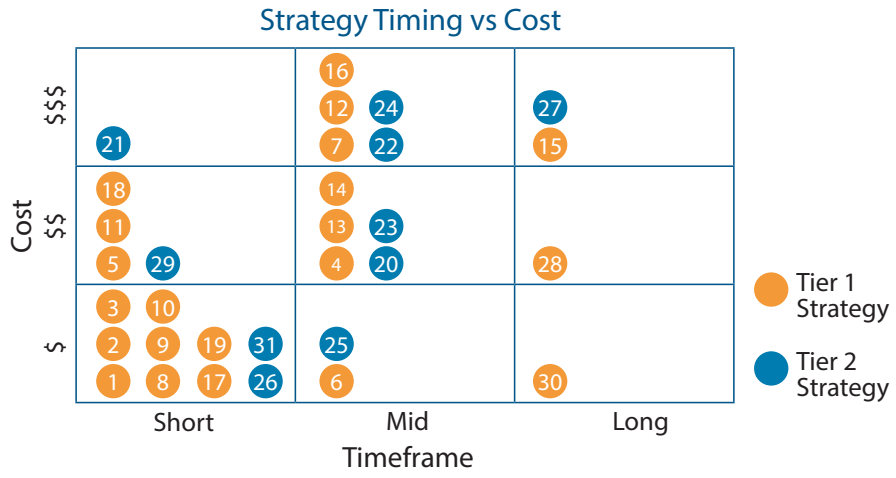

Figure ES-3: Diagram of implementation timing and cost for Tier 1 and 2 strategies

1 Introduction

The City of Naples (City) Critical Assets and Facilities Adaptation Plan (Adaptation Plan) documents the City's proposed approach to address potential impacts posed by climate hazards. This section sets the context and goals for the plan (Section 1.1) and overall report organization (Section 1.2).

1.1. Project Overview and Purpose

The City Adaptation Plan is a comprehensive planning document serving as a roadmap to help prioritize adaptation strategies, land use decisions, and investments to protect the City's built and natural infrastructure.

Climate change impacts are already affecting City residents, businesses, and neighborhoods through a combination of rising air temperatures, higher-than-normal tides, more intense summer rainfall, and coastal storms, which are all projected to worsen in the coming years. Like most communities, the City is tasked with balancing the demand for increasing development and protection of fragile environmental resources that attract residents and visitors to the area. Adding to the challenge is the threat that an evolving climate poses to existing infrastructure, ecological systems, and future planning efforts.

Planning for climate change is not only an opportunity to make infrastructure more resilient to hazards such as flooding and extreme heat, but it will also create more jobs, improve community spaces and public health, enhance the City's long-term economy, and make the City more equitable.

The Adaptation Plan is part of a three-phase process, summarized in Figure 1. It builds on the findings of the City's Critical Assets and Facilities Vulnerability Assessment (Vulnerability Assessment), occurring in Phase 1. The Vulnerability Assessment was used to identify potential climate hazard susceptibilities to infrastructure, the community, and the environment. The Adaptation Plan (Phase 2) focuses on developing potential actions to reduce vulnerabilities identified in the Vulnerability Assessment to support the pursuit for funding and implementation in Phase 3 of the process.

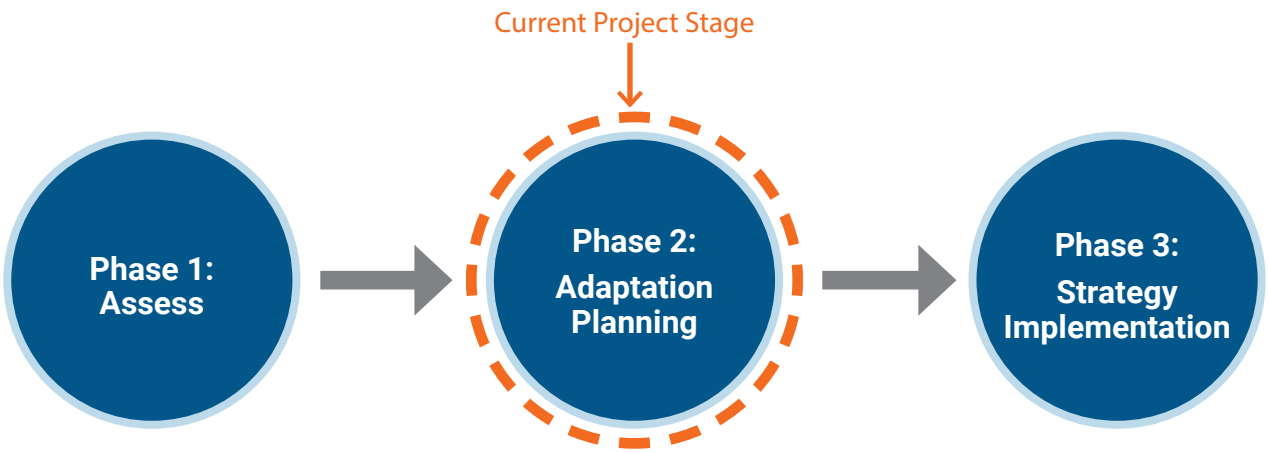

Figure 1: Steps in the adaptation planning process

Adaptation Plan Goals

Based on City staff and community input, the primary goals and objectives of the Adaptation Plan include:

Increase the resilience of Naples to both immediate- and long-term threats posed by climate change hazards

Protect and enhance public assets, natural resources, and quality of life for all

Identify actionable strategies supported by City leadership and the community

Engage with regional stakeholders to maximize strategy benefits and funding

1.2. Project Overview and Purpose

The Adaptation Plan documents a range of prioritized strategies for the City to consider for implementation to provide enhanced protection from existing and future climate hazards. The report is organized as follows:

Chapters

1. **Introduction** – provides background and context of the Adaptation Plan.
2. **Adaptation Focus Areas** – describes the types of vulnerable infrastructure prioritized for adaptation based on the findings of the Vulnerability Assessment.
3. **Strategy Development** – describes the process to develop a menu of strategies to reduce the identified climate hazard vulnerabilities of City infrastructure.
4. **Prioritized Strategies** – describes the evaluation process to rank potential strategies.
5. **Strategy Summary Sheets** – documents the description, funding sources, implementation actions, and project partners of prioritized strategies.
6. **Next Steps** – summarizes key findings and next steps to advance implementation of the adaptation strategies.

Appendices

- **A** Provides a description of individual strategies included in the adaptation menu.
- **B** Lists potential grant funding sources to consider for strategy implementation.
- **C** Documents the results of the climate change impacts public survey.


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2 Adaptation Focus Areas

Results of the City's Vulnerability Assessment show that many areas in the City are already affected by flooding and extreme heat, with the frequency and extent of impacts projected to increase by 2040 and 2070. In addition to providing insight of the progression of climate hazard exposure through the coming decades, the Vulnerability Assessment was used as a screening tool to identify the types and locations of assets that could be prioritized for adaptation. This section describes the asset types within each of the evaluated asset categories that were prioritized for adaptation based on the assessment.

2.1. Prioritized Assets

In the Vulnerability Assessment, assets were considered most vulnerable if they were exposed to climate hazards, had a combination of a high or moderate susceptibility to infrastructure damage (sensitivity), and a high or moderate community consequence of failure (consequence) (Figure 2). Asset types located in the upper right quadrant of the diagram were characterized as most vulnerable and prioritized as focus areas for consideration of potential adaptation strategies.

Assets identified as focus areas for adaptation were organized based on high level asset categories as defined by the Resilient Florida program (s. 380.093, Florida Statute):

Transportation Assets and Evacuation Routes Focus Areas

- **Critical Roadways**
  - Evacuation Routes
- **Important North-South Connectors**
  - Gulf Shore Boulevard
  - Crayton Road
  - Gordon Drive
  - 10th Street
- **Important East-West Connectors**
  - Park Shore Drive
  - Harbour Drive
  - Banyan Boulevard
  - Central Avenue
  - 5th Avenue South
  - Mooring Line Drive
- **Traffic Cabinets**
- **Naples Airport**

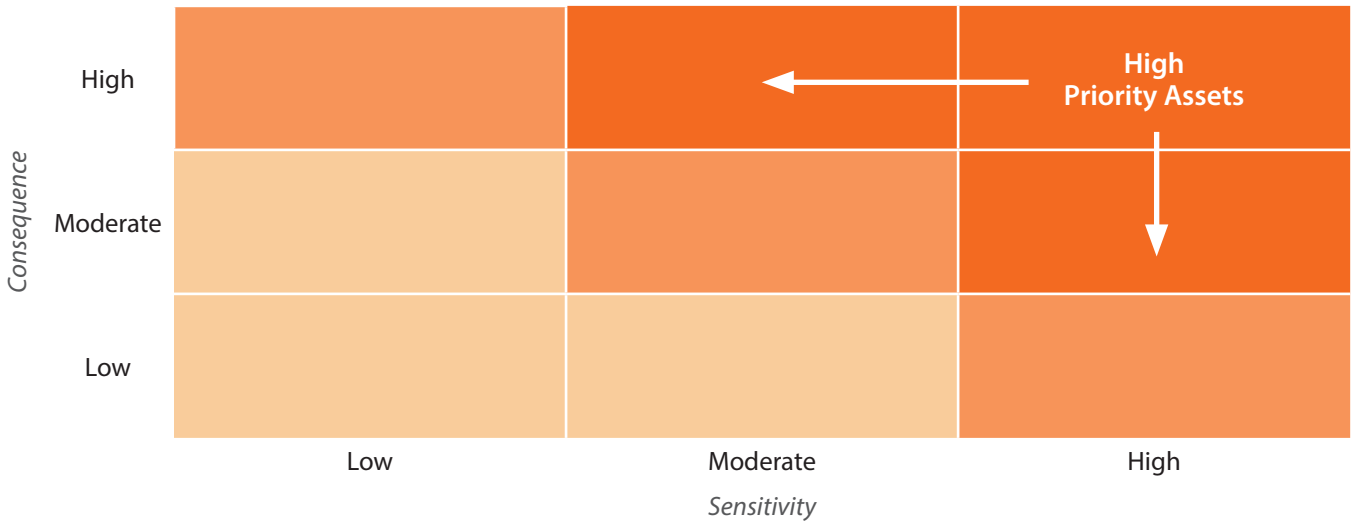


Figure 2: Conceptual approach to prioritize assets for adaptation

Critical Infrastructure Focus Areas

- **Wastewater Treatment Plant**
- **Wastewater Lift Stations**
- **Wastewater Sewer Lines**
- **Electrical Substations**
- **Stormwater Pumps Stations**
- **Stormwater Discharge Points**

Critical Community and Emergency Facility Focus Areas

- **City-owned Community Centers**
- **City Government Facilities**
- **Affordable Housing Areas**

Natural, Cultural, and Historical Resources

- **Parks**
- **Wetlands**
- **Beaches**
- **Historic Buildings**

Flooding of Police Department property during Hurricane Ian

3 Strategy Development

This section describes the process to develop a preliminary list of adaptation strategies to address key climate vulnerabilities. The preliminary list of strategies was developed to address climate hazard susceptibilities identified in the vulnerability assessment, prioritized adaptation focus areas, and a screening of ongoing City initiatives that may enhance the City's climate resilience.

The following subsections provide more detail on the approach and guiding principles used to define potential adaptation strategies (Section 3.1), the creation of an adaptation menu (Section 3.2), and the resulting list of preliminary strategies to be considered (Section 3.3).

3.1. Approach to Adaptation

Fundamental to the development of the Adaptation Plan was taking a holistic approach to enhancing climate hazard resilience of the City's assets and facilities. This means not only considering the retrofit of individual assets to accommodate future climate conditions, but also integrating climate concerns into City policies, planning, and design.

Figure 3 summarizes how strategies were categorized at a high level within the Adaptation Plan. Physical strategies focus on structural changes to the infrastructure (e.g., raising an electrical cabinet out of a flood zone or adding more tree canopy shade). Application of physical adaptation strategies can be applied on different scales: asset-specific and area scale. Asset-specific strategies focus on providing protection for an individual asset (e.g., raising a single generator) while area-scale strategies provide protection for multiple assets in a larger area (e.g., elevating a coastal roadway that doubles as a flood barrier for landward assets). As the extent and frequency of flooding worsens with future climate conditions, the cost effectiveness of addressing vulnerabilities on an asset-by-asset basis may be reduced, encouraging consideration of options for area-scale hazard protection.

Non-physical strategies focus on policy changes (e.g., incorporating sea level rise into design criteria) or obtaining additional information needed to better understand adaptation needs (e.g., performing additional modeling). Non-physical strategies are often completed in conjunction with or as a precursor to physical strategies by providing the supplemental information or political support needed to carry out many physical strategies.

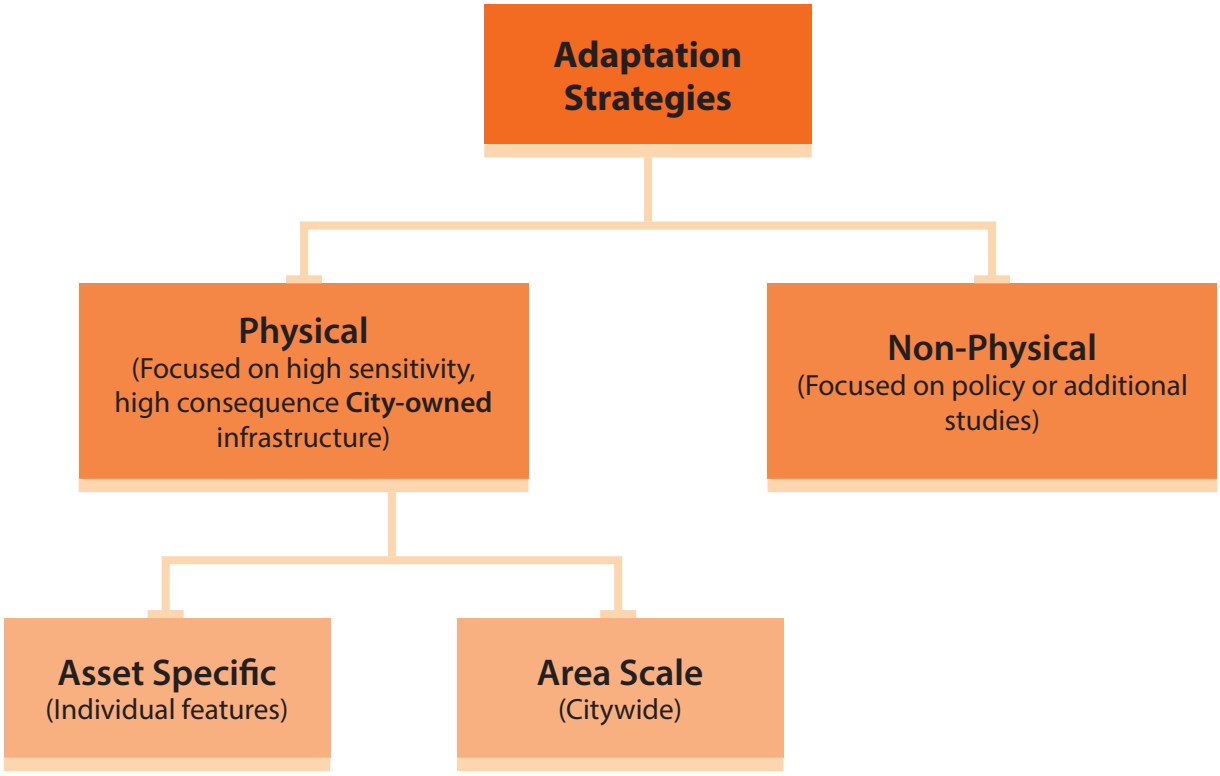


Figure 3: Categorization of adaptation strategies

During development of the Adaptation Plan strategies, several guiding principles were applied:

- **Focus on Public Assets** – Physical strategies outlined in the Adapaton Plan focus on public assets that provide broad services and benefits to the community. Public assets are fundamental to the function of day-to-day city operations and services, are often critical for life safety, and are necessary for the overall quality of life in the community. A focus on public assets also promotes an actionable plan because the City has a greater ability to implement changes for public assets than privately owned property. However, non-physical strategies, such as policy updates to City ordinances and building codes, will support a higher level of hazard protection for both public and private properties across the City.
- **Phased Approach to Adaptation** – The Adaptation Plan assumes that, although climate hazards will continue to worsen over the next several decades, the City does not have to adapt the entire community all at once. Building resilience will continue to be an ongoing process of revising governing policies and constructing infrastructure using considerations that anticipate changing environmental conditions. The Adaptation Plan also recognizes that established cycles of retrofit and rebuilding assets as they reach the end of their functional life offer an opportunity to re-evaluate the siting and design of those facilities to consider higher levels of protection from climate hazards.
- **Comprehensive Strategy Types** – Due to the large-scale climate hazard impacts facing the City, there are very few individual projects that will have a large effect on improving the City's overall climate resilience. Instead, building citywide resilience will require a comprehensive and progressive combination of physical and non-physical strategies to be implemented over time.
- **Strengthening Regional Partnerships** – While the City has the ability to respond to climate hazards through their authority to plan, regulate, tax, and contract for services, the widespread impacts of climate hazards pose complex challenges that can strain funding and staffing capabilities. Furthermore, climate change impacts are not restricted to the City's municipal boundary. Decisions about adapting or modifying land use and infrastructure with the City can affect neighboring areas and vice versa. The Adaptation Plan promotes, wherever practical, the ability to strengthen regional partnerships in Southwest Florida to share resources, leverage expertise, pursue funding opportunities, and develop coordinated approaches to foster cohesive resilience for the greater area.

3.2. Adaptation Menu

Recognizing that there is no single approach that will meet the City's climate hazard protection needs, a menu of adaptation strategies was developed to increase the resilience of future projects and existing infrastructure (Figure 4). The toolbox includes an array of physical and non-physical options that can be applied throughout the City to reduce the overall risk of climate hazard impacts.

To support identification of site suitability and level of hazard protection for physical strategies, a set of asset subcategories was created:

- **Temporary Strategies** include portable measures that are deployed immediately before an expected event to prevent or reduce asset or facility damages. They are typically modular in construction and can be used as a defense for asset-specific or area-scale protection.
- **Stormwater Strategies** include measures to address flooding by modifying the City's stormwater network. Approaches may include increasing the system capacity, preventing backflow of coastal waters into the network, or on-site retention and treatment.
- **Nature-Based Strategies** involve weaving natural features into the built environment to mimic their ability to reduce climate hazards.
- **Asset-Specific Strategies** are applied to provide protection of individual assets by raising, floodproofing, or relocating assets or facilities.
- **Shoreline Strategies** include modifications to the shoreline to mitigate coastal hazards. They typically provide area-scale protection for multiple assets.
- **Extreme Heat Strategies** include modifications to City infrastructure to reduce contributions to the urban heat island effect or addressing increased public health effects from rising temperatures.
- **Non-physical strategies** integrate consideration of climate hazards into City policies, planning, and design to support the implementation of physical strategies.

This high-level menu of options was used to develop an initial long list of potential strategies to consider. Workshops were held with City staff, City Council, and the public to review and refine the strategy options to determine which should be considered a priority or omitted (Refer to Section 4). Additional information, including a description and the hazards mitigated for each menu option is included in Appendix A.

Nature preserves along Naples coastline

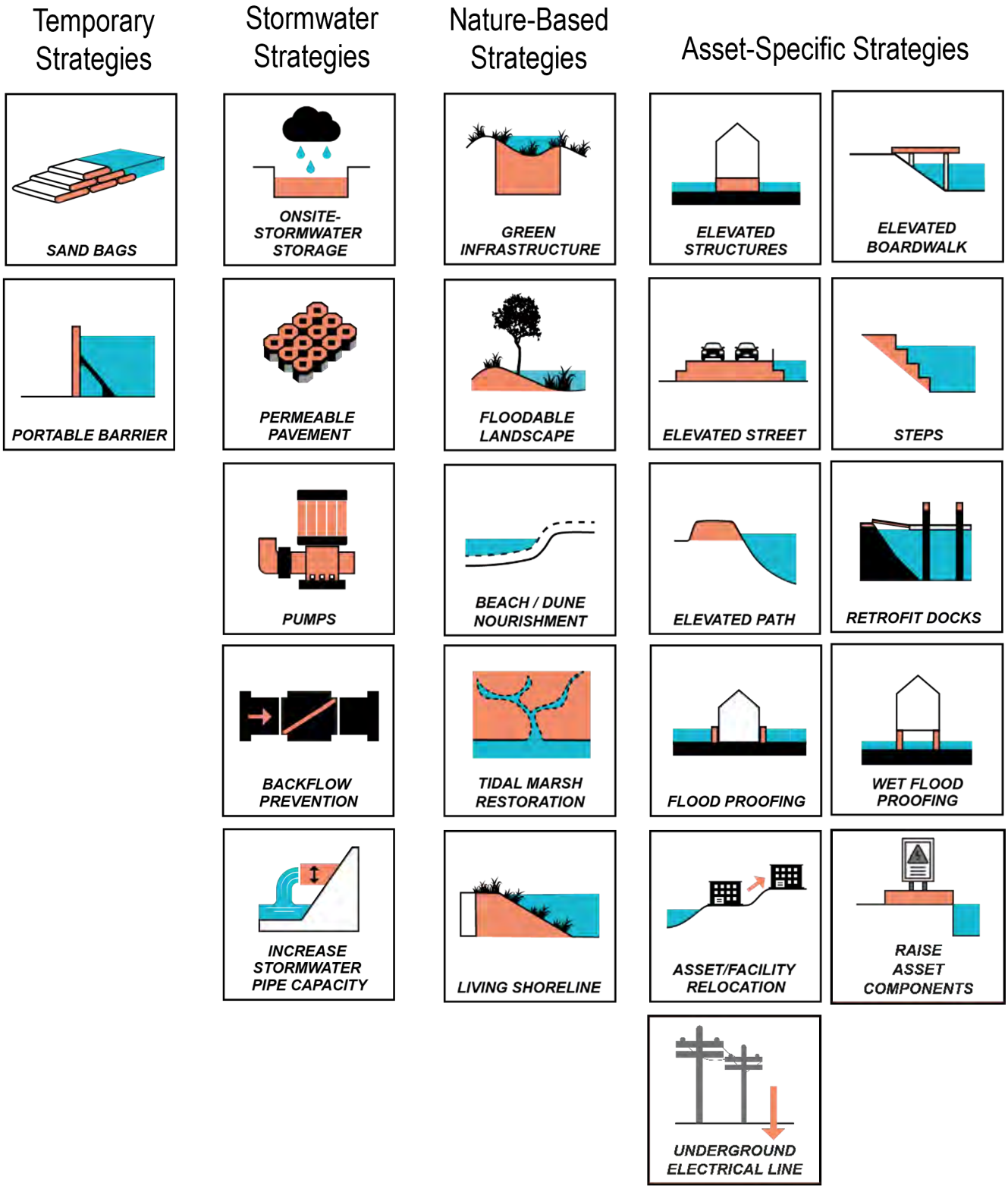
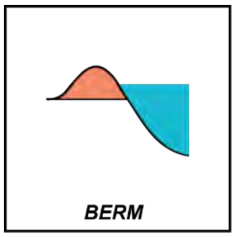
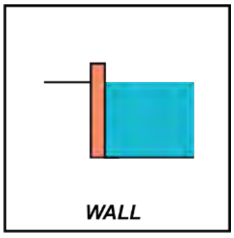
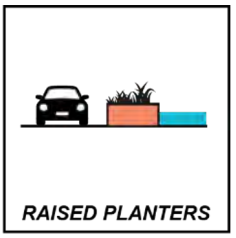


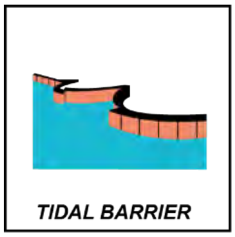
Figure 4: Menu of adaptation strategies

Shoreline Strategies

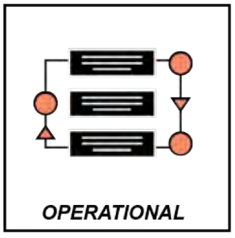




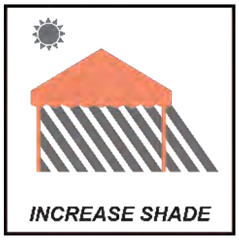


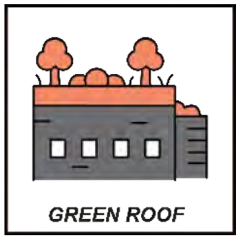


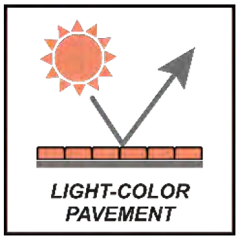
Non-Physical Strategies

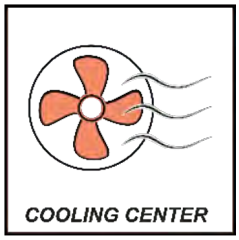


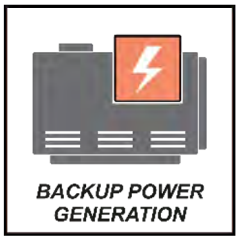
Extreme Heat Strategies









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4 Prioritized Strategies

The initial list of strategy options was refined and prioritized to identify a subset that were prioritized for further development in the Adaptation Plan. Prioritized strategies were those that rated highest based on a set of evaluation criteria or were otherwise designated as a priority during feedback sessions with the City's Resiliency and Adaptation Working Group (Working Group), community-wide online survey, and a workshop hosted with the Neighborhood Association Presidents Council (Figure 5). This section details the evaluation criteria used in the strategy ranking process (Section 4.1), the priorities identified by the Working Group (Section 4.2), and priorities identified by the community (Section 4.3). A finalized list of priority strategies is provided in Section 4.4.

Figure 5: Drivers of rankings for final strategies

4.1. Evaluation Criteria

The most successful adaptation strategies are those that can provide additional benefits beyond mitigating climate change impacts. Strategies that provide multiple benefits and limit negative impacts for the community are more likely to secure funding, political will, and community buy-in. A qualitative criteria framework was developed to evaluate the potential trade-offs of the initial list of strategy options to prioritize those that perform well across each of the criteria factors considered.

Evaluation criteria were organized into four (4) categories, presented in alphabetical order:

- **Engineering** – The ability of a strategy to integrate into regional planning efforts and the potential construction impacts caused during implementation.
- **Environmental** - The impacts a strategy may have on natural resources and ecosystems.
- **Implementation Feasibility** - The simplicity of strategy execution considering regulatory compliance, funding, and stakeholder support.
- **Social Benefits** - The benefits a strategy may have on community infrastructure, public health and safety, and quality of life in the surrounding area.

A preliminary set of potential evaluation criteria options was populated for each of the four categories based on a review of considerations applied in similar climate adaptation planning projects across the country. The full list of criteria was vetted by the City's Working Group and feedback was used to refine the list to three criteria per category, for a total of 12 criteria to evaluate each strategy (Figure 6).

A simple rating methodology was used to compare the tradeoffs among the strategies across each of the categories. Criteria were rated on a two-level scale of positive or neutral/unknown impacts with associated scores of 1 and 0, respectively. For each strategy, ratings across all criteria were tallied and summed to produce a strategy score ranging from 0 (low priority strategy) to 12 (high priority strategy). Table 1 provides descriptions of the selected criteria and definitions for how ratings were assigned.

Engineering	Environmental	Social Benefits	Implementation Feasibility
1. Protect City's Critical Assets	1. Improves water quality	1. Improves public health metrics (e.g., public access and access to emergency services)	1. Funding/ financing is partially or fully available
2. Ability to adapt to climate considerations over time	2. Protects, enhances, and expands sensitive habitats and ecosystem services	2. Enhances resilience of the transportation network and supporting systems	2. Capital and maintenance costs
3. Addresses multiple hazard types	3. Reduces or offsets energy consumption or improves energy efficiency	3. Reduces risk of injury or loss of life	3. Ability to implement given current policies and regulations

Figure 6: List of strategy evaluation criteria

Naples Waterfront (Source: Adobe Stock Image)

Table 1: Adaptation strategy prioritization criteria and rating rubric

Category	Criteria	Rating	Definition
Engineering	*Protects City's critical assets*	1	Strategy provides direct protection for the city's critical assets.
		0	Strategy does not provide direct protection for city's critical assets, or ability to provide protection is unknown.
	Ability to adapt to climate considerations over time	1	Strategy can be easily modified to adapt over time to maintain protection for anticipated future climate conditions.
		0	Strategy cannot be modified to adapt to anticipated future climate conditions, or adaptation capacity is unknown.
	Addresses multiple hazard types	1	Strategy addresses more than one hazard type.
		0	Strategy does not address more than one hazard type, or the ability to address multiple hazards is unknown.
Environmental	*Improves water quality*	1	Strategy improves local water quality of the city's drainage canals, retention areas, bays, and the Gulf.
		0	Strategy does not improve water quality of the city's drainage canals, retention areas, bays, and the Gulf, or impact is unknown.
	Protects, enhances, and expands sensitive habitats and ecosystem services	1	Strategy provides positive benefits to sensitive ecosystems and/or improves their ability to provide services to the community.
		0	Strategy does not benefit sensitive ecosystems and/or improve their ability to provide services to the community, or impact is unknown.
	Reduces or offsets energy consumption or improves energy efficiency	1	Strategy lessens energy demand and/or improves energy efficiency.
		0	Strategy does not lessen energy demand and/or improve energy efficiency, or impact is unknown.
Social Benefits	*Improves public health metrics*	1	Strategy produces positive impacts for city public health metrics.
		0	Strategy does not produce positive impacts for city public health metrics, or impact is unknown.
	Enhances resilience of the transportation network and supporting systems	1	Strategy enhances resilience of city's transportation network.
		0	Strategy does not enhance resilience of city's transportation network, or impact is unknown.
	Reduces risk of injury or loss of life	1	Strategy increases life safety and protection.
		0	Strategy does not increase life safety and protection, or impact is unknown.

Category	Criteria	Rating	Definition
Implementation Feasibility	*Funding/financing is partially or fully available*	1	Full or partial funding for strategy implementation has been previously identified to provide potential cost-sharing opportunities.
		0	Funding for strategy implementation has not been identified.
	Capital and maintenance costs	1	Strategy has capital and maintenance cost requirements that can be sustained by the city.
		0	Strategy does not have capital and maintenance costs that can be sustained by the city, or cost to implement strategy is unknown.
	Ability to implement given current policies and regulations	1	Strategy can be effectively implemented. city has the authority and capacity to take ownership and policy/ ordinances currently exist to support the strategy.
		0	Strategy may encounter implementation challenges due to policies or ordinances that prohibit the strategy, or the ability to implement is unknown.

4.2. Resiliency and Adaptation Working Group Strategy Priorities

Throughout development of the Vulnerability Assessment and Adaptation Plan, a Resiliency and Adaptation Working Group (Working Group) has convened at strategic points in the project to inform findings based on their working knowledge of evaluated City infrastructure and polices. The Working Group consisted of representatives from all City departments, divisions, and the Naples Airport to promote the selection of strategies that reflect the City's identified needs and priorities to achieve enhanced resilience.

In December 2023, a workshop was held with the Working Group to:

- Understand the status of existing projects already underway that could increase the City's resilience to climate change hazards
- Document additional project needs that could reduce the risk of City infrastructure
- Gauge preferences for strategy options to be included in the Adaptation Plan

In general, strategy concepts that received the largest amount of support from City staff were physical strategies targeted at alleviating existing climate hazard impacts to City infrastructure. Supported flood strategy concepts included elevation (major transportation routes, electrical panels and controls, power generators), stormwater drainage improvements (increase drainage capacity and stormwater inlet cleaning), floodproofing (wastewater lift stations and aging sewer mains), and event-based flood protection measures (deployable flood barriers for flood-prone City buildings).

Extreme heat strategies receiving the most support from City staff included some physical strategies but focused primarily on policy and informational studies to better inform extreme heat impacts and heat-reduction needs. Physical strategies included ways to increase shade and reduce elevated local temperatures (expand citywide tree planting program and pilot cool pavement projects). Policy strategies focused on updating building codes (promote cool roofs for public buildings and developing a heat ordinance for outdoor worker safety). Additional studies identified as needed include an urban heat analysis to better understand strategic placement of additional water fountains and increased shade opportunities.

Following the strategy preference workshop, a series of focused 1-hour interviews with individual Working Group members was set up in March/April 2024 to refine the narrative and implementation details of the prioritized list of strategies (Section 4.4). During the interviews, Working Group members provided information about historical climate hazard impacts to infrastructure, clarification of potential project needs to enhance resilience of the managed asset or facility, and insight of potential implementation feasibility challenges that should be considered during development of the strategy details.

4.3. Community Strategy Priorities

To inform the strategies prioritized in the Adaptation Plan, the City hosted a workshop with the Neighborhood Association Presidents Council in January 2024 (Figure 7). Table 2 lists the neighborhoods represented at the workshop.

The primary objectives of the workshop were to:

- Enable community leaders to understand the process and purpose of the Vulnerability Assessment and Adaptation Plan and encourage them to support the City with outreach to their respective neighborhood residents to participate in a digital survey.
- Further understand the impacts of climate hazards (flooding and extreme heat) through the perspectives of community members located across the city.
- Begin to document community preferences for potential adaptation strategies that will be recommended as part of the Adaptation Plan.

Table 2: Participating neighborhoods in the Resiliency Adaptation Workshop

Aqualane Shores Association
Coquina Sands
Gulf Shore Association of Condominiums
Moorings Property Owners Association
North Naples Beach Association
Old Naples
River Park
Royal Harbor
Seagate
Sun Terrace

Figure 7: Presidents Council participants

4.3.1 Workshop Activities

The workshop agenda included:

- A short presentation to provide an introduction to the project, an overview of the Vulnerability Assessment approach, and identified key vulnerabilities.
- An interactive breakout exercise where participants were asked to identify the climate hazards posing the most risk to the community and mark up a map of locations where climate hazard impacts are already being experienced.
- A short presentation of the process used to develop a list of adaptation strategies and evaluation criteria to rank them using a standardized process.
- A breakout exercise where participants were asked to vote on their top 10 strategies to include in the Adaptation Plan (Figure 8).
- A facilitated discussion of themes identified in the results of the strategy votes.
- An opportunity for the group to provide feedback on additional factors that may not be currently included in the project but could be important considerations to enhance the city's resilience.

Figure 8: Workshop participants voting on top strategy priorities

4.3.2 Key Community Workshop Themes

In general, participants were highly concerned about flood issues affecting City infrastructure and private property and agreed that action should be taken by the City to address the posed risks. Participants generally agreed that high tide and coastal storm flooding were the climate hazards of most concern to the City but acknowledged that it is often a combination of multiple factors (e.g., summer rainfall during high tide events) that creates the flooding being experienced more regularly. Extreme heat was not viewed as the most significant threat by any of the participants.

Several participants also shared that although the Adaptation Plan is considering impacts in 2040 and 2070, flooding is already affecting many public areas and private properties across the City under existing climate conditions. Participants generally agreed that strategy preferences should be given to infrastructure that is currently at risk.

The strategies with the most votes included a mix of both physical and non-physical approaches to adaptation:

- Elevating backup power for City facilities
- Replacing aging sewer mains
- Installing more stormwater pump stations
- Hardening electrical substations
- Continuing beach renourishment and dune restoration
- Coordinating with Collier County for regional protection
- Conducing a watershed master plan

Of the strategies receiving the most votes, the group generally agreed that the highest priority strategies included the following:

- Replacing aging sewer mains
- Installing more stormwater pump stations
- Continued beach renourishment and dune restoration

Several topics that participants felt could be beneficial to supplement the plan included:

- Maintenance dredging of ponds and canals to increase their capacity during flood events.
- Prioritize strategies that also enhance water quality issues (e.g., oyster restoration, mangrove expansion, etc.).
- Develop public-private partnership opportunities for private landowners to supplement City budgets in order to complete stormwater drainage and road raising projects that mitigate localized residential flood impacts.

4.3.3 Citywide Public Survey

In addition to the Neighborhood Association Presidents Council workshop, the City released a digital survey to the public to gather citywide input on existing climate hazard impacts affecting residents and gauge community input on preferred approaches to adaptation. In total, 213 responses were received. When asked about the types of adaptation measures the City should prioritize, the top three selections were stormwater upgrades, utility improvements, and elevated roads (Figure 9).

Results of the public survey are included in Appendix C.

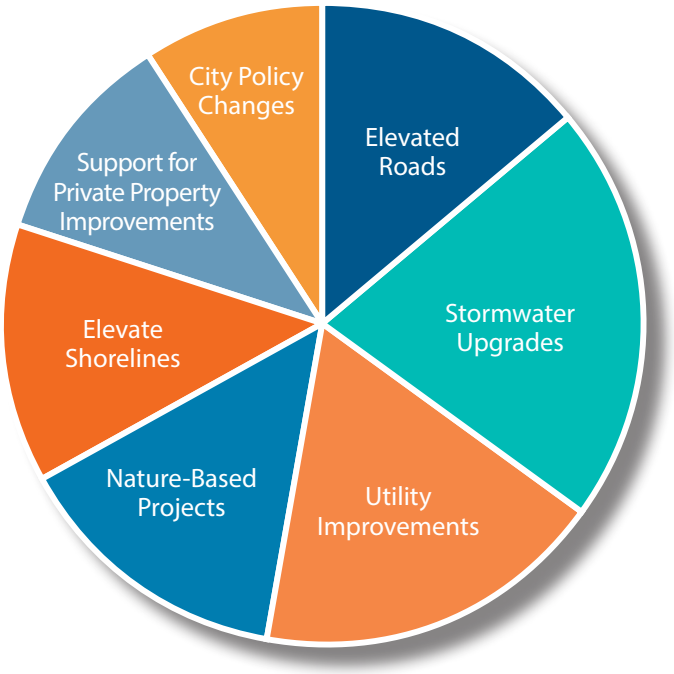


Figure 9: Breakdown of survey respondent preferences for types of adaptation

"I believe staying in front of climate changes, instead of having to adapt after problems occur, helps to keep Naples vibrant, saves money and could save lives."

"Providing more native Florida plants within parks, medians, and urban spaces will allow for more shade and help with urban heat."

"I have lived at this residence 50+ years and never have we had the amount of flooding as we've experienced the last 2 years."

"Planting more trees on avenues and streets would provide more shade in the summer when we walk around with our dogs and grand kid. It also helps cool down the streets."

"Flooding from high tides and rain are a recurring and chronic problem. Current city regulations limiting fill elevations to one foot after demolition of lower homes, seems in conflict with climate change and what lies ahead."

Quotes from digital citywide survey respondents

Flood Hazards

- More than 75% of respondents indicated experiencing flooding at least 7 days each year.
- Flood sources were most often linked to regular summer rainfall and high tide events.
- More than 80% of respondents selected roadways and walkways as the areas of the City most often observed as flooded.
- Top 4 priorities for assets that should be prioritized for protection included residences, businesses, transportation networks, and utilities.
- More than 60% of respondents "Strongly Agreed" that it is necessary for the City to take action to address flooding.

Extreme Heat Hazards

- Approximately 60% of respondents reported experiencing at least 7 days each year with a need to modify planned activities due to extreme heat conditions
- There was less agreement on the City's responsibility for extreme heat adaptation efforts.
  - » 40% of the respondents signified that the City needs to take action to address extreme heat.
  - » 20% do not feel the City needs to take action.
  - » 40% did not have an opinion.

Downtown Naples (Source: Adobe Stock Image)

4.5. Prioritized Strategies

Through a combination of project evaluation criteria scoring (Section 4.1), City staff input (Section 4.2), and community feedback (Section 4.3), a set of 47 ranked strategies were developed to enhance the City's resilience to climate hazards. To provide guidance for prioritizing implementation, recommended strategies were grouped into High, Mid, and Low tiers, based on the strategy score (Table 3) using the following breakdown:

- Tier 1 (19 Strategies): Score of 8 or above
- Tier 2 (12 Strategies): Score of 7
- Tier 3 (16 Strategies): Score of 6 or below

Strategies documented in the Adaptation Plan are not intended to be an exhaustive set of measures for enhancing the City's climate resilience or a list of actions the City is committing to implement. Rather, the listed strategies represent options for the City to consider that have been recognized for their ability to reduce identified climate hazard vulnerabilities, support City staff needs to protect managed infrastructure, and ability to provide long-term benefits to the community.

Scoring was the primary indicator of the overall benefit based upon the criteria used in the evaluation; however, prioritizing actions for implementation will require further evaluation and consideration of other factors. Implementation factors such as project complexity, estimated project cost, and the level of required coordination could be required to move a strategy forward. Some strategies will be more costly and complex than others and will, therefore, require more time and steps to implement while other strategies may be advanced on a shorter timeline due to overall lower project costs, lower complexity, and availability of existing resources. In addition, funding availability may shift how strategies are ultimately prioritized for implementation to take advantage of funding and technical support opportunities, such as Federal or State grant programs.

Additional details for each of the strategies are discussed in Section 5.

Strategy Breakdown

60% of prioritized strategies are non-physical actions focused on policy, additional studies, or coordination efforts to improve community resilience.

40% of prioritized strategies are physical strategies focused on infrastructure improvements.

Naples Beach (Source: Adobe Stock Image)

Table 3: Strategy score breakdown

#	Strategy Title	Strategy Type	FDEP Asset Class*	Tier	Score
1	Conduct a Watershed Master Plan	Non-Physical	CI, TAER	1	10
2	A Business Case for Resilience Study	Non-Physical	CCEF	1	10
3	Expand Coordination with County for Regional Flood Protection	Non-Physical	CI, TAER	1	10
4	Evaluate Options for Climate Hazard Protection of Socially Vulnerable Neighborhoods	Non-Physical	CCEF	1	10
5	Enhance Stormwater Debris Management Program	Non-Physical	CI, TAER	1	10
6	Increase Shade Opportunities in Neighborhoods	Physical	NCHR	1	10
7	Implement Naples Airport Master Drainage Plan Improvements	Physical	CI	1	9
8	Incorporate Consistent Sea Level Rise Considerations into City Planning and Design Documents	Non-Physical	CI, CCEF	1	9
9	Develop Climate Resilience Outreach Materials	Non-Physical	CCEF	1	8
10	Perform Summer Hot Spot Thermal Analysis	Non-Physical	NCHR	1	8
11	Continue Beach Nourishment and Expand Dune Revegetation Pilot Projects	Physical	NCHR	1	8
12	Install Additional Stormwater Pumps	Physical	CI, TAER	1	8
13	Harden Wastewater Treatment Plant and Elevate Shoreline	Physical	CI	1	8
14	Floodproof Wastewater Lift Stations	Physical	CI	1	8
15	Coordinate with FP&L to Harden Electrical Infrastructure	Non-Physical	CI	1	8
16	Install and Elevate Backup Power Generation for Critical Infrastructure	Physical	CI	1	8
17	Inventory Seawalls and Update Seawall Height Ordinance	Non-Physical	CI	1	8
18	Enhance Resilience of City Data Centers	Physical	CI, CCEF	1	8
19	Assess Opportunities for Natural Based Solutions	Non-Physical	NCHR	1	8
20	Continue Current Wastewater Sewer Maintenance and Replacement Program	Physical	CI	2	7
21	Elevate Airfield Electrical Vault	Physical	CI	2	7
22	Floodproof Stormwater Pump Stations	Physical	CI	2	7

#	Strategy Title	Strategy Type	FDEP Asset Class*	Tier	Score
23	Continue Efforts to Consolidate Current Coastal Stormwater Outfalls	Physical	CI	2	7
24	Identify and Raise Critical Roadways	Physical	TAER	2	7
25	Establish Flood Impact Monitoring Program	Non-Physical	CI, TAER	2	7
26	Monitor Naples City Dock Shoreline Improvement	Non-Physical	CI	2	7
27	Relocate and Elevate Police Station Complex	Physical	CCEF	2	7
28	Complete Mast Arm Conversion Projects	Physical	CI	2	7
29	Pilot Cool Pavement Projects	Physical	TAER	2	7
30	Update Climate Projections as Necessary	Non-Physical	CCEF	2	7
31	Create Vehicle Storm Relocation Plan	Non-Physical	CCEF	2	7
32	Expand Oyster Reef Restoration	Non-Physical	NCHR	3	6
33	Develop SLR Best Practices for Businesses	Non-Physical	CCEF	3	6
34	Convert Fleischmann Park into A Floodable Park	Physical	NCHR	3	6
35	Expand Cooling Center Network	Physical	CCEF	3	6
36	Survey Public Drinking Fountains	Non-Physical	CI	3	6
37	Develop an Extreme Heat Educational + Awareness Program	Non-Physical	CCEF	3	6
38	Expand Cooling and Efficiency Funding Program	Non-Physical	CCEF	3	6
39	Incentivize Cool/Green Roofs	Non-Physical	CCEF	3	6
40	Survey City Buildings FFEs	Non-Physical	CCEF	3	5
41	Install Temporary Flood Barriers for City Facilities	Physical	CCEF	3	5
42	Develop Historic Building Flood Guidelines	Non-Physical	CCEF	3	5
43	Conduct a Climate Action Plan	Non-Physical	CCEF	3	4
44	Develop a Homeowner's SLR Guide	Non-Physical	CCEF	3	4
45	Establish Home Flood Improvement Grant Program	Non-Physical	CCEF	3	4
46	Establish Extreme Heat Monitoring Program	Non-Physical	CCEF	3	4
47	Purchase Emergency Response Watercraft	Non-Physical	CCEF	3	2

**FDEP Asset Class Key: CI = Critical Infrastructure; CCEF = Critical Community and Emergency Facilities; NCHR = Natural, Cultural, and Historical Resources; TAER = Transportation Assets and Evacuation Routes.*

5 Strategy Summaries

This section presents a series of summary sheets prepared for each of the prioritized strategies. Each sheet includes additional information to support strategy funding and implementation, with the level of detail varying for each priority tier. The collection of strategy summary sheets is phased to be carried out across a variety of time frames and with a range of potential strategy leads and supporting partners. They are designed to provide a comprehensive approach to enhancing the City's resilience to flooding and extreme heat hazards.

The following graphic outlines the content included in the Tier 1 strategy summary sheets. Tier 2 strategy sheets provide similar information, but with less detail to focus on a strategy description, strategy lead, order of magnitude cost, and implementation timing. Tier 3 strategies are documented in a table and include a brief description of the strategy.

Additional information on specific funding opportunities listed in the Tier 1 strategy sheets is described in Appendix B.

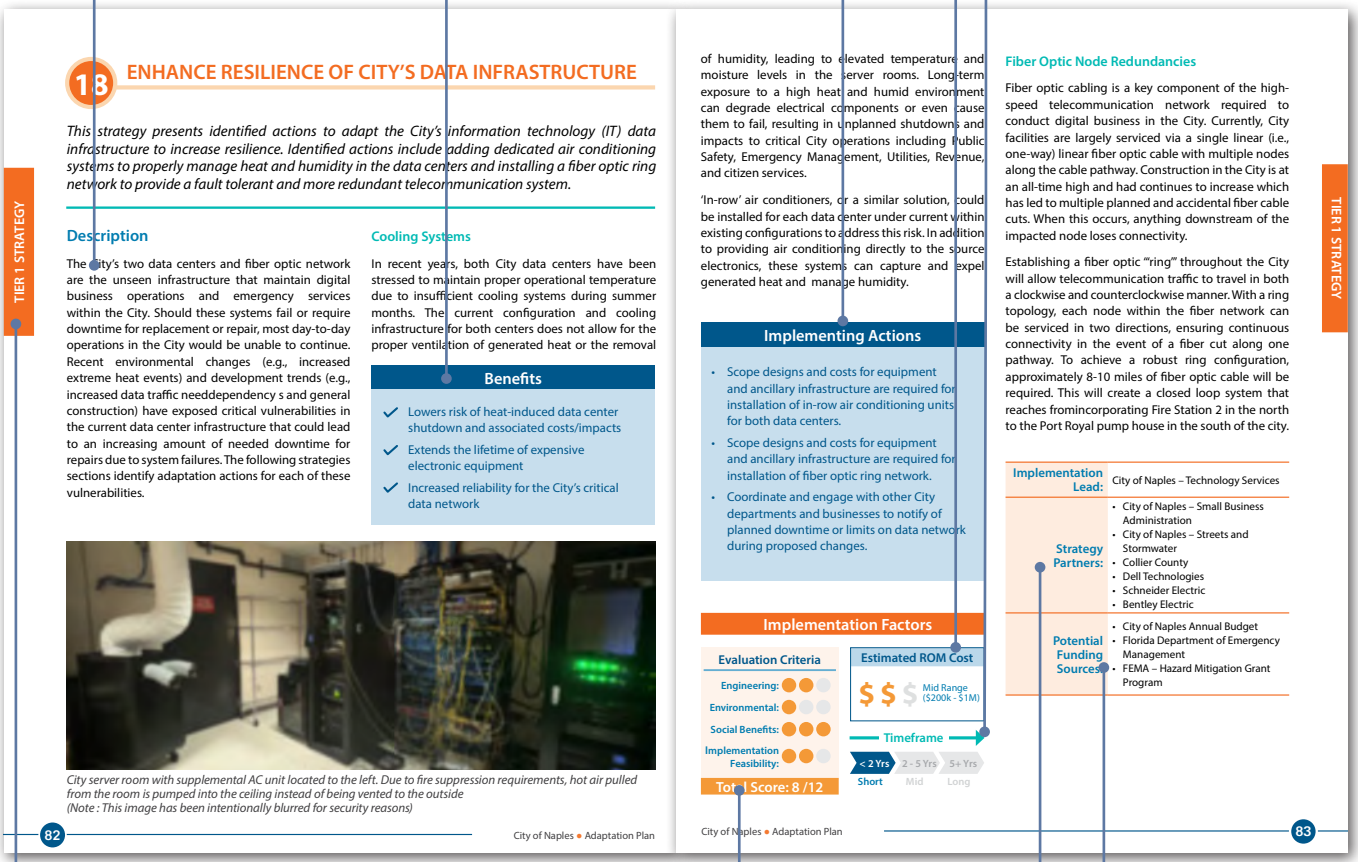
DESCRIPTION
Background and details of strategy

IMPLEMENTING ACTIONS
Supporting actions that may be needed to carry out strategy

COST
Rough order of magnitude cost:
$ (<$200k)
$$ ($200k - $1M)
$$$ (> $1M)

BENEFITS
Key benefits of the strategy

TIMEFRAME
Timeline to begin implementation



TIER 1 STRATEGY

13 ENHANCE RESILIENCE OF CITY'S DATA INFRASTRUCTURE

This strategy presents identified actions to adapt the City's information technology (IT) data infrastructure to increase resilience. Identified actions include adding dedicated air conditioning systems to properly manage heat and humidity in the data centers and installing a fiber optic ring network to provide a fault tolerant and more redundant telecommunication system.

Description

The City's two data centers and fiber optic network are the unseen infrastructure that maintain digital business operations and emergency services within the City. Should these systems fail or require downtime for replacement or repair, most day-to-day operations in the City would be unable to continue. Recent environmental changes (e.g., increased extreme heat events) and development trends (e.g., increased data traffic needdependency s and general construction) have exposed critical vulnerabilities in the current data center infrastructure that could lead to an increasing amount of needed downtime for repairs due to system failures. The following strategies sections identify adaptation actions for each of these vulnerabilities.

Cooling Systems

In recent years, both City data centers have been stressed to maintain proper operational temperature due to insufficient cooling systems during summer months. The current configuration and cooling infrastructure for both centers does not allow for the proper ventilation of generated heat or the removal

Benefits

- Lowers risk of heat-induced data center shutdown and associated costs/impacts
- Extends the lifetime of expensive electronic equipment
- Increased reliability for the City's critical data network

City server room with supplemental AC unit located to the left. Due to fire suppression requirements, hot air pulled from the room is pumped into the ceiling instead of being vented to the outside
(Note : This image has been intentionally blurred for security reasons)

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of humidity, leading to elevated temperature and moisture levels in the server rooms. Long-term exposure to a high heat and humid environment can degrade electrical components or even cause them to fail, resulting in unplanned shutdowns and impacts to critical City operations including Public Safety, Emergency Management, Utilities, Revenue, and citizen services.

'In-row' air conditioners, or a similar solution, could be installed for each data center under current within existing configurations to address this risk. In addition to providing air conditioning directly to the source electronics, these systems can capture and expel generated heat and manage humidity.

Implementing Actions

- Scope designs and costs for equipment and ancillary infrastructure are required for installation of in-row air conditioning units for both data centers.
- Scope designs and costs for equipment and ancillary infrastructure are required for installation of fiber optic ring network.
- Coordinate and engage with other City departments and businesses to notify of planned downtime or limits on data network during proposed changes.

Implementation Factors

Evaluation Criteria
Engineering:
Environmental:
Social Benefits:
Implementation Feasibility:
Total Score: 8 /12

Estimated ROM Cost
$ $ $ Mid Range ($200k - $1M)

Timeframe
< 2 Yrs Short | 2 - 5 Yrs Mid | 5+ Yrs Long

Fiber Optic Node Redundancies

Fiber optic cabling is a key component of the high-speed telecommunication network required to conduct digital business in the City. Currently, City facilities are largely serviced via a single linear (i.e., one-way) linear fiber optic cable with multiple nodes along the cable pathway. Construction in the City is at an all-time high and had continues to increase which has led to multiple planned and accidental fiber cable cuts. When this occurs, anything downstream of the impacted node loses connectivity.

Establishing a fiber optic "'ring"' throughout the City will allow telecommunication traffic to travel in both a clockwise and counterclockwise manner. With a ring topology, each node within the fiber network can be serviced in two directions, ensuring continuous connectivity in the event of a fiber cut along one pathway. To achieve a robust ring configuration, approximately 8-10 miles of fiber optic cable will be required. This will create a closed loop system that reaches fromincorporating Fire Station 2 in the north to the Port Royal pump house in the south of the city.

Implementation Lead: City of Naples – Technology Services

Strategy Partners:
- City of Naples – Small Business Administration
- City of Naples – Streets and Stormwater
- Collier County
- Dell Technologies
- Schneider Electric
- Bentley Electric

Potential Funding Sources:
- City of Naples Annual Budget
- Florida Department of Emergency Management
- FEMA – Hazard Mitigation Grant Program

TIER 1 STRATEGY

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STRATEGY PRIORITY
Tier 1 (Highest)
Tier 2 (Medium)
Tier 3 (Lowest)

EVALUATION CRITERIA
How the strategy scored for each of the considered criteria

LEAD AND PARTNERS
City departments and other organizations that could support strategy implementation

FUNDING SOURCES
Potential eligible grants or funding opportunities to implement strategy

Figure 10: How to read the strategy diagram

Naples Shopping District (Source: Adobe Stock Image)

1 CONDUCT A WATERSHED MASTER PLAN

This strategy recommends the creation of a watershed master plan (WMP) to provide a more comprehensive understanding of the City's flooding risk, improve land-use management decisions, and improve the community's score within the National Flood Insurance Program's Community Rating System (CRS), thereby lowering insurance rates for residents.

Description

A WMP is an important next step in the City's flood management strategy. The City's current understanding of flood risk is primarily informed by a combination of stormwater modeling completed for individual drainage basins across the City and a record of observed flooding obtained through resident flood complaints. While basin-scaled stormwater models provide in-depth information about stormwater infrastructure needs within the evaluated drainage basins, they do not consider potential flooding from natural flood sources, such as rivers and bays that originate from outside of the city's jurisdictional boundary and may be contributing to incoming flood volumes. Flood models used to develop a WMP are designed to provide a more comprehensive representation of flood sources and typically consider more intense design storms (e.g., 100-year rainfall event) than traditional municipal stormwater models (e.g., 10-year or 25-year rainfall event).

WMPs can also provide insight into land management patterns. Watershed flood models can highlight areas of intense runoff or where the watershed

Benefits

- ✓ Potential reduced insurance costs for residents
- ✓ More comprehensive understanding of City's regional flood sources
- ✓ Ability to make more informed regional land use decisions that reduce City's flood risk

The Gordon River watershed is a major potential flood source for the City (Source: Gulfshore Life, Nick Shirghio)

would benefit from increased water storage areas or watershed restoration to mitigate downstream flood issues. The ability to visualize flooding influences at this scale can lead to more-informed land-use management and zoning decisions, improvements in water quality, and the development of additional flood mitigation strategies.

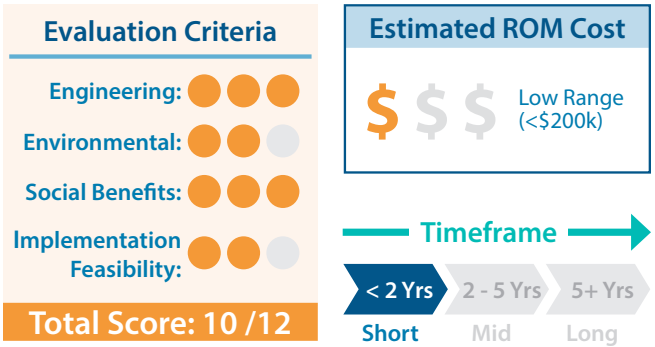
Completion of a WMP will increase the City's eligibility to achieve a higher class rating in the National Flood Insurance Program's (NFIP) Community Rating System (CRS), a voluntary incentive program that recognizes community efforts that exceed minimum flood protection requirements in the NFIP. The City is currently rated at Class 6 and actively pursuing Class 4 eligibility. One of the pre-requisites for achieving a Class 4 is completion of the WMP. The City can also earn increased credit by considering future flood scenarios in the WMP, such as those used by the City's Sea Level Rise Vulnerability Assessment if they are expanded to the entire modeled watershed.

To achieve this strategy, the City is exploring partnerships with local universities and the Florida Department of Emergency Management (FDEM) to develop the WMP, including data gathering, conducting flood modeling, creating the plan, and identifying larger-scale flood mitigation strategies to reduce impacts from identified flood sources.

Implementing Actions

- Identify the appropriate project partners to coordinate data collection, perform watershed modeling, and develop plan.
- Define the boundaries of the watershed to consider. A larger watershed boundary may capture increased flood sources but will also increase the cost of the study.
- Comparison with CRS program requirements to ensure the final WMP will increase City's eligibility for higher credit class within the CRS program.
- Communication plan to share results of the WMP with relevant City departments to improve the design of capital improvement projects, such as the stormwater system.

Implementation Factors



Implementation Lead:	Buildings Department and Natural Resources Division
Strategy Partners:	• Florida Atlantic University • Florida Department of Emergency Management • Federal Emergency Management Agency
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Emergency Management • Florida Department of Environmental Protection Springs and Watershed Restoration Program • FEMA Hazard Mitigation Grant Program • USDA National Resources Conservation Service Watershed Rehabilitation Program • EPA Healthy Watersheds Protection Program • EPA WaterSMART Cooperative Watershed Management Program

2 A BUSINESS CASE FOR RESILIENCE STUDY

Beyond the physical effects of flooding, the economic consequences of these damages to infrastructure and communities are important to understand. This strategy examines the City's economic risk of flood hazards and the business case for investing in resilience.

Description

The City has completed a climate change vulnerability assessment to understand the types and locations of infrastructure and facilities that are most susceptible to damage due to flood hazard exposure. However, understanding the economic consequences of flood hazard impacts can help encourage continued action to address the challenges the City faces.

This strategy focuses on completing a benefit-cost analysis to compare the cost of adaptation strategies with the cost of damage that could occur if no action is taken. When the ratio of the benefits is greater than one, an investment can be considered economically justified. In addition to an analysis of direct physical damages, the study can also account for cascading effects such as business disruption, traffic delays, and loss in critical services. It is also possible to look at the co-benefits of the adaptation investments, such as job creation and increases in recreation space.

Benefits

- ✓ Contributes to the understanding of projected returns on investments of flood adaptation strategies
- ✓ Enhances public will for action
- ✓ Engages business community as a partner in making climate-resilient investments

Similar analysis has been completed for Southeast Florida and the Tampa Bay regions

Similar efforts have been completed on a multi-county scale for the Tampa Bay[1] (Making the Economic Case for Resilience in Tampa Bay) and Southeast Florida[2] (The Business Case for Resilience in Southeast Florida), areas where the economic benefits of resilience were compared with the avoided economic losses. In both studies, the work was completed as a collaboration of public and private sector partners who shared a commitment to enhance the well-being of the regions. The economic analysis that was used to reinforce the value of coordinated actions and multi-sector engagement was a critical step to inform decision making around how best to protect communities and businesses within the evaluated counties.

Implementing Actions

- Engage with potential local private sector partners to gauge interest in collaboration.
- Determine which resilience strategies would be well-suited for benefit-cost analysis

Implementation Factors

Evaluation Criteria

Engineering: ●●●
Environmental: ●●●
Social Benefits: ●●○
Implementation Feasibility: ●●○

Total Score: 10 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples - Public Works Department
Strategy Partners:	• Greater Naples Chamber of Commerce
Potential Funding Sources:	• City of Naples Annual Budget • Private local developers or investment firms based in Naples • FDEP Resilient Florida Program

The City can commit to promoting a resilient economy through strategic investments and collaboration between public and private sectors (Source: Jerome Labouyrie / Adobe Stock Photos)

[1]https://issuu.com/tampabaypartnership/docs/making_the_economic_case_for_resilience_in_tampa_b
[2]https://seflorida.uli.org/business-case-for-resilience-southeast-florida/

3 EXPAND COORDINATION WITH COUNTY FOR REGIONAL FLOOD PROTECTION

This strategy focuses on increasing coordination between the City and County to develop regional flood protection best practices, mitigation options, and funding opportunities for potential actions.

Description

Planning for and responding to flood hazards often requires a multi-jurisdictional approach to effectively address the magnitude of potential impacts across a region. Flood mitigation planning completed without coordination with neighboring jurisdictions can lead to a disjointed approach due to conflicting codes, ordinances, and varying levels of flood protection, potentially worsening flood impacts.

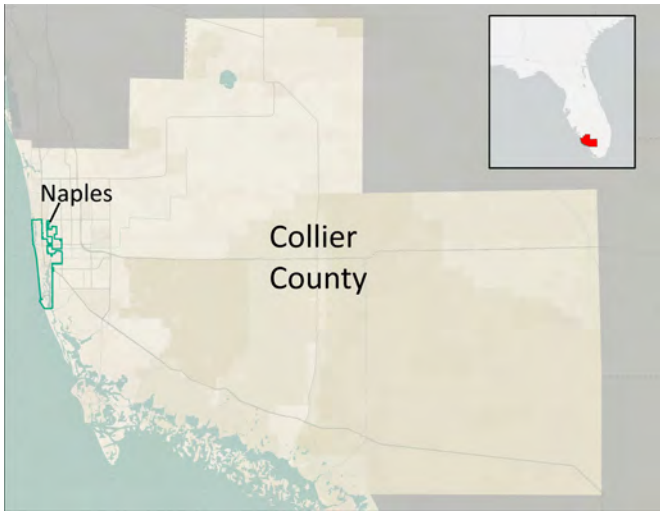
The City currently coordinates with the County for several flood hazard initiatives, including

- Hurricane evacuation warnings;
- Post-storm clean up;
- Beach nourishment activities;
- Quarterly Floodplain Management Planning Committee Meetings; and
- The USACE Collier County Coastal Storm Risk Management Feasibility Study.

These current efforts have established a beneficial relationship with both the City and County committing resources and staff time to identify opportunities to increase the region's resilience to flood hazards. This strategy supports the City's

Benefits

- ✓ Establishes a formal mechanism to promote cross-jurisdictional coordination to reduce flood risk
- ✓ Serves as a platform for coordinating pursuit of new funding opportunities for flood protection projects
- ✓ Potential increase in CRS Class and insurance savings for residents



Naples is the largest city within Collier County

continued coordination with the County through these activities and to capitalize on these working groups to further expand regional flood protection.

The City and County could set up a series of focused meetings within the Floodplain Management Planning Committee Working Group to discuss outcomes of their respective climate change vulnerability assessments and adaptation planning efforts completed for the separate jurisdictions. This transfer of knowledge could allow the City and County to identify shared flood hazard susceptibilities and develop opportunities to collaborate at a regional level scale to address these shared vulnerabilities.

Coordination between the two entities could also be useful for identifying opportunities for potential State and Federal funding or cost sharing for regional-scale flood protection measures that would benefit both the City and County. Lastly, the City and County could coordinate on projects that earn credits in the National Flood Insurance Program's Community Rating System program to increase the scale of the project, and therefore the credits earned.

Implementing Actions

- Identify key City and County staff to attend focus group meetings.
- Present findings of the Critical Assets and Facilities Vulnerability Assessment and Adaptation Plan.
- Identify list of flood protection projects that would benefit from coordination with the County.

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●●○
Social Benefits: ●●●
Implementation Feasibility: ●●●

Total Score: 10 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples
Strategy Partners:	• Collier County – Community Planning & Resiliency Division • Collier County – Building Plan Review & Inspection
Potential Funding Sources:	• City of Naples Annual Budget • Collier County Annual Budget • FEMA Safeguarding Tomorrow Revolving Loan Fund Program

TIER 1 STRATEGY

4 CLIMATE HAZARD PROTECTION OPTIONS FOR SOCIALLY VULNERABLE NEIGHBORHOODS

This strategy recommends potential solutions to mitigate extreme heat and flooding impacts in the City's historically disadvantaged neighborhoods. Options include creating a continuous seawall around the River Park East neighborhood and adding heat refuge areas throughout the neighborhoods and Charlie C Anthony Park.

Description

The East and West River Park neighborhoods house many of the City's low-income homeowners and renters. Although the neighborhoods are impacted by the same frequent flooding and extreme heat hazards as other City's residents, they have fewer resources to respond and recover, making them disproportionately vulnerable.

The City's latest Community Redevelopment Agency's (CRA) Redevelopment Plan includes targeted actions to improve these neighborhoods while retaining affordable housing[1]. For example, the CRA Redevelopment Plan highlights drainage and shoreline repairs that would mitigate flooding impacts in these neighborhoods. However, the CRA Redevelopment Plan does not contain messaging on resiliency and adaptation actions to prepare these communities for climate hazards. This strategy focuses on complementing the current CRA Redevelopment with actions and projects that the City could pursue to make these neighborhoods more resilient in advance of future climate impacts. To accomplish this task, the strategy should include strong partnerships with non-profit and community-based organizations that

Benefits

- ✓ Reduction in flood damages occurring in socially vulnerable neighborhoods
- ✓ Increased shade canopy and heat refuge areas in socially vulnerable neighborhoods
- ✓ Improved public access and amenities in Charlie C Anthony Park

George Washington Carver Apartments (River Park West) were constructed at grade and experienced flooding during Hurricane Ian (Source: Google Maps)

specialize in assisting disadvantaged communities. These organizations can assist with conducting the necessary public engagement and the equitable implementation of projects, even at a pilot scale.

Flooding

Residents of both River Park neighborhoods have previously notified City staff of a need for assistance in dealing with localized flooding impacts[1]. River Park East is characterized primarily by waterfront single-family homes along the Gordon River. Homes have limited flood protection from a mix of low seawalls and riprap structures, but the condition of these structures has not been maintained and the designs and elevations are not uniform throughout the neighborhood[1]. During high water coastal events (e.g., King Tides and coastal storms) low shorelines can be overtopped, flooding adjacent properties and roadways. To address existing and future flood risks, the following upgrades could be considered:

- **Seawalls** – Neighborhood seawalls could be retrofit, raised, and expanded to create a continuous protection structure with a uniform minimum height.
- **Elevated Pathway** - The seawall around residential areas could be tied into an elevated pedestrian pathway around Charlie C Anthony Park to provide consistent flood protection of the area.
- **Property-Specific Actions** - Supplemental strategies, such as improving stormwater drainage and elevating individual properties or homes may also be required to address inland localized flood issues.

Conceptual diagram of recommended strategies for the East River Park Community

[1]Naples Community Redevelopment Agency – CRA Neighborhood Plans for: River Park East, River Park West, Lake Park & The Design District (2020)

The apartment complex and parking lot of River Park West are areas of low elevation that receive runoff from the adjacent FPL property and retail areas, which contributes to flooding during heavy rainfall events. During Hurricane Ian, many first floors of these buildings were flooded. To reduce flood conditions, the City could consider the following upgrades:

- **Stormwater Improvements** - Identify areas where additional rainfall storage areas or drainage infrastructure could be installed, particularly throughout the apartment parking lots and adjacent properties.
- **Elevate Buildings and Infrastructure** - The City could work with the apartment complex management to elevate the buildings or raise electrical infrastructure located at ground level.
- **Deployable Barriers** - Provide deployable flood protection for building entry ways to prevent floodwater from entering homes.

Extreme Heat

In both River Park East and West, there are few shaded or water-based opportunities to escape from extreme heat conditions. At Charlie C Anthony Park, much of the open space areas, including the perimeter pedestrian path is exposed to direct sunlight. Without areas of heat refuge available, residents of both neighborhoods are susceptible to the health impacts of extreme, which discourages outdoor activities. This strategy supports the City in increasing shade cover and providing additional heat refuge areas in these neighborhoods as the occurrence of extreme heat days and length of summer heat waves is expected to increase.

In coordination with other strategies, the City could prioritize these neighborhoods for projects that address extreme heat including the increased planting of large canopy trees (Refer to Strategy 06), where to pilot cool pavement projects (Refer to Strategy 29) and where to expand the City's cooling center network (Refer to Strategy 35). In addition to the provision of extra shade, the City could install "splash-pads" or other water-based recreational features at Charlie C Anthony Park as alternative heat refuge areas, particularly for children.

Implementing Actions

- Engage with the neighborhoods to confirm preferred strategies to improve flood and extreme heat resilience.
- Incorporate climate resilience and adaptation actions in the next update of the Community Redevelopment Action Plan.
- Identify potential non-profit organizations or other agencies as project partners that specialize in working with disadvantaged communities in addressing climate hazards.

Implementation Factors

Evaluation Criteria

Total Score: 10 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples
Strategy Partners:	• City of Naples – Community Redevelopment Agency • City of Naples – Parks, Recreation & Facilities • City of Naples – Utilities • City of Naples – Streets and Stormwater • Habitat for Humanity • Collier Community Foundation • River Park Homeowners Association
Potential Funding Sources:	• State of Florida Legislation Funds • FEMA Public Assistance Program • FEMA Hazard Mitigation Assistance Program • FEMA Building Resilient Infrastructure and Communities • NOAA National Integrated Heat Health Information System • CDC Climate-Ready States and Cities Initiative Grants • EPA Environmental and Climate Justice Community Change Grants Program • EPA Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program • EPA Building Blocks for Sustainable Communities • USDA Forest Service Urban and Community Forestry Program

Most of Charlie C Anthony Park has limited shade opportunities (Source: Google Maps)

Stillwater Cove Apartments in River Park East (Source: Jon Austria/Naples Daily News)

5 ENHANCE STORMWATER DEBRIS MANAGEMENT PROGRAM

This strategy recommends that the City obtain additional street sweeping and vacuum truck vehicles to further reduce annual stormwater system cleaning costs and to prioritize additional areas of the City that may need more frequent cleaning.

Description

Streets and parking lots can quickly accumulate pollutants and debris (sediment, trash, leaves) and, when combined with stormwater, can lead to water quality impacts and localized flooding due to clogged stormwater drains. Street sweeping and stormwater catch basin maintenance can minimize these effects by capturing debris before it enters the system, providing a preventative and more cost-effective approach of stormwater management.

Benefits

- ✓ Reduced stormwater maintenance costs
- ✓ Reduced localized flooding during heavy rainfall events
- ✓ Fewer roadway disruptions due to maintenance

The City's streetsweepers prevent trash and debris from clogging the stormwater system.

The City currently employs a dual strategy to prevent debris from entering the stormwater system. At major stormwater inlets, the City has installed metal-frame baskets that are regularly cleaned by the City's vacuum truck to capture large debris materials. The City also currently utilizes two street sweeper vehicles to capture debris from major roadways and curb gutters six days a week. City maintenance staff have noted that, in the areas serviced by the street sweepers and vacuum trucks, there has been reduced maintenance needs of the stormwater system.

This strategy focuses on expanding the success of this program by purchasing an additional street sweeper and vacuum truck. Interviews with City staff noted that the additional vehicles would increase the coverage of the debris management program and add important redundancy should any of the vehicles need to be serviced. With the additional resources, the City can identify further priority areas in the City that may not being serviced regularly. The City's stormwater basin assessment studies may be helpful to determine frequently flooded areas of the stormwater system that could benefit from enhanced debris cleaning.

Implementing Actions

- Identify streets and areas of the City that would benefit from enhanced debris management.
- Evaluate potential purchase and vehicle maintenance costs of new vehicles.
- Develop operations and management plan to utilize additional resources most effectively.

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●●○
Social Benefits: ●●●
Implementation Feasibility: ●●●

Total Score: 10 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples – Streets and Stormwater
Strategy Partners:	No other strategy partners identified
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Environmental Protection Water Quality Improvement Grant • Florida Department of Environmental Protection State Water Quality Assistance Grant • EPA Clean Water State Revolving Fund • FEMA Safeguarding Tomorrow Revolving Loan Fund Program

6 INCREASE SHADE OPPORTUNITIES IN NEIGHBORHOODS

This strategy recommends the City expand current shade coverage through the use of natural features, such as large-canopy trees, and the construction of artificial shade structures. The proposed program should also include public engagement and education efforts to communicate to residents the value of providing increased shade, particularly using native hardwood tree species.

Description

In recent decades, the City has experienced an increase in the number of high-heat (>90° F) days and longer-duration summer heatwaves[1]. Regional high temperatures are worsened by the City's rapid growth and expanded urban areas, which can contribute to urban heat island effects that raise local temperatures. Exposure to elevated temperatures can lead to significant health impacts (e.g., heat stroke, heat exhaustion), particularly among older individuals, children, and outdoor workers. The use of shade structures, including large canopy trees, can limit direct heat exposure and can help to reduce regional urban heat island effects.

Benefits

- ✓ Reduced risk of public heat-induced illnesses
- ✓ Increased biodiversity of urban canopy
- ✓ Increased public awareness of high heat risks and solutions
- ✓ Improved air quality

In addition to reducing local temperatures, the City's urban forest program has many additional benefits: improved air quality, energy conservation, decreased stormwater runoff, and improved property values

[1]City of Naples- Critical Assets and Facilities Vulnerability Assessment (2023)
[2]City of Naples – Urban Forest Plan (2020)

Only about one-third of the City's public spaces currently have tree canopy (i.e., shade) coverage[2]. Since the 1990's, the City has had a robust street tree planting program focused on replacing dead or fallen exotic and palm species with native hardwood species, such as live oaks, green buttonwoods, and non-invasive tropical exotics like the Royal Poinciana to their extensive benefits for shade, improved air quality, and ability to withstand storms. This strategy focuses on expanding the current tree planting program by identifying areas that would benefit from increased shade coverage, particularly public and pedestrian spaces such as sidewalks, playgrounds, and parks.

In areas with limited feasibility for tree planting (e.g., bus stops, narrow sidewalk easements, under powerlines), the City could explore adding artificial structures, such fabric canopies or shelters. To inform best practices on placement of various shade options, the City could develop a shade placement guidance document to assist City staff in consistent decision-making. Shade priorities may be able to leverage findings from other strategies, such as a thermal hot spot analysis (Refer to Strategy 10) to identify areas with elevated summertime temperatures, development of an extreme heat monitoring program (Refer to Strategy 46) to track long-term effectiveness of increased shade on temperature, and prioritized shade options for socially vulnerable neighborhoods (Refer to Strategy 04).

This program, particularly the replacement of palms with hardwoods, would benefit from a targeted public outreach program to convey the importance of shade cover in preventing heat related health issues. The program has received pushback from some residents concerning the planned replacement of palms due to their iconic South Florida appearance. Engagement with the public may take a variety of forms including, informational sessions ahead of planned tree replacements to demonstrate the project benefits, seeking public input on locations in need of more shade, or developing a citizen science and leadership urban forester program to assist in tree inventories, community education, and public advocacy for the need for increased hardwood species.

Implementing Actions

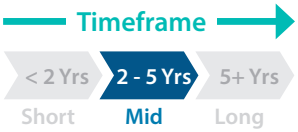
- Utilize existing tree canopy maps and public engagement to identify areas that would benefit from increased shade coverage.
- Update the City's Street Tree Program best practices for the "Right Tree, Right Place" approach using insights from tree damage due to recent hurricane events.
- Develop proposed alternative shade options for areas not suitable for tree plantings.
- Develop a targeted public outreach program to advocate for planned tree replacements that highlights the benefits of hardwood species.

Implementation Factors

Evaluation Criteria

Total Score: 10 /12

Estimated ROM Cost



Implementation Lead:	City of Naples – Parks, Recreation and Facilities
Strategy Partners:	• City of Naples – Natural Resources • City of Naples – Planning • City of Naples – Streets & Stormwater • Florida Department of Agriculture and Consumer Services - Urban and Community Forestry Program • Naples Botanical Garden
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Agriculture and Consumer Services - Urban and Community Forestry – Plantings, Preservation, and Invasive Control (UCF-PPIC) • Florida Power & Light • EPA Environmental and Climate Justice Community Change Grants Program • USDA Forest Service Annual National Urban and Community Forestry Challenge Cost Chare Grant Program • USDA Forest Service Urban and Community Forestry Program

TIER 1 STRATEGY

7 IMPLEMENT NAPLES AIRPORT MASTER DRAINAGE PLAN IMPROVEMENTS

This strategy recommends implementing the proposed actions of the Naples Airport Master Drainage Plan. Strategies may include converting open swales to a piped underground stormwater retention system to improve pollutant filtering and discourage wildlife and the construction or reconfiguring of stormwater ponds.

Description

The Airport is an important facility for recovery operations in the event of hazard events impact the City. It is located adjacent to the Gordon River, and is vulnerable to flooding temporary storm-induced flooding, sea level rise, and projected increasing storm frequency and intensity. The airport also treats and conveys runoff from over 400 acres of runoff from adjacent industrial areas to the east and northeast. To assess drainage and water management function at the airport and implement a multi-phased approach to improve stormwater concerns, the Airport is conducting a Master Drainage Plan (Drainage Plan) that will culminate in a set of flood mitigation and water quality improvement projects. This strategy

Benefits

- ✓ Reduced risk to aircraft from birds
- ✓ Reduced flood impacts to Airport operations
- ✓ Improved water quality of stormwater runoff

Pond 212 at Naples Airport. Lines in water represent riprap baffles (Source: Naples Airport)

encourages the City coordinate with the Airport to implement recommendations of the Drainage Plan.

A focus of the Drainage Plan is to convert existing open swales into underground drainage systems to remove areas of standing water following flood events. Ponding is of particular concern because it can attract birds that pose a risk to aircraft operations. The underground drainage system will also include features to improve the water quality of runoff discharged from the site into the adjacent waterbodies.

The Plan will also recommend the re-design and re-construction of existing stormwater ponds to accommodate increased runoff and provide rapid recovery from storms without impacting water quality. The pond shoreline will use a design that is not conductive to foraging or nesting birds.

In 2015, the Airport re-constructed Pond 212 to handle the large runoff amounts from the industrial area to the east. Riprap baffles were placed inside the pond to further improve water quality through the airport stormwater system. This system has demonstrated, through testing, an improved capture and reduction of pollutants. The Airport is planning to build on the success of this pond design, which was awarded the J. Bryan Cooper Environmental Award by the Florida Airports Council, by re-configuring other ponds on the property to improve flood resiliency and water quality.

Implementing Actions

- Coordinate with Airport staff to review Drainage Plan and permitting needs of stormwater improvement recommendations.
- Assess stormwater drainage of adjacent industrial areas for ways to divert stormwater runoff from entering airport property.

Implementation Factors

Evaluation Criteria

- Engineering: ●●○
- Environmental: ●●○
- Social Benefits: ●●○
- Implementation Feasibility: ●●●

Total Score: 9 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

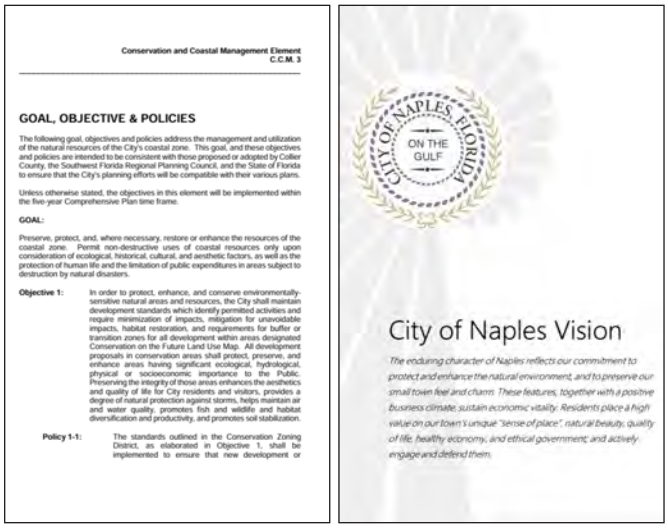
Implementation Lead:	Naples Airport
Strategy Partners:	• City of Naples – Streets & Stormwater • Federal Aviation Administration – Airport Improvement Program
Potential Funding Sources:	• Naples Airport Annual Budget • FAA – Airport Improvement Program • Florida Department of Environmental Protection Resilient Florida Grant Program • Florida Department of Transportation • FEMA Safeguarding Tomorrow Revolving Loan Fund Program

8 INCORPORATE SEA LEVEL RISE CONSIDERATIONS INTO CITY PLANNING AND DESIGN DOCUMENTS

This strategy focuses on mainstreaming sea level rise considerations into relevant plans, policies, and regulations to establish a citywide sea level rise planning framework that promotes protection of long-term infrastructure investments.

Description

Despite an identified vulnerability to flooding, the City does not currently have established policies or standards to increase the flood resilience of city development projects. Consideration of projected climate conditions (e.g., sea level rise, increased precipitation) by all City departments for various types of planning purposes (e.g., infrastructure planning, transportation planning, land use planning) is important to maintain and comprehensive level of flood protection. The intent of this strategy is to scan the City's overarching policy, planning, and visioning documents and design guidelines for opportunities to incorporate consideration of sea level rise. Integration of the proposed language into key planning and design documents will help to ensure that future investments by the City consider climate change and incorporate strategies, as appropriate.


Conservation and Coastal Management Element
C.C.M. 3

GOAL, OBJECTIVE & POLICIES

The following goal, objectives and policies address the management and utilization of the natural resources of the City's coastal zone. This goal, and these objectives and policies are intended to be consistent with those proposed or adopted by Collier County, the Southwest Florida Regional Planning Council, and the State of Florida to ensure that the City's planning efforts will be compatible with their various plans.

Unless otherwise stated, the objectives in this element will be implemented within the five-year Comprehensive Plan time frame.

GOAL:

Preserve, protect, and, where necessary, restore or enhance the resources of the coastal zone. Permit non-destructive uses of coastal resources only upon consideration of ecological, historical, cultural, and aesthetic factors, as well as the protection of human life and the limitation of public expenditures in areas subject to destruction by natural disasters.

Objective 1: In order to protect, enhance, and conserve environmentally-sensitive natural areas and resources, the City shall maintain development standards which identify permitted activities and require minimization of impacts, mitigation for unavoidable impacts, habitat restoration, and requirements for buffer or transition zones for all development within areas designated Conservation on the Future Land Use Map. All development proposals in conservation areas shall protect, preserve, and enhance areas having significant ecological, hydrological, physical or socioeconomic importance to the Public. Preserving the integrity of those areas enhances the aesthetics and quality of life for City residents and visitors, provides a degree of natural protection against storms, helps maintain air and water quality, promotes fish and wildlife and habitat diversification and productivity, and promotes soil stabilization.

Policy 1-1: The standards outlined in the Conservation Zoning District, as elaborated in Objective 1, shall be implemented to ensure that new development or

Example planning and visioning documents to incorporate climate change language

Examples of planning documents to consider for language updates include:

- City Building Code – The existing building code defers to State Building Code requirements, which are typically required design elevations for facilities based on the FEMA BFE. However, BFEs are calculated based on historically observed water level data and do not consider how future climate conditions could impact flood heights. By only considering BFEs for the design and implementation of facilities, city-owned buildings and properties may still be at risk to flooding. Many communities across the State are amending their building code requirements to consider sea level rise in addition to the BFE to maintain existing flood protection levels through the coming decades.

Benefits

- ✓ Proactive consideration of future flood risks to City investments
- ✓ Consistent level of flood protection for City capital projects
- ✓ Increased coordination among City departments and staff

- Comprehensive Plan – The City is currently updating elements of the Comprehensive Plan, which could lead to additional zoning and code changes. Updates underway include the incorporation of sea level rise language into a stand-alone Coastal Management Element. Updates to this element provide an opportunity to require the consideration of sea level rise projections into the siting and design of new and redevelopment projects.
- Vision Plan – In 2019, City updated their Vision Plan, which includes language on initiative and priorities to strategically improve resiliency to sea level rise, including incorporating sea level rise into the design of stormwater projects, collaboration with Collier County and the State, and improving the levels of service to account for sea level rise.

In addition to planning documents, engineering and design specifications could be updated to consider a consistent level of flood protection. Examples of design documents that could be updated include the Utilities Specifications and Standards Manual, Design Review Handbook, and the Public Right of Way Construction Standards. Depending on political support, the City may initially select a sea level rise projection with a higher flood risk tolerance (e.g., NOAA Intermediate Low) to integrate this strategy into planning and design processes. If the City finds that City infrastructure is still being compromised by flood events, the selected sea level rise projection can be updated to reflect a lower risk tolerance for potential damage (e.g., NOAA Intermediate High).

Implementing Actions

- Identify City planning and design documents and update with language concerning sea level rise impacts.
- Scan capital improvement projects list for investments that could benefit from considering future flood projections.
- Create a capital planning design guidance document to assist City staff with incorporating the appropriate sea level rise amount into project designs.
- Develop training for City staff to understand updated sea level rise requirements.
- Update sea level rise projection(s) and source as necessary.

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●●○
Social Benefits: ●●●
Implementation Feasibility: ●●○

Total Score: 9 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples - Planning Department
Strategy Partners:	No other partners were identified
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Environmental Protection Resilient Florida Grant Program • NOAA Coastal Partnership Initiative • FEMA Safeguarding Tomorrow Revolving Loan Fund Program

TIER 1 STRATEGY

9 DEVELOP CLIMATE RESILIENCE OUTREACH MATERIALS

This strategy recommends the City work with external partners to develop targeted outreach materials that communicate the science of climate change, potential impacts to the City, how the City is adapting, and ways the public can become engaged.

Description

Climate change science and associated impacts can often be overwhelming and seem irrelevant for many individuals. However, providing the public with an understanding of how climate change may impact daily life is critical to generate the public support required for adaptation strategies that can address these impacts. Citizens are more likely to change their behavior and support climate resilience initiatives if they have a clear understanding of the issues and solutions.

Contextualizing hazards and providing localized examples can be useful to provide residents with agency over how to adapt without over-dramatizing

Benefits

- ✓ Enhanced understanding of climate hazards among citizens
- ✓ Increased public support for climate resilience initiatives
- ✓ Inclusive engagement for historically underserved communities most affected by climate impacts

The City's online Story Map is an example of community outreach materials that can be expanded upon to reach a wider audience of residents.

the problem. Outreach that includes public engagement aspects can also increase ownership and responsibility within the community, resulting in better and more sustainable implementation of adaptation measures.

This strategy recommends the City coordinate with external partners, such as local universities and/or governmental agencies, to synthesize climate-related topics and generate targeted outreach materials for residents. These outreach materials (e.g., one-pagers, short videos, periodic newsletters) should highlight local impacts and the importance of action. The City could also engage with the public to showcase these products and gather feedback on how to approach adaptation initiatives related to the challenges. Public engagement strategies will be particularly important for communicating with the City's most disadvantaged populations to ensure that messaging is relevant and considerate and that actions are achievable and equitable.

The creation of materials should be more targeted for specific audiences based on the potential impacts or assets effected. These products should be adapted to consider the demographics and social conditions of the targeted groups. For instance, a social media campaign should use terminology teenagers and young adults can relate to, while a pamphlet or flyer handed out at a farmers' market, community event, or a public workshop should tailor language towards older adults.

Outreach materials can also include descriptions of what the community can do to increase the City's overall resilience to climate hazard events. Examples may include placing riprap along the shoreline to allow mangroves to recruit and grow.

Lastly, the City could develop an outreach strategy for disseminating the materials to target audiences. This should include cooperation among multiple City department staff so that messaging is consistent and includes relevant terminology, where needed. Public engagement and outreach efforts could be measured for impact and opportunities for improvement could be identified with each iteration.

Implementing Actions

- Identify external stakeholders, such as universities and non-profit organization, that can assist with providing data and information or outreach efforts.
- Work with partners to develop effective and engaging outreach materials that target specific demographic and social groups.
- Ensure messaging is consistent across City departments.
- Develop and implement a strategy for disseminating outreach materials (public workshop, social media, attending or presenting at local community gatherings), and evaluating efforts.

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●●○
Social Benefits: ●●○
Implementation Feasibility: ●●○

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples – Natural Resources Division
Strategy Partners:	• Universities • Non-Profit Organizations • Local Agencies
Potential Funding Sources:	• City of Naples Annual Budget • NOAA Environmental Literacy Program Grants • EPA Environmental Education Grants

10 PERFORM SUMMER HOT SPOT THERMAL ANALYSIS

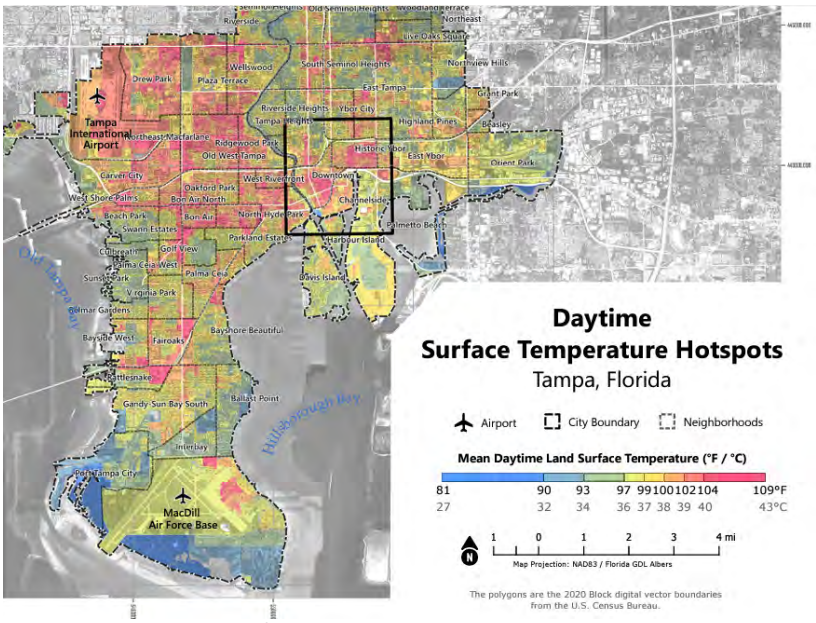
This strategy focuses on performing a summer hot spot analysis to identify specific areas of the city where heat is being retained. Findings of the analysis can be used to develop potential solutions and reduce the City's urban heat island effect.

Description

Urban areas retain significant amounts of solar radiation due to limited shade cover and the extensive use of paved surfaces, such as roadways and parking lots. These surfaces contribute to higher-than-average daytime and nighttime temperatures in urban environments compared to surrounding areas by absorbing large amounts of solar radiation and re-emitting it as heat. During summer months, these "urban heat islands" can contribute to significant health impacts to residents and increase the energy use and cooling costs for local businesses and homeowners. By identifying the locations of heat islands, the City can develop targeted solutions that reduce the amount of heat emitted from these areas or provide local heat refuge options for residents and visitors.

Benefits

- ✓ Targeted identification of thermal hot spot areas within the City
- ✓ Findings can be used to support projects for multiple City Departments



Example thermal hot spot map of Tampa, FL (Source: Tampa Climate Equity and Action Plan)

Although the City evaluated potential changes in air temperature as part of the Climate Change Vulnerability Assessment, the source data used for the assessment was too coarse in resolution to identify temperature discrepancies within the City boundary. To obtain the spatial distribution of urban surface temperatures and identify urban hotspots, a multi-year analysis of high-resolution satellite land surface temperatures is required. Federal agencies (e.g., NASA and USGS) offer free-to-download data that can be used as baseline information for the analysis. The input datasets can be aggregated in a geospatial software to generate an output map that presents the spatial distribution of areas corresponding to temperature hot spots within the city.

The final map(s) can provide insight into areas of the city that are disproportionately warmer based on the extent of impervious surfaces or percent of shade cover. The City can use findings from the analysis to propose solutions for mitigating the causes and impacts of the high heat conditions and provide increased heat refuge options. Examples can include the construction of shade structures, water-based recreation features, and cooling centers.

Thermal hot spot analysis maps can also support the implementation of multiple other strategies including the identification of where to increase plantings of shade trees as part of the Urban Tree Canopy Program (Refer to Strategy 06), identifying where to pilot cool pavement projects (Refer to Strategy 29), identifying where to expand the City's cooling center network (Refer to Strategy 35), and identifying which communities to engage with concerning outreach and monitoring of extreme heat impacts (Refer to Strategies 37 & 46).

Implementing Actions

- Identify relevant data source and downland necessary datasets.
- Perform thermal hot spot analysis
- Utilize findings to inform locations of other adaptation strategies and urban heat projects.

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●○○
Social Benefits: ●●●
Implementation Feasibility: ●●○

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples - Natural Resources Division
Strategy Partners:	No other strategy partners identified
Potential Funding Sources:	• City of Naples Annual Budget • NOAA National Integrated Heat Health Information System

TIER 1 STRATEGY

11 CONTINUE BEACH NOURISHMENT AND EXPAND DUNE REVEGETATION PROJECTS

This strategy focuses on the City's continued coordination with Collier County and the U.S. Army Corps of Engineers (USACE) to support beach renourishment projects and encourage the use and expansion of dune vegetation projects to strengthen the resilience of the City's dune system.

Description

The City's coastal environment serves both as an important economic driver and natural flood protection. To maintain these benefits requires the City to actively preserve the health of this coastal system. Each year, this effort is challenged by seasonal wave processes, and occasionally by extreme events (e.g., tropical storms and hurricanes), that narrow the beach and erode dune systems. As sea levels rise and coastal storms intensify, these erosion forces will increase furthering the need for intervention, further justifying the need for intervention to sustain the beach system.

Benefits

- ✓ Enhanced shoreline protection from rising sea levels and coastal storms
- ✓ Improved beach preservation
- ✓ Habitat restoration, preservation, and creation
- ✓ Enhanced recreational value of coastal environment

Dune plantings at the 10th Ave beach access. Source: Naples Botanical Garden

Since 1996, the City has coordinated with Collier County and the USACE to perform both scheduled and emergency beach nourishment projects following coastal storm events. At least one project has provided nourished sand to sections of City's coastline every year since 2005.

To supplement beach nourishment activities, the City has partnered with the Naples Botanical Garden to replant dunes with native vegetation to help keep sand in place to grow dune heights and provide a stronger barrier against coastal storm surges.

Historically, there has been an emphasis on utilizing sea oats and sea grapes for dune restoration. However, after noting that sections of dune with a mix of vegetation species tended to experience less impacts from coastal storm events, the Naples Botanical Garden is conducting pilot projects within the City to assess the effectiveness of diversifying the planted vegetation species to increase the resilience of the shoreline.

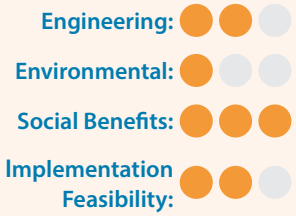
This strategy recommends the City continue to coordinate with the County and USACE, support beach nourishment, and the expansion of dune planting using a diversity of native vegetation based on the findings of the pilot studies.

Implementing Actions

- Continue to coordinate with County and USACE staff to formalize future beach nourishment considerations, where appropriate, including timing and logistics.
- Assess dune revegetation project findings to determine most successful mix of vegetation species and best planting practices for future efforts.
- Identify potential areas to expand dune planting projects.
- Develop public messaging materials and signage to communicate the purpose of dune enhancement

Implementation Factors

Evaluation Criteria



Total Score: 8 /12

Estimated ROM Cost

$$ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples - Natural Resources Division
Strategy Partners:	• Naples Botanical Garden • Collier County • U.S. Army Corps of Engineers • Florida Gulf Coast University • Rookery Bay National Estuarine Research Reserve
Potential Funding Sources:	• City of Naples Annual Budget • Collier County Annual Budget • Collier Community Foundation • U.S. Army Corps of Engineers • NOAA National Coastal Resilience Fund

12 INSTALL ADDITIONAL STORMWATER PUMPS

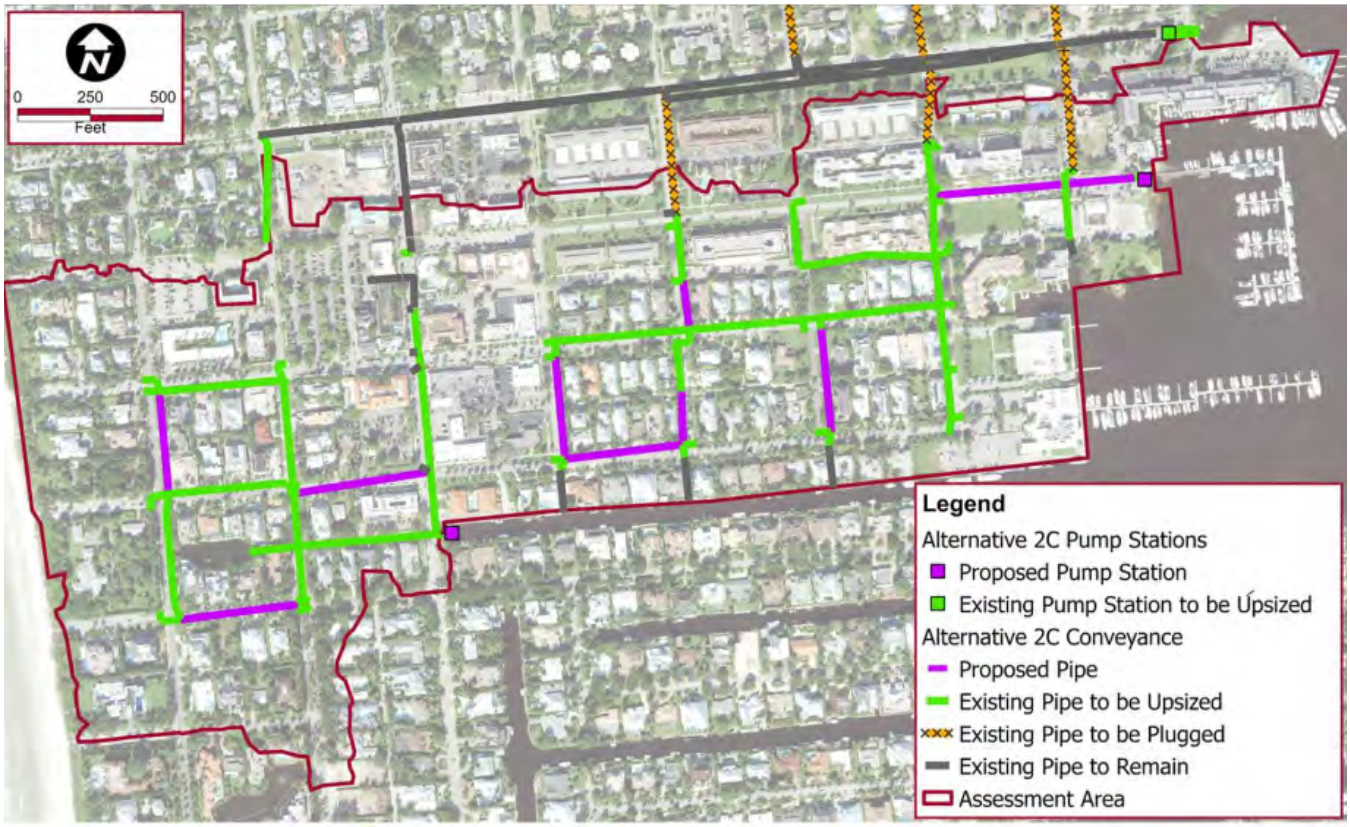
This strategy focuses on implementing the siting, design, funding, and installation of proposed pump stations based on findings from the City's Multi-Basin Assessments.

Description

The City's stormwater management system is heavily reliant on the use of pumps to convey runoff from low-lying areas that cannot be drained effectively by gravity-driven systems. Pumps are an increasingly important component of the stormwater network, particularly when considering that sea level rise will further elevate downstream coastal water level conditions and reduce the efficiency of the drainage network's ability to discharge water from low-lying stormwater outfalls.

Benefits

- ✓ Improved stormwater management system efficiency
- ✓ Reduced flood damages to property and infrastructure
- ✓ Increased resilience to changes in rainfall intensity and coastal water levels change



The Multi-Basin Assessments identified areas of the City that would benefit from additional stormwater pumps (Source: Multi-Basin Assessment)

[1]City of Naples – Multi-Basin Assessments

The City has analyzed pump capacity in five of the City's stormwater basins as part of a Multi-Basin Assessment. The Multi-Basin Assessment[1] evaluated the current stormwater system performance for rainfall scenarios under existing and future conditions that consider changes future rainfall intensity and the effect that rising coastal water levels has on the stormwater system's ability to convey runoff. The findings of these assessments identified where current infrastructure (e.g., pumps) is insufficient to handle existing and projected stormwater flows. The City has prioritized three locations that would benefit from the installation of additional stormwater pumps: 17th Avenue South, 3rd Street South, and North of Cove Inn.

This strategy focuses on the installation of recommended pump stations, which will require additional funding to finalize their siting, design specifications, and construction to address future flood risk. Installing pumps in these areas may require the City to purchase easements to site the pumps, particularly for the 3rd Street location) and upsized piping to support the increase in flow volumes.

Implementing Actions

- Finalize design specifications, cost estimates and site requirements for the three identified stormwater pumps.
- Pursue funding to produce detailed designs and installation of three proposed pumps.
- Purchase additional easements needed to install pump stations.
- Monitor effectiveness of new pump station's ability to efficiently drain stormwater

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●○○
Social Benefits: ●●●
Implementation Feasibility: ●●○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | **2 - 5 Yrs (Mid)** | 5+ Yrs (Long)

Implementation Lead:	City of Naples – Streets and Stormwater Division
Strategy Partners:	City of Naples – Planning Department
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Environmental Protection Resilient Florida Grants • FEMA Building Resilient Infrastructure and Communities Grant Program • FEMA Hazard Mitigation Grant Program • FEMA Safeguarding Tomorrow Revolving Loan Fund Program

13 HARDEN WASTEWATER TREATMENT PLANT (WWTP) AND ELEVATE SHORELINE

To reduce the flood risk of the City's WWTP, this strategy recommends application of hardening and floodproofing techniques for treatment plant components and elevating the shoreline surrounding the facility.

Description

The City's WWTP is situated on a peninsula extending into Gordon River and is vulnerable to coastal storm surge events. During Hurricane Ian, the WWTP avoided major operational disruptions, but storm surge entered the property on the south side of the peninsula through drainage holes in the wall around the WWTP that are designed to discharge stormwater and prevent on-site ponding. Infrastructure damage was limited to individual system components, such as underground utilities, vehicles, office buildings, lift stations, and odor scrubbers.

Benefits

- ✓ Reduced risk of equipment damage
- ✓ Reduced risk of partially treated wastewater releases
- ✓ Improved safety for WWTP operators

Conceptual diagram of flood defense system for WWTP

Due to its low-lying setting and proximity to the water, the WWTP remains at risk to future flood events. This strategy focuses on site-specific measures to harden the wastewater plant.

The site could benefit from a pre-storm plan to floodproof drainage holes built into the existing walls enclosing critical WWTP facilities and infrastructure. The walls were designed to drain ponding rainfall during extreme events, however, during coastal storm surge events, the drainage holes provide a flood pathway into the facilities. The peninsula shoreline could also be elevated to reduce the likelihood of storm surge overtopping the bank and entering the property. The elevated shoreline could also be coupled with a pre-storm deployable flood gate that extends across the WWTP access roadway to prevent a potential flood pathway from the east side of the property, which is also low-lying. The site design for flood protection may need to consider the addition of drainage or a stormwater pump to discharge potential rainfall that may pond within the elevated property and not be able to efficiently drain using a gravity-driven system.

This type of comprehensive flood defense system provides protection for a facility that is critical to protect in order to prevent costly damages to sensitive equipment, maintain wastewater services to residents during and after storm events, and prevent potential wastewater releases to Gordon River.

Flooding of the WWTP property following Hurricane Ian

Implementing Actions

- Retrofit existing floodwall to prevent storm surge from entering the site
- Determine the feasible level of flood protection (e.g., BFE + 3 feet) to elevate the shoreline and access road flood gate
- Develop entry and exit plans for staff members during deployment of the flood barriers

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	● ○ ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ○

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | **2 - 5 Yrs (Mid)** | 5+ Yrs (Long)

Implementation Lead:	City of Naples - Public Works Department
Strategy Partners:	No other partners were identified
Potential Funding Sources:	• FEMA Building Resilient Infrastructure and Communities Grant Program • FEMA Safeguarding Tomorrow Revolving Loan Fund Program • FDEP Resilient Florida Program

14 FLOODPROOF WASTEWATER LIFT STATIONS

To protect the City's lift stations, which are critical for transferring wastewater to the treatment plant and preventing sewage overflow events, this strategy recommends applying floodproofing techniques that will reduce the likelihood of damage to electrical and mechanical equipment.

Description

All of the City's wastewater lift stations were impacted by flooding during Hurricane Ian. To restore service, most lift stations required a variety of electrical repairs including the replacement of control panels, pumps, flow meters, transducers, and generators, but the infrastructure itself remains vulnerable to future flood events without the application of additional floodproofing measures. This strategy recommends continued efforts to floodproof and elevate lift stations along with their backup pumping or generators to increase resilience of the wastewater network.

Benefits

- ✓ Reduced risk of equipment damage
- ✓ Reduced risk of SSOs and protect environmental health
- ✓ Improved service to sanitary sewer customers

Wastewater lift station control panel with high water mark from Hurricane Ian

A resilient sanitary sewer collection system can continue to serve customers and protect the environment in even the most extreme weather conditions. Lift stations are one of the most critical assets within a collection system and are responsible for the efficient flow of wastewater to the treatment plant. The City has already taken initial steps to improve the flood resilience of lift stations, including raising electrical equipment and providing back up generators. Additional measures to consider are converting any dry pit or suction lift stations to a submersible option. Submersible stations are particularly resilient in flooding situations and can run when the station itself is submerged.

Additional structural improvements include raising of the wet will lids so that flood waters do not directly inflow into the stations, applying floodproof barrier on the housing, waterproofing wet well and valve hatch doors, and elevating backup power generators.

Creation of a power outage contingency plan is also recommended. This plan is typically comprised of basic details of each list station including pump, buck up power or bypass pump provisions. Other beneficial information to include is the size and type of generator plug available for use with a mobile generator. The plan can also be shared with local emergency agencies so that generators can be provided by third parties in case of emergency.

Implementing Actions

- Identify any lift stations in the system that are not submersible and schedule for conversion.
- Develop a power outage contingency plan.
- Prioritize raising control panels and lift station lids starting with those that experience inundation first or based on elevation.

Implementation Factors

Evaluation Criteria

Total Score: 8 /12

Estimated ROM Cost

$$ $ Mid Range ($200k - $1M)

Timeframe

Implementation Lead:	City of Naples – Public Works Department
Strategy Partners:	No other partners were identified
Potential Funding Sources:	• FEMA Building Resilient Infrastructures and Communities (BRIC) Grant • FEMA Safeguarding Tomorrow Revolving Loan Fund Program • FDEP Resilient Florida Program

TIER 1 STRATEGY

15 COORDINATE WITH FLORIDA POWER & LIGHT (FPL) TO HARDEN ELECTRICAL INFRASTRUCTURE

This strategy recommends that the City coordinate with FPL to identify options for hardening substations and electrical infrastructure using elevating or floodproofing techniques to reduce potential flood impacts and limit power loss during flood events.

Description

Electrical substations and associated infrastructure may experience damage or failure even due to temporary exposure to flooding, particularly from saltwater flood sources, such as coastal storms or high tide events. Damage to a substation can affect power supply to all downstream customers and city facilities, affecting critical community services, especially if backup power systems are not in place.

FPL provides power supply and distribution throughout the city and is responsible for upgrades or retrofits (i.e., hardening) of electrical substations located within the city boundary. Because the City does not have the ability to retrofit electrical infrastructure, this strategy focuses on coordination efforts between the City and FPL to understand the completed or planned flood protection strategies for the city's electrical utilities.

In 2022, FPL developed a statewide Storm Protection Program (SPP), which includes an assessment to identify electrical utility infrastructure planned for upgrades to increase resilience to potential disruptions. Several electrical substations within the city were noted as at risk to flood damage with hardening projects identified to address flood

Benefits

- ✓ Increased coordination between City and FPL
- ✓ More resilient electrical network
- ✓ Reduced and shorter power outages following flood events

FPL substation in Naples (Source: Google Maps)

susceptibilities. However, information regarding the planned hardening approach, level of flood protection, or project status was not provided. If not already completed, a detailed assessment is required to evaluate the existing condition of each substation and associated infrastructure such as transformers and switches, to determine if flood mitigation measures are currently in place or programmed.

If existing measures are not in place, there are several hardening options for existing pad-mounted substation and transformer systems, including elevating transformers to be above projected FEMA base flood elevations (BFEs) with sea level rise, replacing transformers with submersible options, or installing dry floodproofing techniques, such as flood barriers or an enclosure design to prevent floodwater from entering the equipment area.

To supplement these efforts, the City could share findings of the City's recently complete Critical Assets and Facilities Vulnerability Assessment to demonstrate the increasing risk of the City's electrical substations in the coming decades. For example, by the year 2070, all of FPL's electrical substations located within the city are at risk to flooding due to coastal storms. The City could also provide FPL with supporting datasets, including flood depths at the substation locations to inform the level of flood protection that may be required for an enhanced level of flood protection at each location.

FPL and the City could also coordinate to discuss efforts the City could lead to reduce flooding near FLP substations. Examples could include increasing storm drainage capacity, installing backflow prevention, or constructing elevated coastal flood protection measures adjacent to low-lying substation infrastructure.

Implementing Actions

- Confirm substation and transformer assets that are at risk of flood exposure for consistency with what is included in the SPP.
- Coordinate with FPL to establish level of feasible flood protection and establish priority list of assts to adapt.

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	○ ○ ○
Social Benefits:	● ● ●
Implementation Feasibility:	● ● ●

Total Score: 8 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | **5+ Yrs (Long)**

Implementation Lead:	Florida Power & Light
Strategy Partners:	City of Naples
Potential Funding Sources:	• City of Naples Annual Budget • FPL Storm Protection Plan • FEMA Hazard Mitigation Grant Program • FEMA Building Resilient Infrastructure and Communities Grant Program • FEMA Safeguarding Tomorrow Revolving Loan Fund Program • DOE Grid Resilience and Innovation Partnerships Grant Program • DOE Grid Resilience Utility and Industry Grants

16 INSTALL AND ELEVATE BACKUP POWER GENERATION FOR CRITICAL FACILITIES

To maintain uninterrupted services in the event of a power outage, this strategy recommends that the City install backup power generation for all critical infrastructure and facilities. The strategy also includes raising existing and proposed generators to be above future floodplain elevations.

Description

Extreme weather events often cause widespread power outages as high winds can down transmission lines and floodwaters can compromise sensitive electronics. Even short-duration power outages bring multiple cascading impacts to communities including delays in emergency response, traffic accidents and delays due to stoplight outages, sewage overflows, and increased risk of heat-related illnesses among vulnerable populations if facilities and homes cannot provide air conditioning.

The use of generators or backup batteries provide a temporary source of power supply and can mitigate the impacts of citywide power outages. Generators are currently in place at some of the City's critical facilities and assets; however, the operating condition and capacity to sufficiently operate the associated asset is not consistently known.

As an initial step to the strategy, the City could conduct an inventory to assess the critical assets that are in need of backup power supply. In addition to noting assets and facilities that do not currently have backup power generator capabilities, the inventory could track the age and condition of existing backup power generators that are currently in place but may need replacement. The inventory could be used to

Benefits

- ✓ Reduces risk to life and safety of residents
- ✓ Sustains critical emergency response and City operations
- ✓ Prevents potential sewage overflows
- ✓ Reduces repair and replacement costs of elevated generators

Elevated backup power generator for a community center in Miami Beach, FL

prioritizes generator installation and replacement for assets based on generator condition and the need to ensure the city's most critical assets, including traffic signals, stormwater systems, and government buildings continue to provide services during extreme weather events.

Several known city assets in need of additional backup power generators include:

- Traffic Cabinets: The City has on-site backup batteries for some traffic cabinets to supply up to eight hours of power following an outage. However, not all of the traffic cabinets have backup batteries installed, leaving some intersections without signals until power can be restored.
- Water Wells: The City has portable generators for the City's potable water wells, which often require 'daisy-chaining' multiple generators to maintain power during outages.
- Streets and Stormwater Department Building: The facility currently has a generator, but it is nearing the end of its useful life and should be replaced.
- Stormwater Pumps and Wastewater Lift Stations: The City has permanent generators installed, but they are often not elevated and some experienced damage during Hurricane Ian.

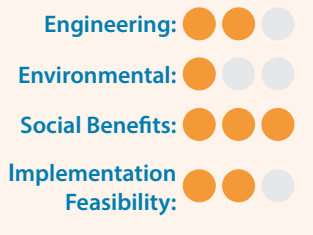
Retrofit, replacement, or installation of all generators should consider appropriate elevations to reduce the risk of existing and future flood damage. If practical, generators should be elevated above the BFE plus the amount of sea level rise that could occur over the generator's functional lifespan.

Implementing Actions

- Inventory critical facilities and assets to determine backup power generation condition and need for elevation, replacement, or new installation of generator.
- Prioritize generator (re)placement based on asset criticality.
- Determine appropriate elevations to account for generator access considerations and future flood risk.

Implementation Factors

Evaluation Criteria



Total Score: 8 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

Implementation Lead:	City of Naples - Public Works Department
Strategy Partners:	• City of Naples – Building Department • City of Naples – Utilities Department • Florida Department of Transportation
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Environmental Protection Resilient Florida Program • Florida Department of Transportation Grants • FEMA Building Resilient Infrastructure and Communities Grant Program • FEMA Hazard Mitigation Grant Program • DOE Grid Resilience and Innovative Partnerships Grant Program

17 INVENTORY SEAWALLS AND UPDATE SEAWALL HEIGHT ORDINANCE

To address deteriorating coastal structures built to protect public and private development along the City's waterfront, this strategy focuses on developing a digitized inventory of existing seawalls and updating the City's seawall height ordinance.

Description

Most of the City's bayfront and canal shorelines are armored by seawalls or riprap to provide coastal erosion and flood protection. The City currently tracks ownership of public and privately owned shoreline structures using an internal record of individual building permits. However, this tracking system may not be comprehensive, particularly for older structures that have not received upgrades in recent decades.

Addressing the City's deteriorating coastal structures has proven to be a challenge due to material costs, wave forces, sea level rise, and other factors of dynamic coastal areas. Additionally, the current tracking system does not provide officials with thorough understanding of the state of the City's coastal protection. Existing structure conditions (e.g., ownership, structure type, material, age, and elevation) are important for identifying potential structure vulnerabilities, prioritization of mitigation actions, and assisting with permitting and regulations. To address these challenges, this strategy focuses on developing a baseline inventory of existing seawalls and other coastal armoring structures. The inventory could include georeferenced locations of public and privately owned structures and digitized information captured by the City's building permits. Development

Benefits

- ✓ Comprehensive tracking of existing seawall conditions to understand where vulnerabilities may exist and upgrades may be needed
- ✓ Enhanced level of flood protection for the City's waterfront

Seawalls overtopped and scoured during Hurricane Ian

of the seawall inventory provides a comprehensive data source and easy-to-access information that can be shared with other City departments and contractors performing upgrade or repair work.

In 2013, the City updated seawall requirements (Ordinance 13-13302) to set the maximum elevation at 4.8 feet above the North American Vertical Datum of 1988 (NAVD88) . Storm surge from Hurricane Ian overtopped many of the City's seawalls, causing damage to many seawall structures and landward properties. To provide an enhanced level of flood protection that considers projected increases in sea level, this ordinance could be updated to reflect a higher water elevation. This strategy aligns with best practices being developed for communities across the state that are planning for greater levels of waterfront flood protection. For example, the seawalls within the City of Miami Beach are required to be above 4.0 feet NAVD88 and shall not exceed 5.7 feet NAVD88 (Resolution 2016-4009). Other communities have a level of flood protection that corresponds to proximity of the flood source. St. Pete Beach requires seawalls to be constructed above 5.0 feet NAVD88 for properties facing the bay and 6.0 feet NAVD88 for properties facing the Gulf of Mexico (City Ordinance Section 2021-01).

Implementing Actions

- Digitize seawall locations and building permit information from each structure.
- Revise maximum seawall design elevation to consider future sea level conditions.
- Develop a minimum seawall design elevation to promote a consistent level of coastal flood protection throughout City.
- Develop community outreach materials to share new seawall requirements with the public.

Changes to the seawall elevation ordinance could be phased to allow for property owner compliance. Triggers for compliance with the new minimum elevation requirements could be when building a new seawall, when a seawall is in significant disrepair (damage exceeds more than 50% of the structure), or when the property owner has been cited for tidal flow breaching of the existing seawall and impacting an adjacent right or way or property.

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	○ ○ ○
Social Benefits:	● ● ●
Implementation Feasibility:	● ● ●

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Implementation Lead:	City of Naples – Planning Department
Strategy Partners:	No other partners were identified
Potential Funding Sources:	• Florida Department of Environmental Protection Beach Management Funding Assistance Program • Florida Department of Environmental Protection Coastal Partnership Initiative • NOAA Transformational Habitat Restoration and Coastal Resilience Grants • FEMA Safeguarding Tomorrow Revolving Loan Fund Program • FDEP Resilient Florida Program

18 ENHANCE RESILIENCE OF CITY'S DATA INFRASTRUCTURE

This strategy presents identified actions to adapt the City's information technology (IT) data infrastructure to increase resilience. Identified actions include adding dedicated air conditioning systems to properly manage heat and humidity in the data centers and installing a fiber optic ring network to provide a fault tolerant and more redundant telecommunication system.

Description

The City's two data centers and fiber optic network are the unseen infrastructure that maintain digital business operations and emergency services within the City. Should these systems fail or require downtime for replacement or repair, most day-to-day operations in the City would be unable to continue. Recent environmental changes (e.g., increased extreme heat events) and development trends (e.g., increased data traffic needdependency s and general construction) have exposed critical vulnerabilities in the current data center infrastructure that could lead to an increasing amount of needed downtime for repairs due to system failures. The following strategies sections identify adaptation actions for each of these vulnerabilities.

Cooling Systems

In recent years, both City data centers have been stressed to maintain proper operational temperature due to insufficient cooling systems during summer months. The current configuration and cooling infrastructure for both centers does not allow for the proper ventilation of generated heat or the removal

Benefits

- ✓ Lowers risk of heat-induced data center shutdown and associated costs/impacts
- ✓ Extends the lifetime of expensive electronic equipment
- ✓ Increased reliability for the City's critical data network

City server room with supplemental AC unit located to the left. Due to fire suppression requirements, hot air pulled from the room is pumped into the ceiling instead of being vented to the outside
(Note : This image has been intentionally blurred for security reasons)

of humidity, leading to elevated temperature and moisture levels in the server rooms. Long-term exposure to a high heat and humid environment can degrade electrical components or even cause them to fail, resulting in unplanned shutdowns and impacts to critical City operations including Public Safety, Emergency Management, Utilities, Revenue, and citizen services.

'In-row' air conditioners, or a similar solution, could be installed for each data center under current within existing configurations to address this risk. In addition to providing air conditioning directly to the source electronics, these systems can capture and expel generated heat and manage humidity.

Implementing Actions

- Scope designs and costs for equipment and ancillary infrastructure are required for installation of in-row air conditioning units for both data centers.
- Scope designs and costs for equipment and ancillary infrastructure are required for installation of fiber optic ring network.
- Coordinate and engage with other City departments and businesses to notify of planned downtime or limits on data network during proposed changes.

Implementation Factors

Evaluation Criteria

Engineering:
Environmental:
Social Benefits:
Implementation Feasibility:

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Fiber Optic Node Redundancies

Fiber optic cabling is a key component of the high-speed telecommunication network required to conduct digital business in the City. Currently, City facilities are largely serviced via a single linear (i.e., one-way) linear fiber optic cable with multiple nodes along the cable pathway. Construction in the City is at an all-time high and had continues to increase which has led to multiple planned and accidental fiber cable cuts. When this occurs, anything downstream of the impacted node loses connectivity.

Establishing a fiber optic "'ring"' throughout the City will allow telecommunication traffic to travel in both a clockwise and counterclockwise manner. With a ring topology, each node within the fiber network can be serviced in two directions, ensuring continuous connectivity in the event of a fiber cut along one pathway. To achieve a robust ring configuration, approximately 8-10 miles of fiber optic cable will be required. This will create a closed loop system that reaches fromincorporating Fire Station 2 in the north to the Port Royal pump house in the south of the city.

Implementation Lead:	City of Naples – Technology Services
Strategy Partners:	• City of Naples – Small Business Administration • City of Naples – Streets and Stormwater • Collier County • Dell Technologies • Schneider Electric • Bentley Electric
Potential Funding Sources:	• City of Naples Annual Budget • Florida Department of Emergency Management • FEMA – Hazard Mitigation Grant Program

TIER 1 STRATEGY

19 ASSESS OPTIONS FOR NATURE-BASED FLOOD HAZARD PROTECTION

This strategy focuses on identifying areas of the City that could be opportunities to enhance traditional flood protection infrastructure (e.g., seawalls and riprap) with the implementation of nature-based solutions.

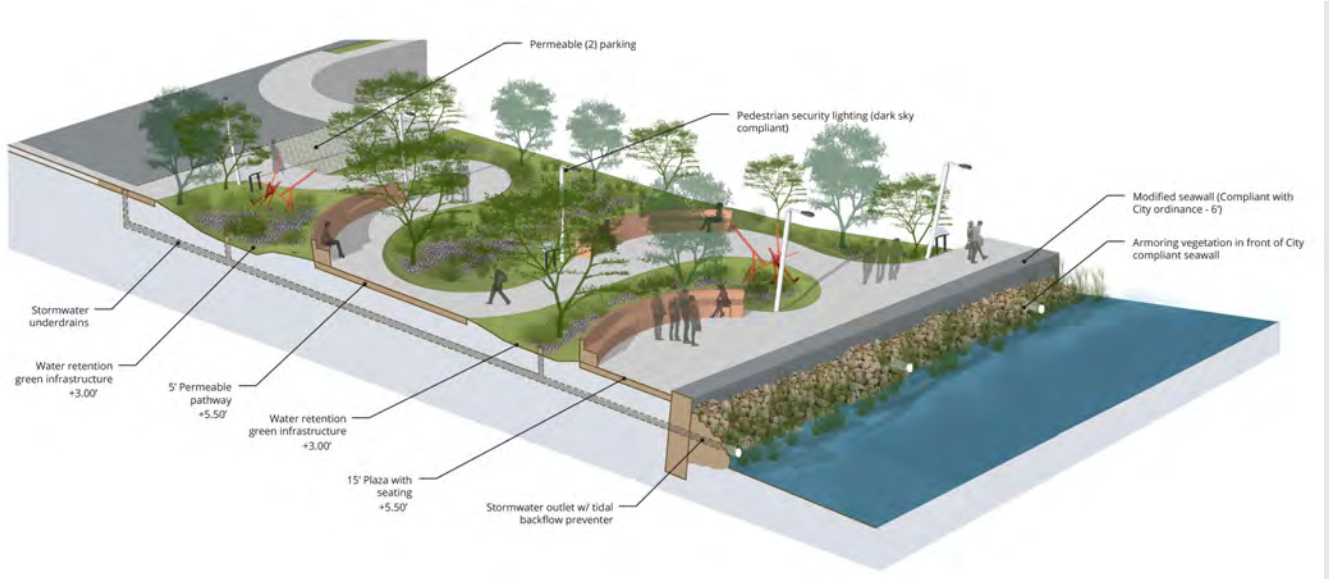
Description

Rapid urbanization in the early 1900s transformed much of the City's coastal wetlands that once served as a sponge for excess stormwater and buffer against tropical storms into a hardened shoreline backed by development. A combination of seawalls, riprap, pumps, and drainage canals currently reduce the City's flooding impacts; however, these gray engineered approaches to flood mitigation are increasingly challenged every year due to sea level rise, changing precipitation patterns, and intensifying coastal storm events.

The effectiveness of traditionally engineered flood protection structures can often be enhanced or replaced by incorporating nature-based elements. In addition to mitigating the impacts of coastal hazards, natural features (e.g., mangroves and other aquatic vegetation, bioswales, and rain gardens) can also improve the health of adjacent waterways, enhance the aesthetics of the shoreline, and increase the City's recreational opportunities.

Benefits

- Reduced flood impacts of public and private properties using nature-based measures
- Improved health of waterways
- Enhanced aesthetics of the City
- Increased recreational opportunities



Conceptual diagram of a waterfront option for nature-based flood protection from the City of Miami's Resilient Waterfront Enhancement Plan. A similar approach could be applied at identified sites throughout the City of Naples. (Source: City of Miami Waterfront Resilience Enhancement Plan)

This strategy focuses on expanding the use of nature-based flood protection throughout the City and identifying locations where placement of nature-based approaches could be prioritized for implementation. To initiate the strategy, the City could develop a Nature-Based Resilience Enhancement Plan to provide inspiration and ideas of approaches applicable for a range of settings across the City. Alternatives could be developed as conceptual designs for pilot sites representative of the City's common typologies (e.g., riverfront, bayfront, Gulf front, low-density residential, high-density residential) to demonstrate feasible options that align with site-specific characteristics and hazard protection needs. Options could be provided for both public and privately-owned property to engage residents in opportunities to contribute to the overall increased resilience of the city.

To promote alternatives that are compliant with regulatory requirements, the conceptual design alternatives could also be shared with federal, state, and local regulatory agencies for guidance on potential permitting and implementation needs of the nature-based elements. Findings from this step could be used to develop a permitting guide that informs design considerations of nature-based solutions for flood protection and serves as the first step in the implementation framework.

Implementing Actions

- Coordinate with local organizations neighborhood representatives to identify specific areas for pilot projects.
- Identify City typologies to consider in plan or for pilot projects.
- Generate and provide public outreach materials on the benefits of the projects.
- Explore the creation of an incentive program for homeowners and businesses to implement nature-based features.
- Monitor and evaluate the effectiveness of pilot projects to address flood hazards.

Implementation Lead:	City of Naples – Natural Resources Division
Strategy Partners:	• City of Naples – Streets and Stormwater • The Naples Botanical Garden • The Nature Conservancy
Potential Funding Sources:	• National Fish and Wildlife Federation National Coastal Resilience Fund • NOAA Coastal Resilience Grant Program • Environmental Protection Agency – Clean Water Act Nonpoint Source Grants • Environmental Protection Agency – Urban Waters Small Grants Program • Environmental Protection Agency – Environmental Justice Small Grants Program • FEMA - Building Resilient Infrastructure in Communities Program • FEMA – Flood Mitigation Assistance Grant Program

Implementation Factors

Evaluation Criteria

Engineering: ●●○
Environmental: ●●○
Social Benefits: ●●○
Implementation Feasibility: ●●○

Total Score: 8 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

20 CONTINUE CURRENT WASTEWATER SEWER MAINTENANCE AND REPLACEMENT PROGRAM

This strategy recommends continuation and expansion of the City's existing wastewater sewer maintenance and replacement program to prevent inflow and infiltration (I&I) during wet weather events.

Description

Flooding events due to high tides, rainfall, and coastal storms place pressure on the sanitary sewer collection system through I&I into the sewer mains. During wet weather and high coastal water events, flood water can enter sewer mains through cracks or leaky seals caused by aging pipelines. This excess water can exceed the treatment plant's flow capacity or introduce saltwater to the plant, which disrupts the biological treatment processes.

The City currently assesses wastewater infrastructure annually to identify pipeline deficiencies that may contribute to I&I or overflow events. The program is currently reactive in its pipeline retrofit and replacement approach by looking for visible evidence on the ground surface (e.g., sinkholes, smoke testing) where pipelines are damaged. This strategy focuses on promoting the continuation of this program while supporting the City's Utilities Department to develop a Sanitary Sewer Master Plan. The Plan is expected to provide a more proactive repair/replacement scheduling method to rehabilitate sections of pipeline prior to the occurrence of I&I or potential overflows.

Solana Road sanitary sewer forcemain replacement

Proactive repair/replacement programs can be developed using existing data sources held within the utility. System data attributes such as material, date of construction, lift station run times and seasonal high-water tables can be evaluated to prioritize areas in the collection system that should be studied for I&I. I&I studies should be conducted to measure the amount and at what points extraneous water is entering the collection system. This data can then be used to prioritize funding for repairs and rehabilitation providing the best results per dollar invested and reduce damage to roads due to sinkholes.

Benefits

- ✓ Reduced risk of Sanitary Sewage Overflows
- ✓ Reduced power consumption within collections system
- ✓ Recapturing capacity that can be allocated to future growth

Implementation Lead: City of Naples – Public Works Department

Implementation Factors

Evaluation Criteria

Engineering:	● ○ ○
Environmental:	● ● ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

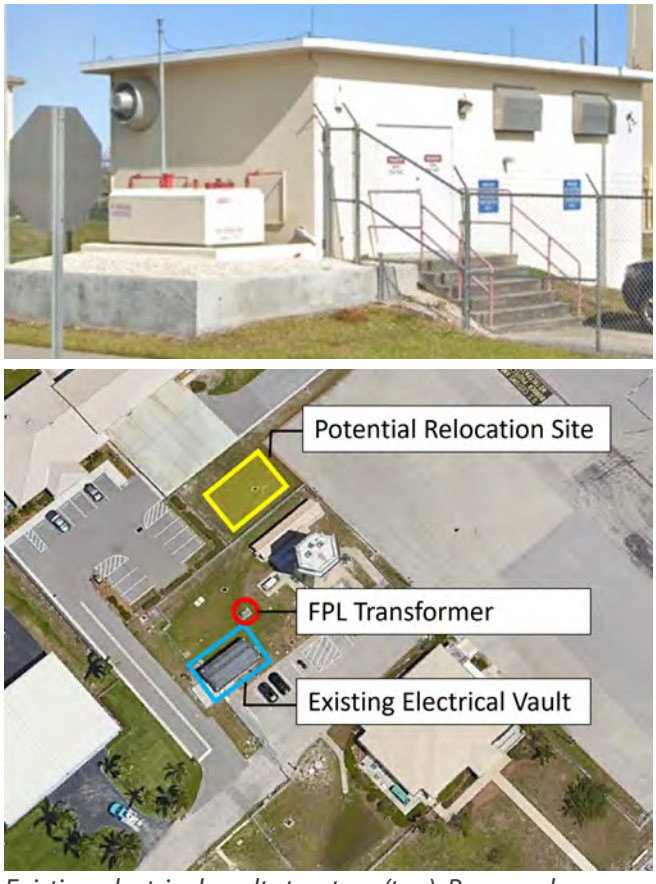
< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

21 ELEVATE AIRFIELD ELECTRICAL VAULT

This strategy recommends relocating and elevating the Naples Airport electrical vault structure to avoid flood damage of this critical asset.

Description

The electrical vault at the Airport contains multiple electrical components critical to the operation of the Airport's navigational aid equipment and on-site facilities. During Hurricane Ian, floodwaters prevented access to the vault and nearly entered the structure housing. There are currently no redundant systems at the Airport for these essential electrical systems and, if damaged, the Airport would likely experience flight impacts to flight operations until the infrastructure was repaired or replaced.



Existing electrical vault structure (top); Proposed relocation area (bottom)

This strategy focuses on relocating and elevating the vault housing structure to reduce the likelihood of potential flooding. The Airport has identified a new location for the vault and prepared initial designs for the proposed improvements. Due to its criticality, the Airport plans to elevate the first floor of the new structure to 3 feet above FEMA's Base Flood Elevation and will also relocate the building's generator, which is currently located inside the structure housing, to be an external and elevated unit. The Airport is also coordinating with FPL to raise the vault's adjacent electrical transformer that serves the asset.

Benefits

- ✓ Increased flood resilience for a regionally important asset
- ✓ Enhanced coordination between the City and Naples Airport
- ✓ Implement a previously identified critical need within the County's Local Mitigation Plan.

Implementation Lead: Naples Airport

Implementation Factors

Evaluation Criteria

- Engineering: ●●○
- Environmental: ●○○
- Social Benefits: ●●○
- Implementation Feasibility: ●●○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

22 FLOODPROOF STORMWATER PUMP STATIONS

This strategy recommends the City elevate critical electrical components of stormwater pump stations or otherwise floodproof station housings to prevent water intrusion that could affect pump operations.

Description

Stormwater pump stations are a critical component of the City's stormwater network and are necessary for removing large volumes of runoff from low-lying areas of the City that are unable to drain efficiently. Although stormwater pumps are typically designed to be submersible and maintain operations during flood events, their functionality depends the ancillary electrical components and control panels to remain above flood elevations or otherwise being floodproofed to prevent water contact. None of the City's three existing stormwater pump stations have been modified to improve their resilience to flooding through elevation or other floodproofing techniques.

If feasible, equipment or controls in the pump station can be elevated or the pump station building can be flood proofed using application of an impermeable layer to the exterior or the building to prevent water seepage through the building walls. Associated back up power generators should also be elevated to ensure their functionality in the event of a power outage. The design elevation of electrical equipment and generators will need to be determined based on site-specific feasibility, costs, and the estimate flood levels for each location. Due to the criticality of stormwater pump stations, where possible, the BFE plus 2 feet or the 0.2-percent annual chance flood elevation (whichever is higher) should be considered as a minimum baseline elevation for electrical equipment and controls for an extra factor of safety[1]. Maintenance access will also need to be considered in the design of elevated infrastructure through use of stair platforms.

Elevated stormwater pump station in Sea Isles City, New Jersey. To reduce the structure footprint, submersible pumps are located underground and electrical controls are on an elevated platform. (Source: Sea Isle News)

Benefits

- ✓ Increased resilience of essential flood management assets
- ✓ Reduced replacement costs due to flood damage

Implementation Lead: City of Naples – Streets and Stormwater

Implementation Factors

Evaluation Criteria

Engineering:	●●○
Environmental:	●○○
Social Benefits:	●●●
Implementation Feasibility:	●○○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Mid Range ($1M+)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

23 CONTINUE EFFORTS TO CONSOLIDATE EXISTING COASTAL STORMWATER OUTFALLS

To increase the level of flood protection, reduce beach erosion, and improve local water quality, this strategy supports continued efforts to consolidate a series of coastal stormwater outfalls located on the Gulf Coast beaches.

Description

Currently, the City's Drainage Basin II area discharges stormwater from a series of 10 aging and untreated beach outfalls to the Gulf of Mexico (Gulf). The City is redesigning the stormwater collection and discharge network in this area to increase the level of flood protection, reduce beach erosion, and improve local water quality. The proposed new design includes removing the existing beach outfalls and, consolidating new outfalls to two locations. The new outfalls will be buried and extend further offshore than current outfalls to be discharged. Additional infrastructure improvements will include adding a pump station that can handle higher volumes of stormwater and a treatment system that will improve water quality by removing sources of bacteria before they reach downstream waters.

Naples existing coastal stormwater outfalls

Due to the multiple benefits offered by the coastal stormwater system redesign, this strategy supports the City's ongoing efforts to continue seeking additional funding and implementation of the planned design. Funding efforts could involve collaboration with Collier County to pursue shared funding from State and Federal grant agencies. Additional funding could be pursued through Collier County's Tourist Development Council (TDC) funds that allocate use of tourist tax dollars for special projects in the region.

Benefits

- ✓ Improved water quality
- ✓ Reduced beach erosion
- ✓ Enhanced aesthetics of coastal areas

Implementation Lead: City of Naples – Public Works Department

Implementation Factors

Evaluation Criteria

Engineering:	● ○ ○
Environmental:	● ● ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

24 IDENTIFY AND RAISE CRITICAL ROADWAYS

This strategy recommends the elevation of critical roadway corridors to maintain access to evacuation routes and critical services during and after flood events.

Description

The City's roadway network is critical for daily travel throughout the City and serves as the primary means of evacuation and response activities during emergencies. A single point of failure in the roadway network can create delays, and in some instances, may isolate neighborhoods, large populations, critical facilities, or local businesses. Flooding events have increasingly affected low-lying roadways and restricted access for both residents and emergency responders.

Critical roadways to consider for elevating in Naples

This strategy focuses on the phased raising of roadways, starting with corridors identified as important for evacuation and interconnectivity throughout the City. The design elevation of the selected roadways should consider an enhanced level of service that accounts for future flood levels due to an increase in rainfall and rising coastal water levels. To maximize available roadway improvement funds, elevations could be raised incrementally by 3 to 6 inches during regularly scheduled roadway improvement projects (typically completed on a 10-year basis). Incremental elevation will also allow adjacent properties and infrastructure to be raised as needed to avoid connectivity challenges.

Benefits

- ✓ Reduced frequency and/or duration of road closures due flooding
- ✓ Enhance safety though improved emergency evacuation and response conditions
- ✓ Reduced disruption to regular daily travel and activity

Implementation Lead: City of Naples – Streets & Stormwater Division

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	○ ○ ○
Social Benefits:	● ● ●
Implementation Feasibility:	● ● ○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | **2 - 5 Yrs (Mid)** | 5+ Yrs (Long)

25 ESTABLISH FLOOD IMPACT MONITORING PROGRAM

This strategy recommends creating a flood impact monitoring program to track the frequency, flood sources, and locations of the greatest community impacts. Information from the monitoring program can be used to identify repetitive impact areas and understand the combination of environmental conditions contributing to flooding.

Description

he City is vulnerable to frequent flooding during rainfall, high tide, and coastal storm events. These flooding events can cause a variety of impacts to the community, including traffic delays, damaged utilities, and flooded properties. Although the City monitors for extreme flood events posed by approaching tropical storms and hurricanes, it does not currently have a coordinated flood monitoring system capable of capturing the combination of physical flood conditions (e.g., amount of rainfall, storm surge levels, tide elevations) that occurs to produce the flooding or the associated impacts to infrastructure and facilities.

This strategy recommends the City develop an internal data application to capture flooding event information including impacted locations, a description of impacts, and the weather conditions that contributed to the flooding. With this information, the City can monitor frequently affected areas, worsening impacts over time, and the effectiveness of implemented adaptation strategies. With an understanding of the weather conditions that caused past flood events, the City could identify high priority areas that may require pre-flood event action, such as an increase in preventative stormwater maintenance or the deployment of flood barriers for the entryways of low-lying buildings located near water bodies.

Flooding on Riviera Drive during a combined rainstorm and high tide event in July 2019. (Source: City of Naples)

Monitoring flood impacts could also be used to support the City's messaging service that provides life-safety alerts to residents, such as flooded areas to be avoided based on knowledge of conditions that cause flooding of specific areas of the city.

Benefits

- ✓ Improved understanding of flood sources and local flood impacts
- ✓ Enhanced ability to identify and prioritize flood mitigation projects
- ✓ Provides a means of tracking effectiveness of flood adaptation projects

Implementation Lead: City of Naples –Natural Resources Division

Implementation Factors

Evaluation Criteria

Engineering:	● ○ ○
Environmental:	● ○ ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ●

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

26 MONITOR NAPLES CITY DOCK SHORELINE IMPROVEMENT

The City has recently installed flood protection measures to reduce frequent flooding that occurs near the Naples City Dock. This strategy focuses on monitoring the effectiveness of these interventions and supplementing with additional flood protection actions, as needed, to maintain flood prevention of the site.

Description

The Naples City Dock represents a relatively low area of the shoreline, providing a potential flood pathway for inland parts of the city, including the downtown area. During heavy rainfall and high tide events, coastal water levels can overtop the shoreline and backflow into the stormwater drainage pipes, with limited ability to drain from the area until the tides subside. When flood events occur in this area, the intersection of 8th St and 12th Ave S experience ponding water, which restricts access to adjacent businesses and the City Dock.

To address this flood issue, the City recently completed modifications including shoreline elevation using riprap, installation of backflow preventers at the outfall, and enlarging the stormwater inlet. Since completion of these shoreline modifications, the City has not experienced any annual high tides or coastal storms to test the effectiveness of the project. Continued monitoring of the site is needed to evaluate the effectiveness of these modifications and to determine if additional flood strategies are needed.

Low-lying shoreline near dock (top) and flooding after Tropical Storm Issaic in 2012 (bottom) (Source: City of Naples and Naples Daily News-David Albers)

Benefits

- ✓ Opportunity to assess effectiveness of flood adaptation measure

Implementation Lead: City of Naples – Public Works

Implementation Factors

Evaluation Criteria

- Engineering: ●●○
- Environmental: ●○○
- Social Benefits: ●●●
- Implementation Feasibility: ●○○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

27 RELOCATE AND ELEVATE POLICE STATION COMPLEX

To increase the reliability of the City's life safety operations, this strategy recommends elevating or relocating the police station complex to a higher location.

Description

The City's police station complex and parking lot frequently floods during summer afternoon rain events, restricting building access and emergency response operations. The complex was originally constructed near the City's horticultural landfill in the 1970s and is located in close proximity to the Gordon River. In the late 1990s, a new police administration building has been constructed on the property and is located four to five feet higher than the original 1970s buildings. Subsequent development of the adjacent area has also increased the volume of runoff that flows toward the station, which is now lower than the surrounding properties and roadways.

The primary access roadway (Goodlette-Frank Road) has been elevated by the County to mitigate flooding impacts but is now multiple feet above the parking lot entryway and is a source of flooding for the station. During Hurricane Ian, Goodlette-Frank Road experienced nearly three feet of flooding, which also inundated the police station lot and building entryways. Although police response vehicles were relocated prior to the storm, flooding blocked access to buildings and the City's fuel pumps stations. Flooding also damaged a nearby wastewater lift station, causing sewage backups within the police station.

To increase emergency response capabilities of the station, the City could consider reconstructing and raising the police facilities in their existing location or relocating the police station complex to a higher elevation property elsewhere in the city. The proposed complex could also be designed as the City's as new Public Safety Building that includes additional emergency services, such as the fire department, dispatch center, and a meeting space or as a full Emergency Operations Center (EOC) to house the city's decision makers during emergency events. As an EOC, the site should be designed with redundant services for water, wastewater, and power generation to keep operations sustained during and after an emergency event. The new location could also include parking that can accommodate emergency vehicles, including those with high clearance requirements (e.g., fire trucks, high-water vehicles), which was identified as an ongoing need for the City.

Flooding of Police Department property during Hurricane Ian

Benefits

- ✓ Ability to respond more efficiently following hazard events
- ✓ Provides state-of-the-art upgrades to City's emergency response facilities
- ✓ Enhanced protection of critical emergency response vehicles and equipment

Implementation Lead: Naples - Police

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	○ ○ ○
Social Benefits:	● ● ●
Implementation Feasibility:	● ● ○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ High Range ($1Million +)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

28 COMPLETE MAST ARM CONVERSION PROJECTS

This strategy recommends the continuation and completion of the City's ongoing conversion program to replace all span wire mounted traffic signals with mast arm mounted signals.

Description

Hurricane Ian's high winds caused downed and damaged traffic signals across the City. These damages created intersection delays and restricted response and recovery efforts. Following the storm, the City prioritized the conversion of all span wire mounted signals to mast arm mounted signals, which are better able to withstand hurricane force winds. To-date, City efforts have successfully replaced most of the span wire traffic signals, leaving only five intersections in need of this conversion.

Completion of the mast arm conversion program will increase safety within the city by maintaining traffic signal operation during and following storm events. Functioning signals will also preserve the operational capacity of the intersections and roadways during response and recovery efforts. Finally, the reduced frequency of downed and damaged traffic signals will reduce city maintenance and repair costs.

Converted traffic signal mast arms along 3rd Street South (Source: Google Maps)

Benefits

- ✓ Enhanced safety by maintaining traffic signals during and immediately following storm events
- ✓ Maintained operational capacity at intersections and on roadways
- ✓ Reduced traffic signal repair costs

Implementation Lead: City of Naples – Streets and Stormwater

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	○ ○ ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ●

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

29 PILOT COOL PAVEMENT PROJECTS

This strategy recommends the piloting of cool pavement projects for potential scaling across the City. Projects may include permeable pavement, pavement surface treatments, or lighter colored pavement to decrease heat absorption.

Description

Conventional paving materials are often dark in color, which causes them to absorb incoming solar radiation during daytime sun exposure and slowly release this energy as heat. In urbanized areas, large expanses of heat absorptive asphalt and concrete can noticeably increase air temperatures when compared to undeveloped surrounding areas.

To offset the factors contributing to localized elevated temperatures, the City could implement potential pavement alternatives for roadways and parking lots. The use of pavement treatments and lighter pavement colors can also reduce surface temperatures by reflecting sunlight and reducing absorption of the sun's energy. Permeable pavement, which provides a pervious surface that cools the surface through air circulation or water evaporation, could also be considered for parking lots and alleys. Permeable pavement has the added benefit of allowing the infiltration of water during rainfall events.

Workers applying cool pavement coating to roadway in Pheonix, AZ. Source: Scientific American

Many cities across the U.S., including Phoenix, AZ; New York City, NY; Austin, TX; and Raleigh, NC are implementing pilot projects to test the effectiveness and scalability of cool pavement actions. The City can leverage the findings from other strategies that identify temperature hot spots in the City to select potential pilot sites (Refer to Strategy 10). Potential areas are likely to be those with heavy development or limited tree cover. If successful, the use of these materials can be deployed at larger scales throughout the City to increase benefits.

Benefits

- ✓ Increased lifespan for roadway surfaces
- ✓ Reduced energy consumption and costs needed to cool buildings
- ✓ Improved comfort and health of residents and visitors

Implementation Lead: City of Naples – Streets and Stormwater

Implementation Factors

Evaluation Criteria

Engineering:	● ● ○
Environmental:	● ○ ○
Social Benefits:	● ● ○
Implementation Feasibility:	● ● ○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Mid Range ($200k - $1M)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

30 UPDATE CLIMATE PROJECTIONS AS NECESSARY

This strategy focuses on efforts to regularly revise the climate change and sea level rise projections used by the City to reflect the best available science or to meet updated State of Florida requirements for grant funding.

Description

Climate change and sea level rise projections are periodically updated to reflect technological advances in modeling and new scientific understanding of contributing factors to changes in sea levels. After completion of the City's Adaptation Plan, the City should plan to periodically (e.g., every 5 to 10 years) update the projections considered in planning and operation procedures to reflect the best-available and relevant science.

Incorporating the latest climate projections into plans, policies and designs will promote adaptation efforts that accommodate ongoing local changes in air temperature, precipitation patterns, and sea level rise. Infrastructure designed to the latest climate projections will be more likely to avoid damages during its functional life, reduce risk of impacts to the community, and benefit City budgets over time through a reduced need for repair and replacements frequency.

The National Oceanic and Atmospheric Administration (NOAA), who is responsible for analyzing and providing sea level rise projections at a national level, typically updates sea level rise projections every five years. FDEP utilizes NOAA's sea level rise projections to define the sea level rise thresholds required for consideration in the Resilient Florida grant program, which funded the City's Vulnerability Assessment and Adaptation Plan and provides additional funding opportunities for flood protection projects. It will benefit the City to remain aware of evolving sea level rise projections that are released by NOAA or changes to FDEP grant requirements that could affect eligibility for future funding.

Benefits

- ✓ Maintain eligibility for State and Federal grant funding
- ✓ Increased awareness of potential changes in the climate science that could affect the amount of future sea level rise

Implementation Lead: City of Naples - Natural Resources

Implementation Factors

Evaluation Criteria

Engineering:	●●●
Environmental:	○○○
Social Benefits:	●●○
Implementation Feasibility:	●●○

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | **5+ Yrs (Long)**

31 CREATE VEHICLE STORM RELOCATION PLAN

This strategy recommends the City develop a plan for alternative pre-storm staging sites of city vehicles, including high-clearance or armored vehicles, that allow for quick post-storm deployment to support recovery efforts.

Description

Relocating emergency vehicles ahead of storm events is often required to limit damages to the City's fleet assets and ensure these vehicles can assist in response and recovery efforts. The City currently stages vehicles at local parking garages, the mall, and a self-storage facility property ahead of potential flood events. While the parking garages work for most city-owned vehicles, the ceiling height clearances are too low to accommodate the City's high-water vehicles, such as fire trucks and police hurricane response vehicles. Additionally, the ancillary roadways and garage entrances are often flooded, limiting the ability to access post-storm response vehicles immediately following storm events until floodwaters recede. In 2022, flooding from Hurricane Ian entered the City's Fire Station #1 apparatus bay, damaging a fire truck and equipment that was not relocated prior to the storm.

Flooded Naples fire apparatus (Source: Naples Fire-Rescue Dept vis Facebook)

To expand the City's existing vehicle storm relocation plan, the City could identify additional inland areas suitable for vehicle relocation to protect emergency vehicles during the storm with the ability for quick deployment for post-storm response operations. The City currently has an MOU with the County to store vehicles outside of the city boundary. While this is an option for flood protection of the fleet, it increases emergency response time within the city. The City could also consider investigating if additional private property or business locations within the city could be utilized to reduce the required travel and response times.

Benefits

- ✓ Improved continuity of operations
- ✓ Enhanced emergency response capabilities

Implementation Lead: City of Naples

Implementation Factors

Evaluation Criteria

- Engineering: ●●○
- Environmental: ○○○
- Social Benefits: ●●○
- Implementation Feasibility: ●●●

Total Score: 7 /12

Estimated ROM Cost

$ $ $ Low Range (<$200k)

Timeframe

< 2 Yrs (Short) | 2 - 5 Yrs (Mid) | 5+ Yrs (Long)

Strategy Number	Strategy Name and Description
32	**Expand Oyster Reef Restoration** The City's oyster reef restoration program has resulted in multiple benefits including improved water quality, reduced shoreline erosion, and habitat expansion. The lack of sufficient waterfront staging areas has been challenging and will continue to be for future restoration projects. This strategy will require waterfront land acquisition by the City or exploration of potential public-private partnerships with local businesses or organizations to utilize waterfront areas.
33	**Develop Sea Level Rise Best Practices for Businesses** A set of best practices for businesses focused on enhancing the understanding of and adapting to sea level rise can help owners and decision-makers better understand the physical and financial risks of sea level rise and evaluate potential adaptation options. This strategy recommends the City develop a guide for businesses that characterizes the physical and financial risks of sea level rise, using findings from the Business Case for Resilience strategy (Refer to Strategy #2) and describe what business owners can do for site planning and preparedness to protect the property and on-site assets.
34	**Convert Fleischmann Park into A Floodable Park** Fleischmann Park is an important recreational area in the City, particularly for children, and includes multiple sports fields, a skate park, and playgrounds. Analysis of flood prone areas of completed for the citywide Vulnerability Assessment showed that large areas of the park are at risk of flooding and ponding due to rainfall flooding. This strategy explores the possibility of redesigning aspects of the park to be a floodable play space. This concept maintains the option for recreational/programmatic activities during normal (dry weather) conditions, but also allows the park to double as a flood retention area during heavy rainfall events.
35	**Expand Cooling Center Network** Cooling centers provide critical relief for residents who lack or cannot afford to operate air-conditioning during heat waves. Future City cooling centers should be sited near or within vulnerable communities, in places that are familiar, comfortable, and accessible, and should remain operational into the evening. The City should establish and publicize a threshold to activate cooling centers based on the heat index, which also accounts for humidity, and/or forecasted heat wave duration.

Strategy Number	Strategy Name and Description
36	**Survey Public Drinking Fountains** Public drinking fountains can protect the health of people working, exercising, or recreating outdoors during extreme heat days. A map of existing public drinking fountains will enable the City to identify areas without nearby drinking fountains. Additional drinking fountain locations should be prioritized in public spaces, such as parks, at beaches, along walking and biking trails, and downtown areas.
37	**Develop an Extreme Heat Educational + Awareness Program** This strategy focuses on establishing an educational program designed to inform residents on the health impacts of extreme heat, symptoms of heat illness, safety advice and best practices, and available resources. The program should develop communications materials and protocols for both general outreach during summer months and event-specific outreach during heat waves, including information on cooling center locations and hours and cooling tips. This program can leverage existing educational materials from the National Weather Service, the U.S. EPA, and other federal agencies can maximize efficiency.
38	**Expand Cooling and Efficiency Funding Program** A cooling and efficiency funding program wouldcan support homeowners and businesses to carry out building envelope and other efficiency upgrades to enable buildings to maintain comfortable indoor temperatures while using less energy. The program should be targeted toward the City's older building stock, provide tiered incentives based on household income or level of upgrades desired, and incorporate other sustainability features such as rooftop solar or cool roofs. The program should also build on available federal or state funding and utility provider rebates to provide innovative financing mechanisms, such as on-bill financing, to reduce upfront costs and monthly payments.
39	**Incentivize Cool/Green Roofs** Both cool and green roofs can lower indoor building temperatures by as much as 20 percent, reducing air-conditioning use, energy bills, and the urban heat island effect. The City could design an incentive program to offer a per-square footage rebate to homeowners and businesses for replacing or installing a new roof that incorporates cool and green designs. The incentive program should be paired with an educational or outreach campaign to increase uptake, while pilot or demonstration projects at City-owned buildings could also build awareness.

Strategy Number	Strategy Name and Description
40	**Survey City Buildings Finished Floor Elevations (FFEs)** Buildings with an FFE lower than existing or future flood levels are vulnerable to significant inundation damage. This strategy focuses on surveying the FFEs of all City-owned buildings to identify those that may be at risk during flood events. This information can be used to prioritize potential flood protection strategies to reduce the risk of damage to the building structure and housed contents.
41	**Install Temporary Flood Barriers for City Facilities** Temporary flood barriers– which include portable flood gates, shields, sandbags, or inflatable floodwalls – are relatively low cost and can be deployed before a flood event. The City could consider these as a flexible solution for potential flood pathways (e.g., doors, vents) of city facilities to provide flood protection during temporary coastal storm events.
42	**Develop Historic Building Flood Guidelines** Adapting historic structures presents a unique vulnerability because they require a balance between preserving of the property's historic integrity with the need to increase resilience to flood hazards. Most historic buildings were also constructed without the consideration of flooding and were often built at the ground level. To protect the City's historic buildings from existing and future flood risk, the City could develop flood guidelines specific to historic structures. This document would serve as a framework for selecting appropriate adaptation strategies that reduce the potential for flood damage while retaining many of the essential physical features as possible.
43	**Conduct a Climate Action Plan** Climate action plans allow communities to comprehensively quantify its existing greenhouse gas emissions across all sectors, set community-wide and city-specific reduction targets, and develop multi-benefit emission reduction strategies. The City should investigate developing a climate action plan to strengthen the ability to achieve community priorities for air quality, public health, economic resilience, green workforce development, and mobility.

Strategy Number	Strategy Name and Description
44	**Develop a Homeowner's Sea Level Rise Guide** Although the City's Adaptation Plan focuses on protecting public infrastructure from climate hazards, the City could develop a sea level rise guide to help private homeowners better understand the risk rising seas pose to their property and way of life. The guide could use images and language tailored to residents and focus on potential impacts to property, while providing approaches to adapting private properties to mitigate the risk. This could help homeowners make informed decisions, upgrade vulnerable infrastructure, and avoid last minute emergency repairs.
45	**Establish Home Flood Improvement Grant Program** To assist residents with preparing for the impacts of climate change, the City could explore the development of a City-funded grant program that provides residents with matching funds to make home improvements. Eligible activities could include the construction of green infrastructure elements (e.g., rain gardens and bioswales), home elevating, or installing flood barriers.
46	**Establish Extreme Heat Monitoring Program** The number of extreme heat days and length of summer heatwaves affecting the City have been increasing due to climate change. The increased exposure to extreme heat conditions can produce significant health impacts for residents and reduce the functional life of infrastructure. This strategy focuses on creating a monitoring program to officially track these thermal events to understand trends the City is experiencing and to justify the implementation of strategies to address extreme heat hazards facing the City.
47	**Purchase Emergency Response Watercraft** Flooding during extreme coastal storm events, such as tropical storms and hurricanes, can severely restrict emergency response via roadways. The purchase of additional watercraft built specifically for both fire-rescue and police operations can enhance the capabilities of emergency personnel to provide post-storm response for city residents.

6 Next Steps

The Adaptation Plan was developed to provide a set of holistic strategy options for the City to consider to enhance resilience for climate hazards. This section discusses initial next steps to begin and sustain the plan's implementation.

The purpose of the Adaptation Plan was to develop a set of strategies that will improve climate hazard resilience for critical public infrastructure, vulnerable communities, and sensitive natural resources across the City. Strategies included in the Adaptation Plan have been evaluated and ranked based on a combination of established evaluation criteria and feedback from City staff and the community. Many strategies can be started promptly at a staff level knowing that full implementation of each strategy could take several years or be ongoing.

Initially, special emphasis should be placed on policy and collaboration strategies to enable implementation of many of the larger and more complex physical actions and to maximize the ability to respond to near-term climate hazards. Priority should also be placed on implementing strategies aimed at protecting the City's assets currently identified as vulnerable to existing climate hazards, such as those that are regularly flooded during rainfall or high tide events or experienced damage during Hurricane Ian.

Critical to the pursuit of strategies in the Adaptation Plan will be the identification of funding mechanisms to carry out the work. As an immediate next step, the City could scan the prioritized strategies to identify those that can be included in the City's annual budget or those that will require external resources, such as State and Federal grants. Tier 1 strategies include a list of potential funding sources, which are further described using a funding matrix in Appendix B. This funding matrix may also serve as a resource to identify applicable funding for other strategies included in the plan.

To promote sustained implementation of the Adaptation Plan, the City could provide annual updates to the community and elected officials on progress with carrying out actions or identify needed strategy modifications due to evolving priorities associated with changing environmental conditions and completion of other parallel planning projects across City departments.

Planning for and adapting to anticipated climate change impacts presents many challenges to the community. However, it also presents an opportunity to reimage how the City operates and can continue to prosper in the future. With ongoing and diligent implementation, strategies outlined in the Adaptation Plan will help to prepare the community for future flood and extreme heat conditions while enhancing the overall livability of the City.

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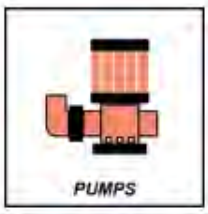
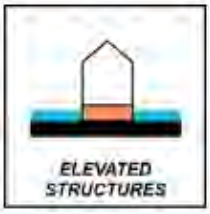
Appendix A

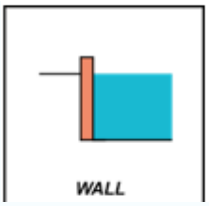
Description of individual strategies included in the adaptation menu.

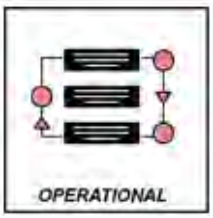
Strategy Type	Strategy Name	Hazards Mitigated	Description
Temporary		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	Portable, sand-filled flexible casings that can be deployed at specific assets prior to an expected flood event. Individual sandbags can be stacked to address varying flood heights.
Temporary		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	Retractable, rigid walls filled with sand or water that be transported to an asset location and deployed ahead of an expected flood event. Multiple sections may be able to be connected to lengthen the barrier.
Stormwater		☐ Storm Surge ☐ High Tides ☑ Precipitation ☐ Extreme Heat	Constructed ponds, or otherwise depressed areas, designed to temporarily retain peak stormwater runoff. Storage areas are able relieve stress on stormwater infrastructure by containing and slowing excess runoff allowing for natural drainage into groundwater.
Stormwater		☐ Storm Surge ☐ High Tides ☑ Precipitation ☐ Extreme Heat	The use of porous paving materials to lessen runoff from heavy rainfall events. More permeable materials allow rainfall to infiltrate the pavement and drain into the ground below, preventing it from entering the stormwater system.
Stormwater		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The use of hydraulic-power systems to improve drainage efficiency in areas that are unable to use gravity-based systems. Pumps can actively convey water through stormwater systems to prevent backflow stoppages.
Stormwater		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The use of in-line check valves or flap gates within the stormwater line network to prevent reverse flow. Reverse flow is often caused by elevated coastal water levels near discharge outfalls.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Stormwater		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The addition of new stormwater pipes or resizing of current pipe infrastructure to accommodate additional volumes of floodwater. New or replacement pipes are often more efficient and adapted to current stormwater demands than older pipes.
Nature-Based		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The use of nature-based designs to mitigate flood impacts. A variety of designs and elements can be deployed or combined to adjust to site conditions. Infrastructure can be placed alongside, or in replace of, traditional infrastructure to improve on-site capture, treatment, and infiltration of stormwater. Infrastructure can also be implemented in coastal areas to provide protection from elevated water levels and erosion.
Nature-Based		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The development or altering of an area to function as a floodable space during extreme events. Critical assets are removed or relocated so the site may function as a natural floodplain. Floodable sites can protect landward assets by storing peak floodwaters and lowering runoff rates into the stormwater system.
Nature-Based		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The placement of sand, or other alteration, of a beach or dune profile to mitigate coastal erosion. Often, profile height is increased to provide greater protection to landward assets from extreme coastal water events.
Nature-Based		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The rehabilitation or improvement to coastal marshes to enhance function as a natural defense structure. Marsh and other wetland areas can serve as a buffer-area to protect coastal areas from extreme coastal water events. The placement of natural fill or native plant species can improve the structure of the marsh soil and make it less susceptible to wave erosion and help to mitigate the impacts of sea level rise.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Nature-Based		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The use of earthen material on a sloping shoreline to dissipate wave energy and mitigate impacts to landward assets. Shoreline can incorporate the use of native plant species to fortify the placed soil. Shorelines can also be backed by a levee or bulkhead for additional support.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The raising of individual buildings using fill or pilings. Structures are typically elevated above projected flood water depths to prevent exposure.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The raising of road surfaces to prevent flood inundation during elevated water events. Roads are often raised in coastal areas but can also be elevated along inland flood sources (e.g., retention ponds and drainage channels). Raised coastal roads can provide flood protection to landward assets in coastal areas.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The use of fill materials to raise the height of path areas above floodwater elevations. Paths are often raised in coastal areas but can also be elevated along inland flood sources (e.g., retention ponds and drainage channels). Elevated coastal paths can serve as protection for landward assets.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	Measures taken to make an asset watertight and avoid any water exposure. The combination of multiple strategies may be required to achieve successful dry-floodproofing.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Asset Specific		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The use of new or replacement pilings to accommodate rising water levels. The increased height prevents damage to the structure from high-water events.
Asset Specific		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The use of a built staircase or steps incorporated into the design of an elevated shoreline to provide water access during non-flood conditions. Steps can be a low-impact development choice to provide public access to coastal areas.
Asset Specific		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The redesign of current dock infrastructure to accommodate rising water levels. Redesign features can include floating docks and taller pilings. Elevating dock infrastructure maintains vessel access and avoids damage to the dock from high water events.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	Measures that allow floodwaters to enter and exit the first flood of facilities without causing significant damage. Wet-floodproofing measures can be used to minimize damage by controlling water entry if exposure cannot be prevented.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The elevation of sensitive infrastructure elements to avoid flood exposure. The elevation of critical components can improve general asset resilience by reducing the potential for full system failure.
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The repositioning of certain assets from areas with high floodwater exposure risk to a site with lower exposure. Relocation can be to a site with higher elevation or a site sufficiently inland to avoid coastal flood exposure.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Asset Specific		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	The burying of electrical lines under roadways with other municipal infrastructure. Undergrounding can prevent the downing of electrical cables during strong wind events which then may become submerged in floodwaters. Undergrounding can also prevent the loss of power during strong storm events.
Shoreline		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The use of earthen material to elevate shoreline heights. Often use to raise coastal shorelines but can also be elevated areas along inland flood sources (e.g., retention ponds and drainage channels). Coastal berms can serve as protection for landward assets.
Shoreline		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The construction of a vertical structural member parallel to a shoreline to mitigate flooding and erosion impacts from strong wave events. Height can be adjusted based on site requirements and potential flood elevation. Walls can be used to protect critical assets required to be near the shoreline.
Shoreline		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The placement of material, typically large rocks, or geometric blocks, on a sloped embankment or seaward of a bulkhead/seawall. Revetments reduce wave energy and mitigate erosion and scouring of coastal infrastructure.
Shoreline		☑ Storm Surge ☑ High Tides ☑ Precipitation ☐ Extreme Heat	Construction of raised vegetations beds that provide an elevated divide between a water interface and an asset. Planters are often used in coastal areas but can also be used in areas along inland flood sources (e.g., retention ponds and drainage channels). The use of natural infrastructure can help lessen the amount of runoff produced during a heavy rain event, alleviating stress on stormwater systems.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Shoreline		☑ Storm Surge ☑ High Tides ☐ Precipitation ☐ Extreme Heat	The deployment of a dam-like structure designed to prevent storm surge or extreme high tides from entering an embayment area.
Non-Physical		☑ Storm Surge ☑ High Tides ☑ Precipitation ☑ Extreme Heat	The development of additional data or research to inform and improve the implementation of physical strategies.
Non-Physical		☑ Storm Surge ☑ High Tides ☑ Precipitation ☑ Extreme Heat	The incorporation of climate resilience principles into long-term city planning documents, policies, and design criteria.
Non-Physical		☑ Storm Surge ☑ High Tides ☑ Precipitation ☑ Extreme Heat	The incorporation of climate resilience considerations into the day-to-day operations and management of city departments. Examples include developing climate awareness programs, increasing collaboration with regional stakeholders on the topic of climate adaptation, and developing extreme heat guidance for city workers.
Non-Physical		☑ Storm Surge ☑ High Tides ☑ Precipitation ☑ Extreme Heat	The implementation of duplicate systems and policies to prevent risk of failure.
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	The addition of new public water delivery services (e.g., water fountains, recreational splash pads) to provide relief during extreme heat days.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	The construction of new, or expansion of current shade systems within the city to increase shade areas provided. Shade structures can be relatively simple, open-air assets that can provide areas to avoid direct sun and heat exposure.
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	The use of alternative paving materials which are lighter in color than traditional asphalt or pavement to reduce heat absorption. The reduction in daytime solar energy absorption decreases the amount of heat released by the structure.
Extreme Heat		☑ Storm Surge ☑ High Tides ☑ Precipitation ☑ Extreme Heat	The implementation of redundant power supply at critical assets to prevent failure during extreme usage or hazard events. The use of back-up generators or the storage of back-up battery supplies can prevent long-term power loss.
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	The increased planting of tree species to provide shade cover. Canopy shade areas are used to offer areas to avoid direct sun and heat exposure.
Extreme Heat		☐ Storm Surge ☐ High Tides ☑ Precipitation ☑ Extreme Heat	The conversion of traditional building roofs to ones that support gardens or other natural areas. The natural infrastructure can cool the building during hot months and keep the building warm during cold months, reducing energy consumption needed for climate control. Green roofs also reduce rainfall runoff that would otherwise be sent into the stormwater management system.

Strategy Type	Strategy Name	Hazards Mitigated	Description
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	An air-conditioned public space to provide temporary relief during extreme heat days. It can be a cooled public building open for respite during extreme heat conditions or an outdoor misting station that can reduce local air temperatures in large public spaces.
Extreme Heat		☐ Storm Surge ☐ High Tides ☐ Precipitation ☑ Extreme Heat	The replacement or installation of new building components (e.g., appliances, windows, etc.) that decrease energy consumption. This can reduce climate control needs and reduce overall energy demand.

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Appendix B

Grant funding matrix

#	Administering Organization	Program/ Grant Name	Description	Source
1	State of Florida Department of Commerce	Small Cities Community Development Block Grant Program	The Small Cities Community Development Block Grant (CDBG) Program, administered by Florida Commerce, provides funding for economic activities, infrastructure improvements and housing rehabilitation. Funds have been used for wastewater and stormwater improvements, road improvements, rehabilitation of substandard housing, downtown revitalization, park facilities, and other projects for public benefit.	https://floridajobs.org/community-planning-and-development/assistance-for-governments-and-organizations/florida-small-cities-community-development-block-grant-program
2	State of Florida Department of Emergency Management	Flood Mitigation Assistance Program	The Flood Mitigation Assistance Program is funded by FEMA and administered through a partnership with the Florida Division of Emergency Management (FDEM). FDEM has the authority and responsibility for developing and maintaining a State Hazard Mitigation Plan, reviewing Flood Mitigation Assistance Program sub applications, recommending technically feasible and cost-effective sub-applications to FEMA and providing pass-thru funding for FEMA-approved and awarded project grants to eligible sub-applicants.	https://www.floridadisaster.org/dem/mitigation/flood-mitigation-assistance-program/
3	State of Florida Department of Environmental Protection - Division of Water Restoration Assistance	Springs and Watershed Restoration Program	The Division of Water Restoration Assistance is responsible for providing financial assistance to fund projects that improve the quality and quantity of the water resources of the state. The division was formed in 2015 when several significant water project funding programs collected from around the agency and brought together under one leadership. Formal adoption of the division was completed by the Legislature in 2016. The Division of Water Restoration Assistance provides funding assistance for projects that improve the quality and quantity of the state's water resources. The division works closely with the water management districts, local governments and other stakeholders to identify and implement springs projects that achieve restoration goals.	https://floridadep.gov/wra/restoration-funding
4	State of Florida Department of Environmental Protection - Office of Resilience and Coastal Protection	Beach Management Funding Assistance Program	The Strategic Beach Management Plan (updated in May 2023) provides an inventory of Florida's strategic beach management areas and coastal barrier tidal inlets along the Atlantic Ocean, Gulf of Mexico and Straits of Florida. The plan identifies the state's critically eroded beaches and develops and maintains a comprehensive long-term management plan for the restoration and maintenance of these shorelines. The Beach Management Funding Assistance Program accepts funding requests on an annual basis from local governments and municipalities for beach and inlet management projects.	https://floridadep.gov/rcp/beaches-funding-program/content/beaches-funding-assistance-information

#	Administering Organization	Program/ Grant Name	Description	Source
5	State of Florida Department of Environmental Protection - Office of Resilience and Coastal Protection	Resilient Florida Program	The Resilient Florida Program includes a selection of grants that are available to counties, municipalities, water management districts, flood control districts and regional resilience entities. To effectively address the impacts of flooding and sea level rise that the state faces, eligible applicants may receive funding assistance to analyze and plan for vulnerabilities, as well as implement projects for adaptation and mitigation. Grants include planning, implementation, or planning and implementation grants. Refer to section 380.093, F.S., for more information on the eligible project and grant types and the requirements to apply.	https://floridadep.gov/ResilientFlorida
6	State of Florida Department of Environmental Protection - Office of Resilience and Coastal Protection	Coastal Partnership Initiative	Through the Coastal Partnership Initiative (CPI), the Florida Coastal Management Program (FCMP) makes federal - specifically, the National Oceanic and Atmospheric Administration (NOAA) - funds available on a competitive basis to Florida's 35 coastal counties and all municipalities within the counties' boundaries that are required to include a coastal element in their comprehensive plan. The CPI was developed to promote the protection and effective management of Florida's coastal resources in four specific priority areas: Resilient Communities, Coastal Resource Stewardship, Access to Coastal Resources, and Working Waterfronts.	https://floridadep.gov/rcp/fcmp/content/coastal-partnership-initiative
7	State of Florida Department of Environmental Protection - Office of Water Policy and Ecosystems Restoration	Alternative Water Supply Grants	Projects funded through this program are intended to prioritize regional projects in the areas of greatest need as well as projects that provide the greatest benefit. Examples of projects funded include reclaimed water, aquifer recharge, water conservation, etc.	https://floridadep.gov/water-policy/water-policy/content/alternative-water-supply-grants-0
8	State of Florida Department of Transportation	County Incentive Grant Program (CIGP)	The County Incentive Grant Program (CIGP) was created for the purpose of providing grants to counties, to improve a transportation facility including transit which is located on the State Highway System (SHS) or which relieves traffic congestion on the SHS, per Section 339.2817, Florida Statutes. Such projects may include resurfacing and paving dirt local roads as long as the statutory requirement is clearly met. For example, if an application is received for CIGP funds to pave a dirt road, the justification must indicate how paving the dirt road would relieve congestion on the SHS. Each eligible project must be consistent to the maximum extent feasible with the Florida Transportation Plan, Metropolitan Planning Organization Plan where applicable, and any appropriate local government comprehensive plan. Counties may submit projects that are not in the Metropolitan Planning Organization Long Range Transportation Plan or local government comprehensive plan; however, if selected, the projects must be amended into these plans within six months and supporting documentation should be provided to the Florida Department of Transportation (department).	https://www.fdot.gov/programmanagement/lp/cigp/default.shtm

#	Administering Organization	Program/ Grant Name	Description	Source
9	State of Florida Department of Transportation	Transportation Regional Incentive Program (TRIP)	TRIP was created to improve regionally significant transportation facilities in "regional transportation areas". State funds are available throughout Florida to provide incentives for local governments and the private sector to help pay for critically needed projects that benefit regional travel and commerce. The Florida Department of Transportation (FDOT) will pay up to 50 percent of the non-federal share of project costs for public transportation facility projects.	https://www.fdot.gov/programmanagement/lp/trip/default.shtm#:~:text=TRIP%20was%20created%20to%20improve,benefit%20regional%20travel%20and%20commerce.
10	The Nature Conservancy	Natural Climate Solutions Accelerator Grant Program	Through the generous support of the Doris Duke Charitable Foundation, The Nature Conservancy launched the U.S. Natural Climate Solutions Accelerator program in 2018 to support projects with potential to substantially increase the use of natural climate solutions. This grant-funding program focuses on helping kick-start innovative and scalable approaches for reducing greenhouse gas emissions and storing more carbon on natural and working lands across the United States. The program has awarded $2.55 million dollars to 15 projects in three rounds of grantmaking. In addition to financial support, grant recipients are offered mentorship and connection to networks and new partnerships.	https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/climate-change-stories/natural-climate-solutions-accelerator-grant/#:~:text=This%20grant%2Dfunding%20program%20focuses,in%20three%20rounds%20of%20grantmaking.
11	U.S. Department of Agriculture - Natural Resources Conservation Service	Watershed and Flood Prevention Operations (WFPO) Program	Helps units of federal, state, local and tribal of government (project sponsors) protect and restore watersheds up to 250,000 acres. This program provides for cooperation between the Federal government and the states and their political subdivisions to work together to prevent erosion; floodwater and sediment damage; to further the conservation development, use and disposal of water; and to further the conservation and proper use of land in authorized watersheds.	https://www.nrcs.usda.gov/programs-initiatives/watershed-and-flood-prevention-operations-wfpo-program
12	U.S. Department of Agriculture - Natural Resources Conservation Service	Watershed Rehabilitation Program	Helps project sponsors rehabilitate aging dams that are reaching the end of their design lives, to address critical public health and safety concerns. The program also allows sponsors to build or augment existing water supplies. NRCS provides technical and financial assistance to sponsors and assists them with the planning, design, and construction of the projects.	https://www.nrcs.usda.gov/programs-initiatives/watershed-rehabilitation
13	U.S. Department of Commerce - NIST	Public Safety Innovation Accelerator Program	Funds activities to accelerate research, development, production, and testing of key public safety capabilities related to mission critical voice, location-based services, and user interface/user experience.	https://www.cisa.gov/sites/default/files/2023-02/23_0215_list_of_emergency_communications_financial_assistance_programs_508.pdf
14	U.S. Department of Commerce - NOAA	Transformational Habitat Restoration and Coastal Resilience Grants	Supports transformational projects that restore marine, estuarine, coastal, or Great Lakes ecosystems, using approaches that enhance community and ecosystem resilience to climate hazards. Funding is available through the Bipartisan Infrastructure Law and Inflation Reduction Act.	https://www.fisheries.noaa.gov/grant/transformational-habitat-restoration-and-coastal-resilience-grants

#	Administering Organization	Program/ Grant Name	Description	Source
15	U.S. Department of Commerce - NOAA	National Oceans and Coastal Security Fund/Resilience Fund	Invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities. Limited funding is available in partnership with the U.S. Department of Defense to support projects advancing nature-based solutions in the vicinity of DoD installations and ranges that enhance military resilience to coastal hazards.	https://www.noaa.gov/infrastructure-law/infrastructure-law-climate-ready-coasts/national-oceans-and-coastal-security-fund
16	U.S. Department of Commerce - NOAA	Flood and Inundation Mapping and Forecasting, Water Modeling, and Precipitation Studies	Funds the transformation of water prediction by delivering operational, continental-scale coastal and inland flood models and mapping capabilities. These capabilities include flood forecasts and projections that will provide actionable decision support services equitably delivered to communities across the nation.	https://www.noaa.gov/infrastructure-law/infrastructure-law-climate-data-and-services/flood-and-inundation-mapping-and-forecasting
17	U.S. Department of Defense - Army Corps of Engineers	Continuing Authorities Program: Emergency Shoreline and Streambank Protection Projects (Section 14)	Funds the construction of emergency shoreline and streambank protection works to protect public facilities, such as bridges, roads, public buildings, sewage treatment plants, water wells, and non-profit public facilities, such as churches, hospitals, and schools.	https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-14/
18	U.S. Department of Defense - Army Corps of Engineers	Continuing Authorities Program: Small Flood Damage Reduction Projects (Section 205)	Allows USACE to develop and construct small flood control projects without the need of specific congressional authorization. The program provides local flood risk management by the construction or improvement of flood control works or non-structural measures.	https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/3482
19	U.S. Department of Defense - Army Corps of Engineers	Flood Plain Management Services Program	Provides technical assistance and planning guidance to Federal agencies, states, local governments, other non-Federal entities, eligible Tribes and the private sector to support effective floodplain management.	https://www.nae.usace.army.mil/Missions/Public-Services/Flood-Plain-Management-Services/
20	U.S. Department of Defense - Army Corps of Engineers	Flood Risk Management Program	Funds the construction of projects that help to reduce the risk of damage in a flood, including $750 million for multi-purpose projects or programs that include flood risk management benefits as a purpose. Program requires specific congressional authorization.	https://www.mvr.usace.army.mil/Business-With-Us/Outreach-Customer-Service/Flood-Risk-Management/

#	Administering Organization	Program/ Grant Name	Description	Source
21	U.S. Department of Defense - Army Corps of Engineers	Hurricane and Storm Damage Reduction Projects (Section 103)	Funds the construction of projects that help to reduce the risk of damage in a coastal storm, targeting states that have been impacted by federally declared disasters over the past six years, including $1 billion for multi-purpose projects or programs that include flood risk management benefits as a purpose.	https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-103/#:~:text=Hurricane%20and%20storm%20damage%20reduction%20projects%20are%20not%20limited%20to,utilizing%20the%20Section%20103%20authority.
22	U.S. Department of Defense - Army Corps of Engineers	Continuing Authorities Program: Aquatic Ecosystem Restoration Projects (Section 206)	Funds the construction of authorized water resources projects to increase aquatic ecosystem restoration, including $1 billion for multi-purpose projects or programs that include aquatic ecosystem restoration as a purpose.	https://www.nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program/Section-206/
23	U.S. Department of Defense - Army Corps of Engineers	Planning Assistance to States	Provides planning and technical assistance to States, Tribes, and local communities to address water resource issues and related work.	https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/
24	U.S. Department of Defense - Army Corps of Engineers	Water-Related Environmental Infrastructure Assistance	Funds engineering and construction of authorized environmental infrastructure projects which provides safe water supply, waste disposal and pollution control to cities and towns to protect human health and safeguard the environment.	https://crsreports.congress.gov/product/pdf/R/R47162
25	U.S. Department of Energy	Energy Savings Performance Contracts (ESPC) Indefinite-Delivery, Indefinite-Quantity (IDIQ)	Allows federal agencies to procure energy savings and facility improvements. DOE IDIQ ESPC is a streamlined master contract that allows federal agencies to work with 21 DOE Qualified Energy Service Companies (ESCOs) holding the current DOE IDIQ ESPC contract. DOE IDIQ ESPCs can provide agencies with a path to significantly reduce energy and operating costs and make progress toward meeting federal energy and related goals.	https://www.energy.gov/eere/femp/awarded-doe-idiq-energy-savings-performance-contract-projects
26	U.S. Department of Energy	Energy Savings Performance Contract (ESPC) ENABLE	Provides facilities an opportunity to implement specific energy conservation measures (ECMs) in a streamlined manner using the Investment Grade Audit Tool and streamlined measurement and verification methods. ESPC ENABLE provides turnkey design, installation, and financing services with short implementation periods (as little as six months from start to award), while ESPC can also be useful if actively managed.	https://www.energy.gov/eere/femp/energy-savings-performance-contract-enable-federal-projects

#	Administering Organization	Program/ Grant Name	Description	Source
27	U.S. Department of Energy	Utility Energy Service Contracts (UESC)	Forms contracts between a federal agency and its franchised serving utility for the purpose of producing measurable energy or water reductions or measurable amounts of demand reduction.	https://www.energy.gov/eere/femp/about-utility-energy-service-contracts
28	U.S. Department of Energy	Smart Grid Grants	Increases the flexibility, efficiency, and reliability of the electric power system, with particular focus on: increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating renewable energy at the transmission and distribution levels, and facilitating the integration of increasing electrified vehicles, buildings, and other grid-edge devices. Smart grid technologies funded and deployed at scale through this program must demonstrate a pathway to wider market adoption.	https://www.energy.gov/sites/default/files/2022-12/Smart%20Grid%20Grants%20Fact%20Sheet%20%28December%202022%29_0.pdf
29	U.S. Department of Energy	Grid Resilience Utility and Industry Grants	Funds the prevention of outages and enhance the resilience of the electric grid.	https://www.energy.gov/sites/default/files/2022-12/Grid%20Resilience%20Utility%20and%20Industry%20Grants%20Fact%20Sheet%20%28December%202022%29.pdf
30	U.S. Department of Energy	Grid Innovation Program	Provides federal financial assistance to demonstrate innovative approaches to transmission, storage, and distribution infrastructure to harden and enhance resilience and reliability, and projects that demonstrate new approaches to enhance regional grid resilience.	https://www.energy.gov/clean-energy-infrastructure/program-upgrading-our-electric-grid-and-ensuring-reliability-and
31	U.S. Department of Energy	Transmission Facilitation Program	Facilitates the construction of electric power transmission lines and related facilities to enable greater clean energy growth and provide low-cost clean energy to more Americans. Administered through the Building a Better Grid Initiative, the program provides support to overcome the financial hurdles in the development of large-scale new transmission lines and upgrading existing transmission as well as the connection of microgrids.	https://www.energy.gov/gdo/transmission-facilitation-program
32	U.S. Department of Energy	Assisting Federal Facilities with Conservation Technologies (AFFECT)	Provides grants to federal agencies that they can leverage with private capital to make energy and water efficiency upgrades to federal buildings.	https://www.energy.gov/eere/femp/assisting-federal-facilities-energy-conservation-technologies-affect-2019-federal-agency

#	Administering Organization	Program/ Grant Name	Description	Source
33	U.S. Department of Energy	Energy Efficiency and Conservation Block Grant Program	Assists states, local governments, and Tribes to reduce energy use, reduce fossil fuel emissions, and improve energy efficiency.	https://www.energy.gov/clean-energy-infrastructure/energy-efficiency-and-conservation-block-grant-program
34	U.S. Department of Energy	Energy Efficient Transformer Rebates	Provides rebates to industrial or manufacturing facility owners, commercial building owners, multifamily building owners, utilities, or energy service companies for the replacement of a qualified energy inefficient transformer with a qualified energy efficient transformer.	https://www.energy.gov/clean-energy-infrastructure/energy-efficient-transformer-rebates
35	U.S. Department of Energy	New Solar Research & Development Program	Encourages collaborative partnerships among industry, universities, national laboratories, federal, state, and local governments and non-government agencies and advocacy groups.	https://www.energy.gov/eere/solar/solar-research-and-development-funding-programs
36	U.S. Department of Energy	Advanced Energy Security Program	Increases the functional preservation of electric grid operations or natural gas and oil operations in the face of threats and hazards.	https://www.energy.gov/bil/advanced-energy-security-program
37	U.S. Department of Energy	Energy Storage Demonstration Pilot Grant Program	Supports agreements to carry out 3 energy storage system demonstration projects.	https://www.energy.gov/oced/energy-storage-demonstration-and-pilot-grant-program
38	U.S. Department of Homeland Security - FEMA	Building Resilient Infrastructures and Communities (BRIC) Grant	Incentivizes public infrastructure projects, projects that mitigate risk to one or more lifelines, projects that incorporate nature-based solutions, and the adoption and enforcement of modern building codes.	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
39	U.S. Department of Homeland Security - FEMA	Flood Mitigation Assistance (FMA) Grant	Funds projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. FEMA selects projects to fund based on severe repetitive loss (i.e., projects that will mitigate flood damage to at least 50 % of structures). Eligible activities for community flood mitigation project must benefit NFIP insured properties.	https://www.fema.gov/grants/mitigation/floods
40	U.S. Department of Homeland Security - FEMA	Hazard Mitigation Grant Program	Provides funding to state, local, tribal and territorial governments so they can rebuild in a way that reduces, or mitigates, future disaster losses in their communities. This grant funding is available after a presidentially declared disaster. Applicants must have a FEMA-approved state or tribal Hazard Mitigation Plan by the application deadline and at the time of obligation of grant funds.	https://www.fema.gov/grants/mitigation/hazard-mitigation

#	Administering Organization	Program/ Grant Name	Description	Source
41	U.S. Department of Homeland Security - FEMA	Rehabilitation of High Hazard Potential Dams	Provides technical, planning, design and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. A state or territory with an enacted dam safety program, the State Administrative Agency, or an equivalent state agency, is eligible for the grant.	https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard-potential-dams
42	U.S. Department of Homeland Security - FEMA	Emergency Management Performance Grant	Provides state, local, tribal and territorial emergency management agencies with the resources required for implementation of the National Preparedness System and works toward the National Preparedness Goal of a secure and resilient nation. The EMPG's allowable costs support efforts to build and sustain core capabilities across the prevention, protection, mitigation, response and recovery mission areas.	https://www.fema.gov/grants/preparedness/emergency-management-performance
43	U.S. Department of the Interior - National Fish and Wildlife Service	America the Beautiful Challenge	Consolidates funding from multiple federal agencies and the private sector to enable applicants to conceive and develop large-scale, locally led projects that address shared funder priorities spanning public and private lands.	https://www.nfwf.org/programs/america-beautiful-challenge
44	U.S. Department of the Interior - National Fish and Wildlife Foundation (NFWF)	National Coastal Resilience Fund	The National Fish and Wildlife Foundation (NFWF) announced the 2024 National Coastal Resilience Fund (NCRF). NFWF will make investments in planning, design, and implementation of natural and nature-based solutions. The goal is to enhance protection for coastal communities from the impacts of storms, floods, and other natural coastal hazards and to improve habitats for fish and wildlife. NFWF will award approximately $140 million in grants to create and restore natural systems to increase protection for communities from current and future coastal hazards and improve habitats for fish and wildlife species. The availability of federal funds estimated in this solicitation is contingent upon the federal appropriations process; funding decisions will be made based on level of funding and timing of when it is received by NFWF. NFWF's regional coastal resilience assessments identify areas, called Resilience Hubs, where natural resource restoration efforts will have the greatest impact for human community resilience and fish and wildlife. Projects need not be located in an area identified by NFWF as a Resilience Hub to be eligible. This program is primarily funded by, and coordinated with, the National Oceanic and Atmospheric Administration (NOAA). Limited funding is available in partnership with the U.S. Department of Defense (DOD) to support projects advancing nature-based solutions in the vicinity of but not within the boundaries of DOD installations and ranges that enhance military resilience to coastal hazards (for more information see the Funding Availability and Match section). Additional funding is provided by other partners, including Occidental and Shell USA, Inc. NFWF will also seek to leverage public or private funds that align with the goals of the NCRF projects to extend the impact of this program.	https://www.nfwf.org/programs/national-coastal-resilience-fund/national-coastal-resilience-fund-2024-request-proposals

#	Administering Organization	Program/ Grant Name	Description	Source
45	U.S. Department of Transportation	Infrastructure for Rebuilding America (INFRA)	Funds transportation projects of national and regional significance. USDOT seeks INFRA projects that address climate change and environmental justice. Projects will be evaluated on whether they were planned as part of a comprehensive strategy to address climate change, or whether they support strategies to reduce greenhouse gas emissions such as deploying zero-emission-vehicle infrastructure or encouraging modal shift and a reduction in vehicle-miles-traveled.	https://www.transportation.gov/buildamerica/financing/infra-grants/infrastructure-rebuilding-america
46	U.S. Department of Transportation	Strengthening Mobility and Revolutionizing Transportation (SMART) Grants	Provides supplemental funding grants to rural, midsized, and large communities to conduct demonstration projects focused on advanced smart city or community technologies and systems in a variety of communities to improve transportation efficiency and safety.	https://www.transportation.gov/grants/SMART
47	U.S. Department of Transportation	Urbanized Area Formula Grants	Funds urbanized areas and governors for transit capital, and provides assistance in urbanized areas for transportation-related planning.	https://www.transit.dot.gov/funding/grants/urbanized-area-formula-grants-5307
48	U.S. Department of Transportation	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grant Program	Provides supplemental funding for grants on a competitive basis for projects that will have a significant local/regional impact.	https://www.transportation.gov/RAISEgrants
49	U.S. Department of Transportation	Neighborhood Access & Equity Grant Program	Funds projects that improve walkability, safety, and affordable transportation, and mitigate or remediate negative impacts from a transportation facility to underserved communities.	https://fundingnature-basedsolutions.nwf.org/programs/neighborhood-access-and-equity-grant-program/
50	U.S. Department of Transportation - Federal Highway Administration	Defense Access Road Program (DAR)	Provides a means for the military to pay their share of the cost of public highway improvements necessary to mitigate an unusual impact of a defense activity. An unusual impact could be a significant increase in personnel at a military installation, relocation of an access gate, or the deployment of an oversized or overweight military vehicle or transporter unit.	https://highways.dot.gov/federal-lands/programs/defense
51	U.S. Department of Transportation - Federal Highway Administration	Construction of Ferry Boats and Ferry Terminal Facilities Formula Program (FBP)	Provides funds for designing and constructing ferry boats and for designing, acquiring right-of-way, and constructing ferry terminal facilities. Ferry boats and terminal facilities that serve vehicular travel as links on public highways (other than Interstate highways), as well as ferry boats and terminals only serving passengers as a fixed route transit facility, may be eligible for certain types of Federal-aid highway funding.	https://www.fhwa.dot.gov/specialfunding/fbp/

#	Administering Organization	Program/ Grant Name	Description	Source
52	U.S. Department of Transportation - Federal Highway Administration	Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) - Formula	Helps making surface transportation more resilient to natural hazards, including climate change, sea level rise, flooding, extreme weather events, and other natural disasters through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk costal infrastructure. The PROTECT Program includes both formula funding distributed to States and competitive grants.	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/protect_fact_sheet.cfm
53	U.S. Department of Transportation - Federal Highway Administration	National Highway Performance Program	Funds projects that provide support for the condition and performance of the National Highway System and provides support for activities to increase the resiliency of the National Highway System to mitigate the cost of damages from sea level rise, extreme weather events, flooding, wildfires, or other natural disasters.	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nhpp.cfm
54	U.S. Department of Transportation - Federal Highway Administration	Surface Transportation Block Grant Program	Promotes flexibility in state and local transportation decisions and provides flexible funding to best address state and local transportation needs.	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/stbg.cfm
55	U.S. Department of Transportation - Federal Railroad Administration	Consolidated Rail Infrastructure and Safety Improvement Grants	Funds projects that improve the safety, efficiency, and reliability of intercity passenger and freight rail.	https://railroads.dot.gov/grants-loans/competitive-discretionary-grant-programs/consolidated-rail-infrastructure-and-safety-2
56	U.S. Department of Transportation - Federal Transit Administration	State of Good Repair Grants, Section 5337	Funds existing fixed guideway systems (including rail, bus rapid transit, and passenger ferries) and high intensity motorbus systems (buses operating in high-occupancy vehicle lanes) to maintain public transportation systems in a state of good repair and to ensure public transit operates safely, efficiently, reliably, and sustainably so that communities can offer balanced transportation choices that helps to improve mobility, reduce congestion, and encourage economic development.	https://www.transit.dot.gov/funding/grants/state-good-repair-grants-5337
57	U.S. Department of Transportation - Federal Transit Administration	Capital Investment Grants Program	Funds transit capital investments, including heavy rail, commuter rail, light rail, streetcars, and bus rapid transit. Federal transit law requires transit agencies seeking Capital Investment Grants funding to complete a series of steps over several years. The law also requires projects to be rated by Federal Transit Administration at various points in the process according to statutory criteria evaluating project justification and local financial commitment.	https://www.transit.dot.gov/CIG

#	Administering Organization	Program/ Grant Name	Description	Source
58	U.S. Department of Transportation - Federal Transit Administration	Research, Development, Demonstration and Deployment Projects (Less Set Aside)	Provides funding to assist innovative projects and activities that advance and sustain safe, efficient, equitable, climate-friendly public transportation. Eligible research and demonstrations under this program explore novel approaches to improve public transportation service.	https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/MAP-21_Fact_Sheet_-_Research_Development_Demonstration_and_Deployment_Projects.pdf
59	U.S. Department of Treasury	Energy Efficient Buildings Deduction (179D)	Funds new construction projects and renovated buildings that meet energy-reduction requirements (full compliance = reduce energy and power cost of interior lighting, HVAC, and hot-water systems by 50% or more).	https://www.govinfo.gov/content/pkg/USCODE-2021-title26/pdf/USCODE-2021-title26-subtitleA-chap1-subchapB-partVI-sec179D.pdf
60	U.S. Department of Treasury	(Wind & Solar) Production Tax Credit (45)	Provides credit to a facility or project that install wind or solar energy. Base credit amount is .5 cents per kWh, "increased credit amount" is 2.6 cents per kWh of electricity sold and produced in 2022. Credit reduced for facilities financed with tax-exempt bonds.	https://www.law.cornell.edu/uscode/text/26/45
61	U.S. Department of Treasury	Clean Electricity Investment Credit (48E)	Provides credit to any energy storage facility placed in service on or after January 1, 2025 with GHG emissions rate not more than 0. Intended to be technology neutral and replace the ITC for facilities going forward. Generally calculated in the same manner as ITC.	https://www.law.cornell.edu/uscode/text/26/48
62	U.S. Environmental Protection Agency	Clean Water Act Nonpoint Source Grant (Section 319 Grants)	Provides technical assistance and financial assistance to designated state and tribal agencies to implement their approved nonpoint source management programs.	https://www.epa.gov/nps/319-grant-current-guidance
63	U.S. Environmental Protection Agency	Water Infrastructure Finance and Innovation Act (WIFIA)	Accelerates investment in water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.	https://www.epa.gov/wifia
64	U.S. Environmental Protection Agency	Environmental and Climate Justice Community Change Grants Program	EPA's new Environmental and Climate Justice Community Change Grants program (Community Change Grants) has announced a Notice of Funding Opportunity (NOFO) for approximately $2 billion dollars in Inflation Reduction Act (IRA) funds in environmental and climate justice activities to benefit disadvantaged communities through projects that reduce pollution, increase community climate resilience, and build community capacity to address environmental and climate justice challenges. These place-based investments will be focused on community-driven initiatives to be responsive to community and stakeholder input. They are designed to deliver on the transformative potential of the IRA for communities most adversely and disproportionately impacted by climate change, legacy pollution, and historical disinvestments.	https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-community-change-grants-program

#	Administering Organization	Program/ Grant Name	Description	Source
65	U.S. Environmental Protection Agency	Superfund Redevelopment Program	Provides technical assistance to communities interested in restoring and reusing formerly contaminated land.	https://www.epa.gov/superfund-redevelopment
66	U.S. Environmental Protection Agency	Five Star and Urban Waters Restoration Grants Program	The Five Star Wetland and Urban Waters Restoration Program is a joint collaboration between the National Fish and Wildlife Federation, EPA, and USDA and provides financial assistance to grassroots partnerships for wetland, forest, riparian and coastal habitat restoration, stormwater management, outreach and stewardship with a particular focus on water quality, watersheds and the habitats they support.	https://www.epa.gov/urbanwaterspartners/five-star-and-urban-waters-restoration-grant-program
67	U.S. Environmental Protection Agency	Technical Assistance to Brownfields Communities	Help communities tackle the challenge of assessing, cleaning up and preparing brownfield sites for redevelopment, especially underserved/rural/small and distressed communities.	https://www.epa.gov/grants/technical-assistance-brownfields-communities-1
68	U.S. Environmental Protection Agency	Sewer Overflow and Stormwater Reuse Municipal Grants Program	Used for planning, designing, and construction of combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), and stormwater management projects.	http://www.epa.gov/cwsrf/sewer-overflow-and-stormwater-reuse-municipal-grants-program
69	U.S. Environmental Protection Agency	Clean Water State Revolving Fund	Provides low-cost financing to communities for a wide range of water quality infrastructure projects, including municipal wastewater facilities, nonpoint source pollution control, decentralized wastewater treatment systems, stormwater runoff mitigation, green infrastructure, estuary protection, and water reuse.	https://www.epa.gov/cwsrf
70	U.S. Environmental Protection Agency	Building Blocks for Sustainable Communities	Works with local communities across the United States, including tribes and territories, to develop smart growth solutions and strategies in ways that benefit human health and the environment. The program uses an inclusive and locally-led process that strengthens local capacity, facilities partnerships and creates a path forward to achieve community-identified goals.	https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities
71	U.S. Environmental Protection Agency	Drinking Water System Infrastructure Resilience and Sustainability	Assist underserved, small, and disadvantaged communities for the purpose of increasing drinking water facility resilience to natural hazards.	https://www.epa.gov/dwcapacity/drinking-water-system-infrastructure-resilience-and-sustainability
72	U.S. Environmental Protection Agency	Environmental Education Grants	Funds projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.	https://www.epa.gov/education/grants
73	U.S. Department of Homeland Security - FEMA	Pre-Disaster Mitigation Grant Program	Makes federal funds available to state, local, tribal and territorial governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.	https://www.fema.gov/grants/mitigation/pre-disaster

#	Administering Organization	Program/ Grant Name	Description	Source
74	U.S. Department of Homeland Security - FEMA	Safeguarding Tomorrow Revolving Loan Fund Program	Provides capitalization grants to states, eligible federally recognized tribes, territories and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters.	https://www.fema.gov/grants/mitigation/storm-rlf
75	U.S. Army Corps of Engineers	Corps Water Infrastructure Financing Program	Accelerates non-federal investments in water resources infrastructure by providing long-term, low-cost loans to creditworthy borrowers.	https://www.usace.army.mil/Missions/Civil-Works/Infrastructure/Revolutionize/CWIFP/
76	U.S. Department of Agriculture - Natural Resources Conservation Service	Emergency Community Water Assistance Grant	Helps eligible communities prepare or recover from an emergency that threatens the availability of safe, reliable drinking water.	https://www.rd.usda.gov/programs-services/water-environmental-programs/emergency-community-water-assistance-grants
77	U.S. Department of Commerce - NOAA	NOAA Broad Agency Announcement	A mechanism to encourage research, education and outreach, innovative projects, or sponsorships that are not addressed through NOAA competitive discretionary programs. It is not a mechanism for awarding congressionally directed funds. Funding for potential projects in this notice is contingent upon the availability of appropriations.	https://coast.noaa.gov/funding/
78	U.S. Department of Commerce - NOAA	Bay Watershed Education and Training	Environmental education program that promotes place-based experiential learning for K–12 students and related professional development for teachers. B-WET fosters the growth of new, innovative programs and encourages capacity-building and environmental education partnerships.	https://www.noaa.gov/office-education/bwet
79	U.S. Department of Agriculture	Education in America Grant	Grants to develop creative educational resources to advance EDEN's mission and the broader land-grant and sea-grant systems, to effectively address disaster management.	https://www.extension-disaster.net/
80	U.S. Department of Agriculture - Natural Resources Conservation Service	Emergency Watershed Protection	A federal emergency recovery program, helps local communities recover after a natural disaster strikes.	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection
81	U.S. Environmental Protection Agency	Healthy Watersheds Protection	To accelerate and expand the strategic protection of healthy watersheds, including freshwater, estuarine, and marine ecosystems, across the United States.	https://www.epa.gov/hwp/healthy-watersheds-consortium-grants
82	U.S. Department of Housing and Urban Development	Section 108 Loan Guarantee Program	Provides Community Development Block Grant (CDBG) recipients with the ability to leverage their annual grant allocation to access low-cost, flexible financing for economic development, housing, public facility, and infrastructure projects.	https://www.hudexchange.info/programs/section-108/

#	Administering Organization	Program/ Grant Name	Description	Source
83	U.S. Department of Agriculture - Forest Service	Urban and Community Forestry Program	Assists State Forestry agencies and partner organizations in addressing and applying nature-based solutions to chronic and emergent economic, social, and environmental challenges in communities across the United States by providing direct funding to communities and especially to communities experiencing low urban tree canopy, dead and hazardous tree conditions, extreme heat and severe flooding, and limited awareness of or access to green job workforce to help them: *Become more resilient to climate change *Combat extreme heat with the cooling effects of increased urban tree canopy *Experience improved forest health conditions and safer access to tree benefits *Attain broadened exposure and access to environmental career pathways.	https://iraucfgrants.urbanandcommunityforests.org/
84	U.S. Department of the Interior - Bureau of Reclamation	WaterSMART Cooperative Watershed Management Program	The Cooperative Watershed Management Program provides funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs through two phases: 1) Watershed Group Development and Watershed Restoration Planning and 2) Implementation of Watershed Management Projects.	https://www.usbr.gov/watersmart/cwmp/index.html

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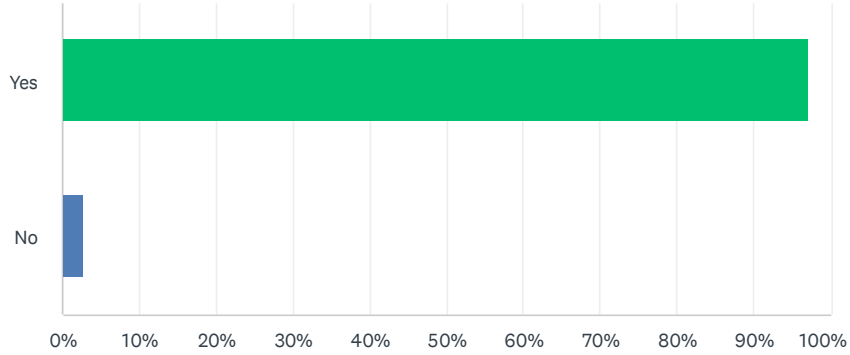
Appendix C

Results of the climate change impacts public survey

Climate Adaptation Plan Survey

Q1 Do you reside or own property within the City limits ?

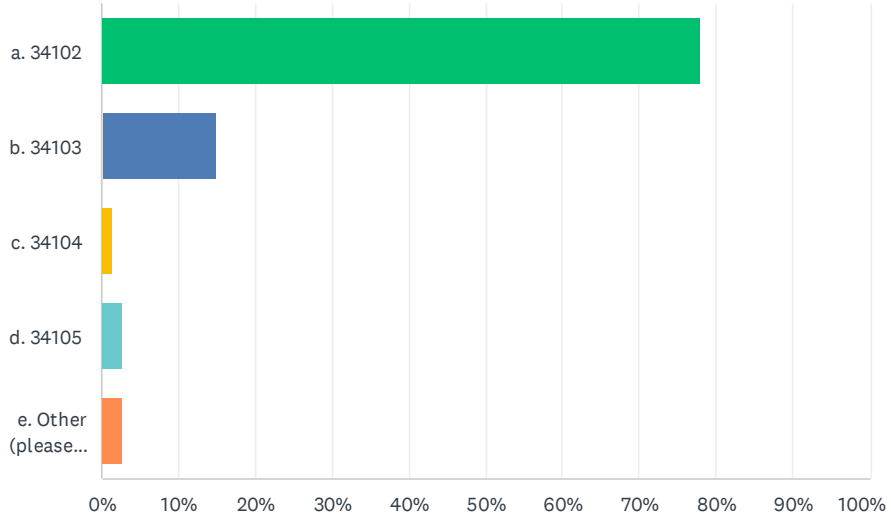
Answered: 213 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	97.18%	207
No	2.82%	6
TOTAL		213

Q2 If yes, please select the zip code you reside or own property:

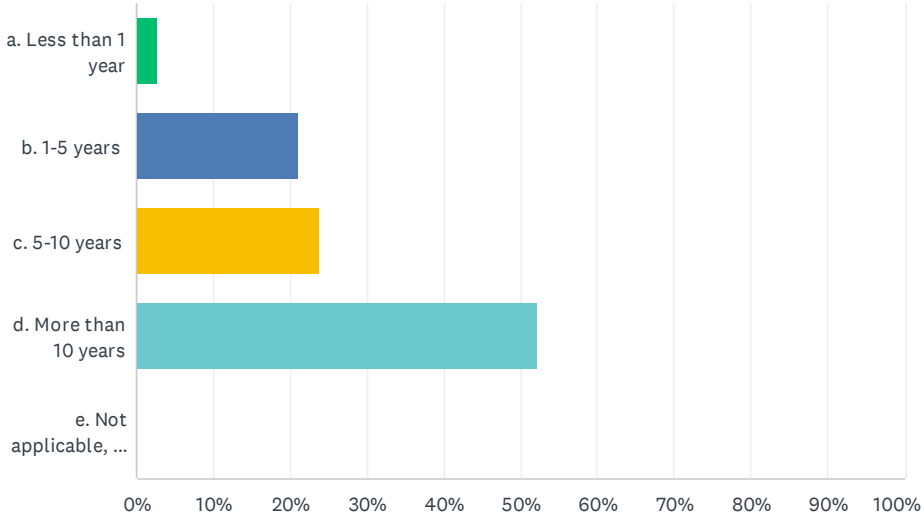
Answered: 213 Skipped: 1



ANSWER CHOICES	RESPONSES	
a. 34102	77.93%	166
b. 34103	15.02%	32
c. 34104	1.41%	3
d. 34105	2.82%	6
e. Other (please specify)	2.82%	6
TOTAL		213

Q3 How long have you lived in the City of Naples?

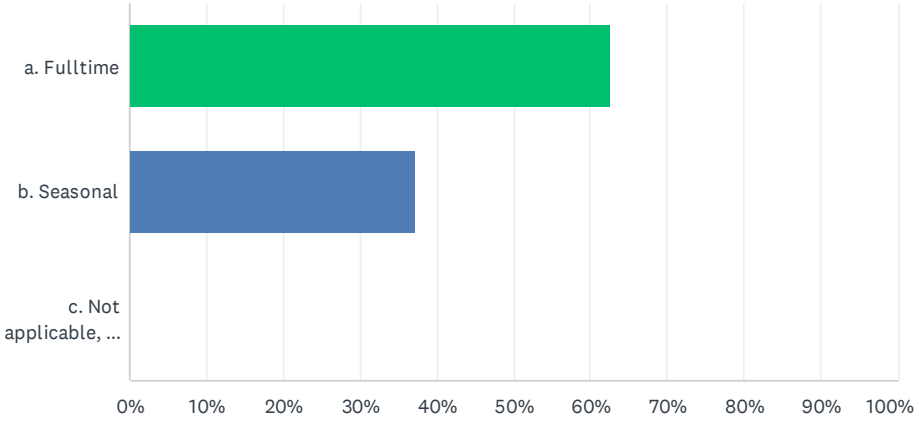
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. Less than 1 year	2.80%	6
b. 1-5 years	21.03%	45
c. 5-10 years	23.83%	51
d. More than 10 years	52.34%	112
e. Not applicable, I do not live in Naples	0.00%	0
TOTAL		214

Q4 Are you a fulltime or seasonal resident?

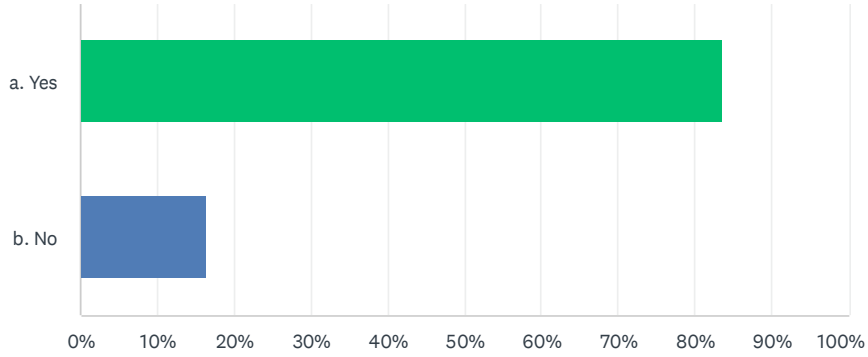
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. Fulltime	62.62%	134
b. Seasonal	37.38%	80
c. Not applicable, I do not live in Naples	0.00%	0
TOTAL		214

Q5 Are you familiar with the term nuisance flooding (also known as high tide flooding, sunny day flooding, or king tide flooding) where flooding occurs as sea levels continue to rise, that is not related to rainfall?

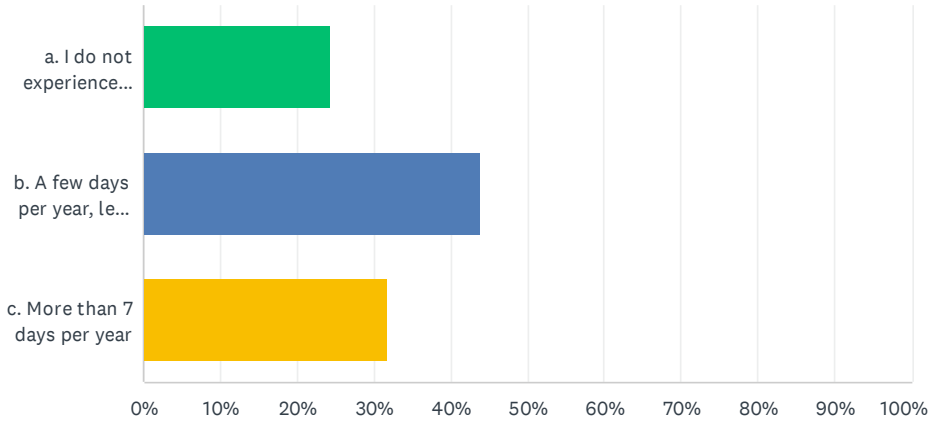
Answered: 213 Skipped: 1



ANSWER CHOICES	RESPONSES	
a. Yes	83.57%	178
b. No	16.43%	35
TOTAL		213

Q6 How many times a year do you/your community experience rainfall flooding or nuisance flooding events?

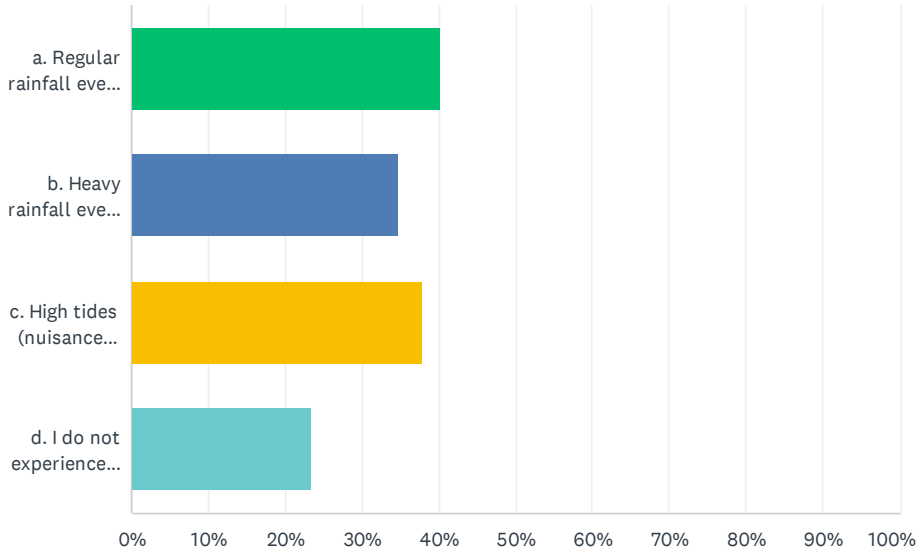
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. I do not experience flooding in Naples	24.30%	52
b. A few days per year, less than 7 days per year	43.93%	94
c. More than 7 days per year	31.78%	68
TOTAL		214

Q7 What type of flooding do you/your community experience? (can select multiple answers)

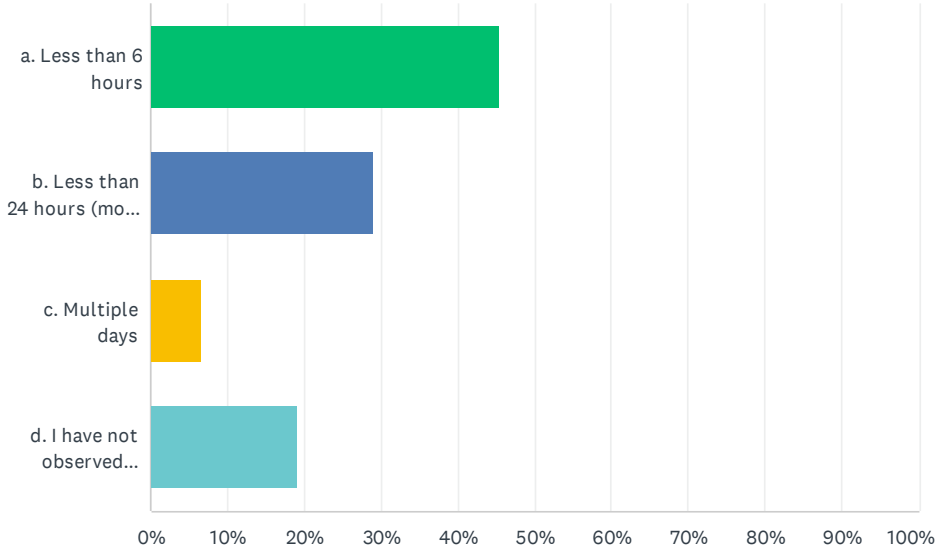
Answered: 213 Skipped: 1



ANSWER CHOICES	RESPONSES	
a. Regular rainfall events (less than 3 inches in 12 hours)	40.38%	86
b. Heavy rainfall events (3 or more inches in 12 hours)	34.74%	74
c. High tides (nuisance flooding)	38.03%	81
d. I do not experience flooding in Naples	23.47%	50
Total Respondents: 213		

Q8 How long does the observed flooding last with each event?

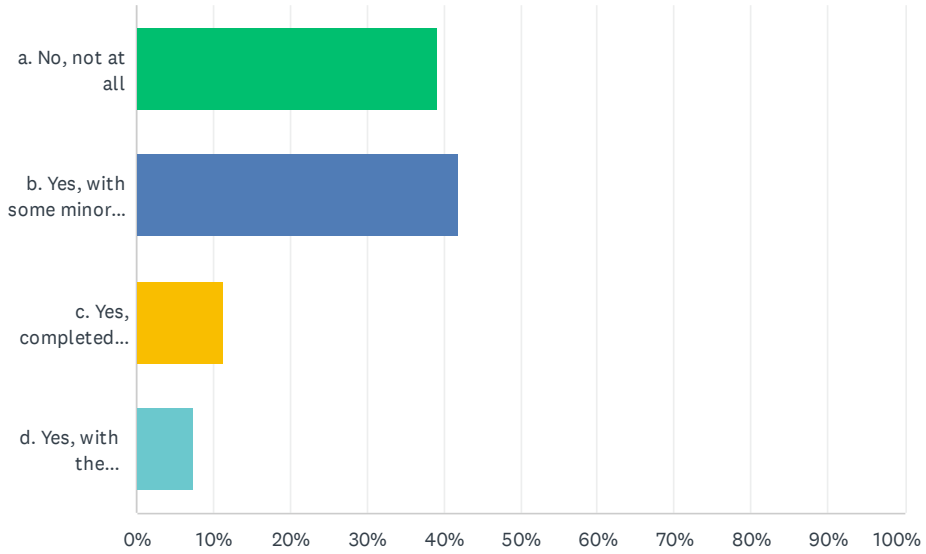
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. Less than 6 hours	45.33%	97
b. Less than 24 hours (more than 6 hours)	28.97%	62
c. Multiple days	6.54%	14
d. I have not observed flooding in Naples	19.16%	41
TOTAL		214

Q9 In the past year, has nuisance flooding or rainfall flooding affected your daily activity?

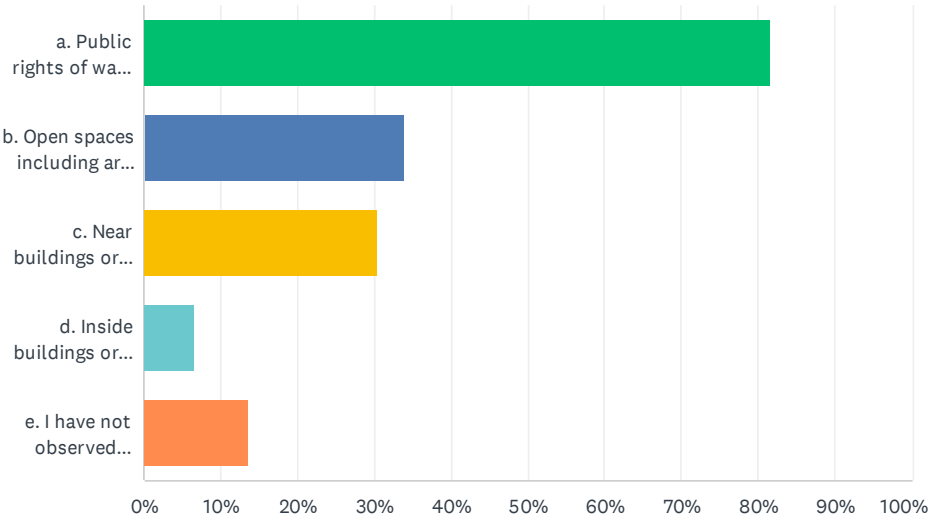
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. No, not at all	39.25%	84
b. Yes, with some minor adjustment of activity (e.g., drove through water)	42.06%	90
c. Yes, completed activity with major revision of activity (e.g., took alternate route, extended, or delayed plans)	11.21%	24
d. Yes, with the cancellation of activity	7.48%	16
TOTAL		214

Q10 What areas within the City does nuisance flooding or rainfall flooding occur? (can select multiple answers)

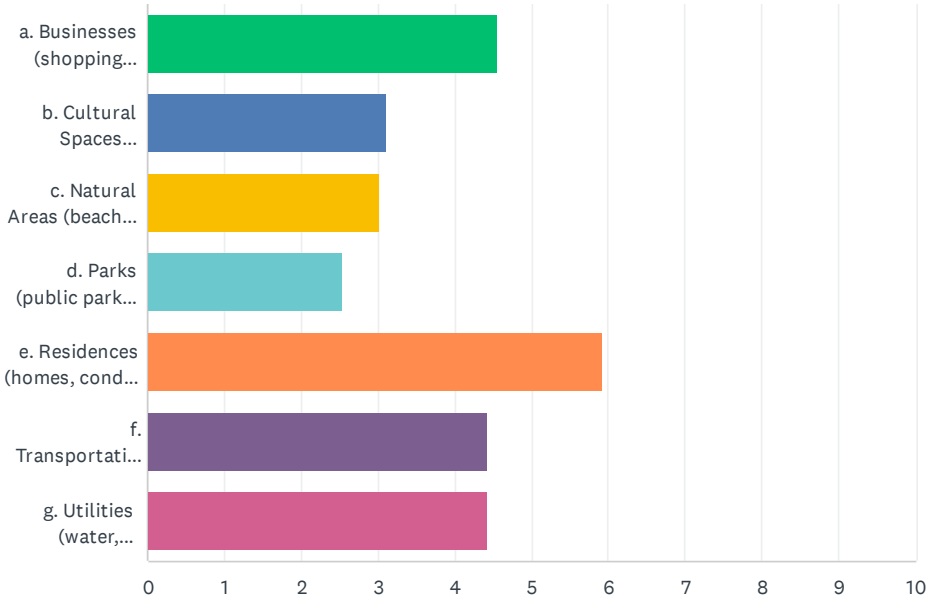
Answered: 213 Skipped: 1



ANSWER CHOICES	RESPONSES	
a. Public rights of way including areas such as roadways and sidewalks	81.69%	174
b. Open spaces including areas such as parks, parking lots, yards, or fields	33.80%	72
c. Near buildings or structures including homes and businesses	30.52%	65
d. Inside buildings or structures including homes and businesses	6.57%	14
e. I have not observed flooding in Naples	13.62%	29
Total Respondents: 213		

Q11 Please prioritize the following community features in terms of importance for flood protection within the City. Rank them from highest to lowest priority:

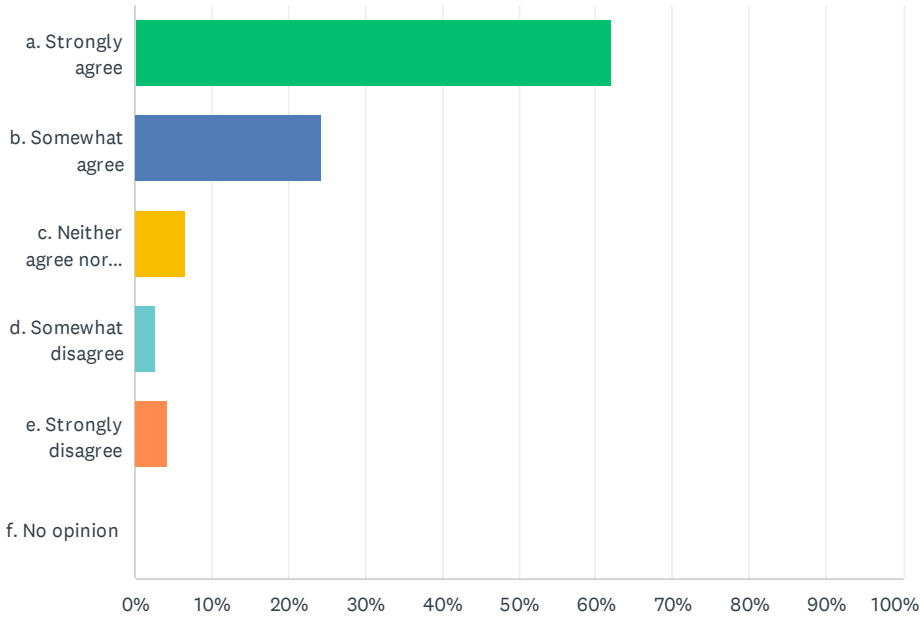
Answered: 213 Skipped: 1



	1	2	3	4	5	6	7	TOTAL	SCORE
a. Businesses (shopping centers, restaurants, offices)	12.68% 27	19.72% 42	15.49% 33	31.46% 67	9.86% 21	6.10% 13	4.69% 10	213	4.57
b. Cultural Spaces (theaters, museums, schools)	2.35% 5	10.80% 23	7.98% 17	9.86% 21	33.80% 72	13.62% 29	21.60% 46	213	3.11
c. Natural Areas (beaches, mangroves, birding areas)	3.29% 7	7.04% 15	12.21% 26	13.15% 28	19.25% 41	20.19% 43	24.88% 53	213	3.02
d. Parks (public parks and beaches)	1.41% 3	0.94% 2	6.57% 14	12.68% 27	18.31% 39	39.44% 84	20.66% 44	213	2.54
e. Residences (homes, condos, apartments)	52.58% 112	16.90% 36	13.62% 29	7.04% 15	6.57% 14	2.82% 6	0.47% 1	213	5.92
f. Transportation Facilities (roadways, sidewalks, trails)	8.92% 19	22.54% 48	24.88% 53	16.43% 35	7.98% 17	11.74% 25	7.51% 16	213	4.43
g. Utilities (water, wastewater, electrical)	18.78% 40	22.07% 47	19.25% 41	9.39% 20	4.23% 9	6.10% 13	20.19% 43	213	4.43

Q12 Would you say that taking action to address flooding within the City is necessary?

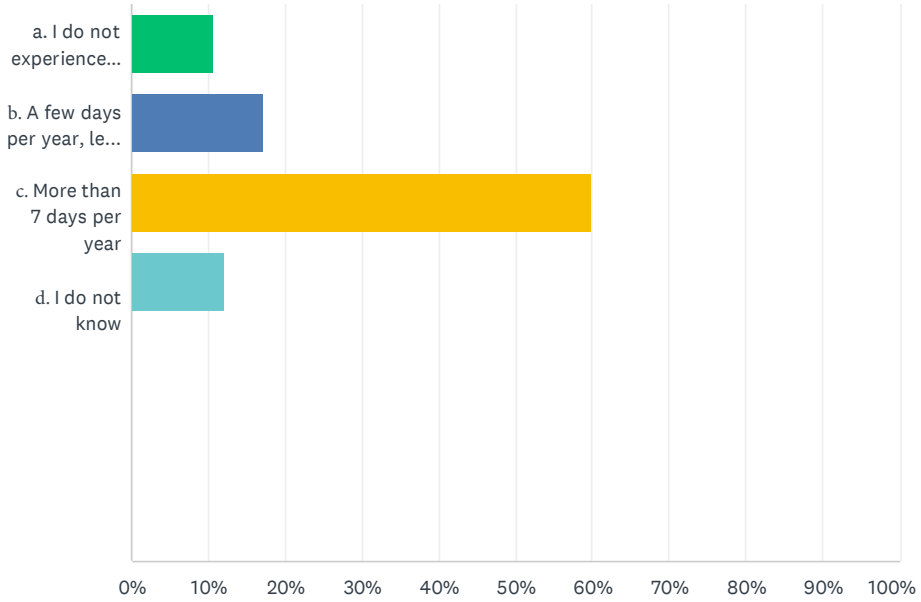
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. Strongly agree	62.15%	133
b. Somewhat agree	24.30%	52
c. Neither agree nor disagree	6.54%	14
d. Somewhat disagree	2.80%	6
e. Strongly disagree	4.21%	9
f. No opinion	0.00%	0
TOTAL		214

Q13 Extreme heat days include days when temperatures feel hotter than 95 degrees and nighttime temperatures feel warmer than normal. How many times a year does your community experience extreme heat?

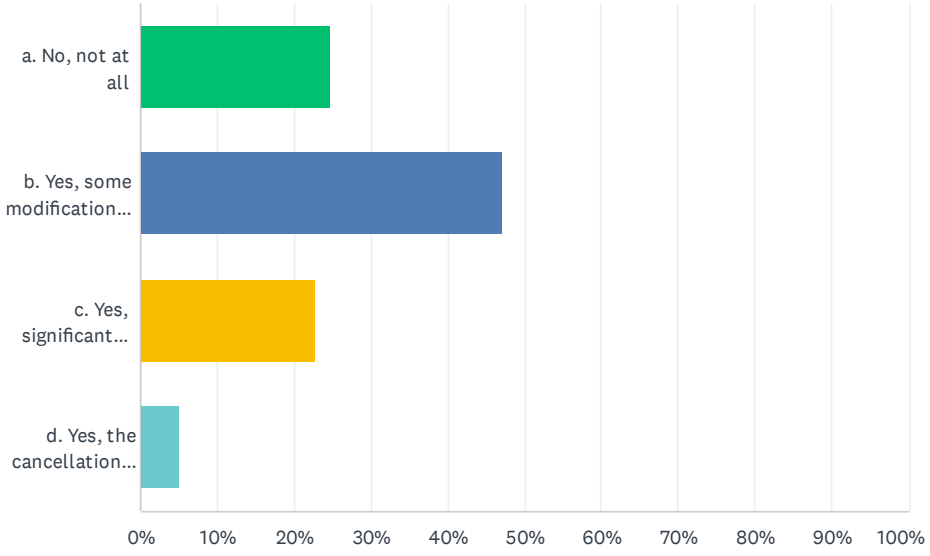
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. I do not experience extreme heat in Naples	10.75%	23
b. A few days per year, less than 7 days per year	17.29%	37
c. More than 7 days per year	59.81%	128
d. I do not know	12.15%	26
TOTAL		214

Q14 Has extreme heat caused you to modify a daily activity?

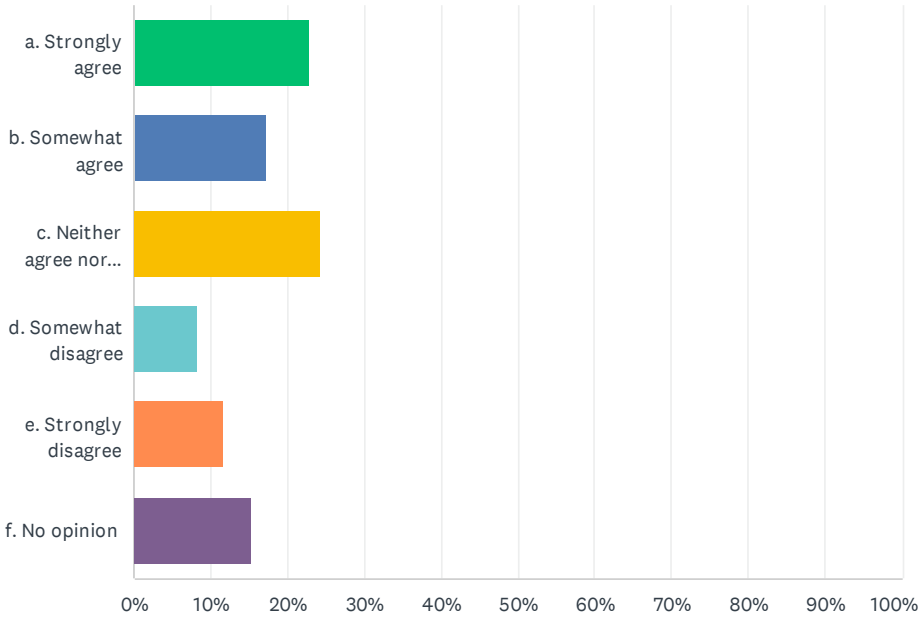
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. No, not at all	24.77%	53
b. Yes, some modification of activity (e.g., adjust time for outdoor activities)	47.20%	101
c. Yes, significant modification of activity (e.g., move activities inside)	22.90%	49
d. Yes, the cancellation of activity	5.14%	11
TOTAL		214

Q15 Do you believe it is necessary to take action to address extreme heat within the City of Naples?

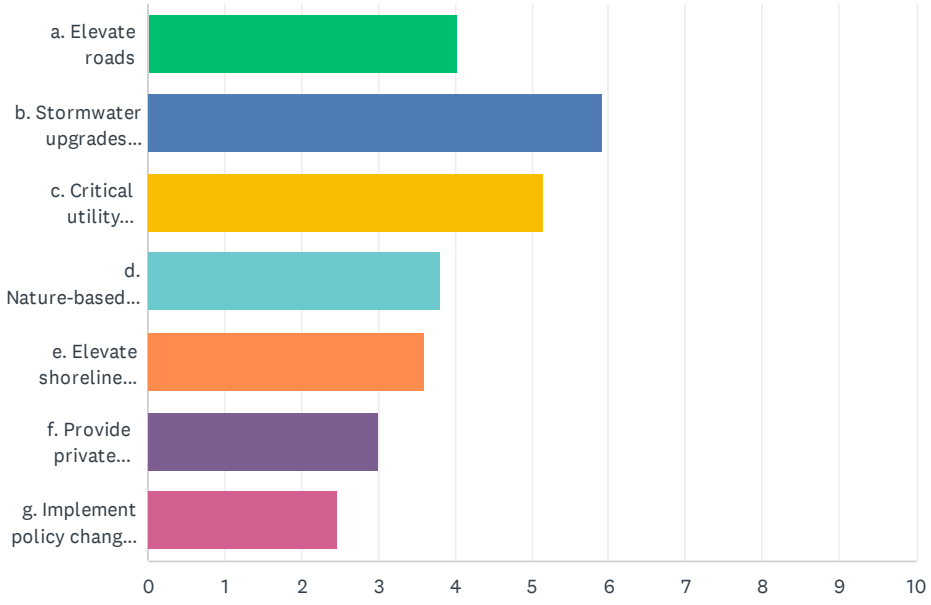
Answered: 214 Skipped: 0



ANSWER CHOICES	RESPONSES	
a. Strongly agree	22.90%	49
b. Somewhat agree	17.29%	37
c. Neither agree nor disagree	24.30%	52
d. Somewhat disagree	8.41%	18
e. Strongly disagree	11.68%	25
f. No opinion	15.42%	33
TOTAL		214

Q16 What climate adaptation measures would you prefer the City to prioritize? (Please rank the following community features in order of importance from highest to lowest priority). Questions 17, 18, 19 & 20 are optional.

Answered: 213 Skipped: 1



Climate Adaptation Plan Survey

	1	2	3	4	5	6	7	TOTAL	SCORE
a. Elevate roads	18.31% 39	8.45% 18	17.84% 38	12.21% 26	14.08% 30	15.96% 34	13.15% 28	213	4.04
b. Stormwater upgrades (elevate pumps, increase system capacity, etc.)	37.09% 79	36.15% 77	15.02% 32	6.10% 13	4.69% 10	0.47% 1	0.47% 1	213	5.92
c. Critical utility improvements (power, wastewater, drinking water, and communications)	14.55% 31	32.39% 69	26.76% 57	14.08% 30	6.57% 14	3.29% 7	2.35% 5	213	5.15
d. Nature-based projects (dune restoration, wetland restoration, shade tree planting, oyster reefs, etc.)	5.16% 11	8.45% 18	14.55% 31	30.99% 66	22.54% 48	11.74% 25	6.57% 14	213	3.81
e. Elevate shoreline protections (seawalls, living berms, etc.)	6.57% 14	6.57% 14	11.74% 25	20.19% 43	30.99% 66	18.31% 39	5.63% 12	213	3.60
f. Provide private property owners options for adaptation strategies	7.98% 17	4.69% 10	7.98% 17	12.21% 26	11.74% 25	36.62% 78	18.78% 40	213	3.00
g. Implement policy changes which incorporates increased flooding and extreme heat projections into Comprehensive Plan/City Code changes	10.33% 22	3.29% 7	6.10% 13	4.23% 9	9.39% 20	13.62% 29	53.05% 113	213	2.48

Disclaimer:

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City of Naples

Natalie Hardman
Natural Resources Manager
Public Works Department
295 Riverside Circle – Naples FL 34102
nhardman@naplesgov.com
www.naplesgov.com/naturalresources