DEP AGREEMENT NO. CM 508

Community Resiliency in the City of Satellite Beach

East Central Florida Regional Planning Council and City of Satellite Beach

Final Project Report

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July 2015

Final Project Report for CM 508

Coastal Resiliency in the City of Satellite Beach

Executive Summary

Satellite Beach spans a barrier island midway along Florida's east coast with the Atlantic Ocean to the east and the Indian River Lagoon to the west. At its widest, the 98% built-out city is about one and one-half miles wide. The city's slightly over 10,000 residents live on just under three square miles of land. The city's highest elevation is slightly over twenty feet (on coastal dunes). More than 85% of its land area is below ten feet, and about half of its land area is below six feet. As a result, Satellite Beach is particularly vulnerable to coastal hazards such as storm surge and shoreline erosion.

Recognizing the risks, in 2009 and 2010 the city teamed with the Indian River Lagoon National Estuary Program (IRL-NEP) to use $25,000 in grant funds obtained by the IRL-NEP from the US Environmental Protection Agency's Climate Ready Estuary Program to: produce an accurate topographic map of the city using available LIDAR data, conduct a vulnerability assessment, and initiate a planning process to mitigate impacts.

In 2013, City Council transmitted to Florida's land-use planning agency (the Department of Economic Opportunity) for approval, comprehensive plan amendment language which incorporated sea level rise into its comprehensive plan. That agency's response commended Satellite Beach for "proposing designation of an Adaptation Action Area for the protection of its residents, prevention of property damage and for a reduction in flood insurance premiums." Satellite Beach City Council adopted the recommended amendments in August 2013.

In 2014, in partnership with East Central Florida Regional Planning Council, the City of Satellite Beach received the DEP Coastal Partnership Initiative Grant to further refine the Adaptation Action Area Policies, conduct a more thorough analysis of hazards, and further engage the residents and business of the City in resiliency planning.

The project consisted of the following phases:

Public Engagement – this consisted of a kick off meeting, an extensive online public input survey to guide the policy and strategy development, and an open house at the close of the grant period.

Vulnerability Assessment - based upon the Brevard County's Local Mitigation Strategy vulnerabilities and methodology in an effort to provide consistency across plans and jurisdictions. The analysis analyzed the following vulnerabilities: sea level rise, flooding, storm surge, and coastal erosion.

Adaptation Action Area Policy Recommendations and Strategies – these were based on the findings from the public survey as well as the data analysis of vulnerabilities.

At the conclusion of the grant, the City, along with numerous partners from the project, submitted a proposal to Sea Grant to continue to move its Coastal Resiliency efforts

forward, using the information and developments from this project as a base. Efforts continue to use the City of Satellite Beach as pilot for communities across the Central Florida Region as well as the state.

Methodology

The City of Satellite Beach and the East Central Florida Regional Planning Council established a project team that was comprised of agency and city staff as well as staff from the Florida Department of Economic Opportunity, Brevard County, Florida Institute of Technology and Florida Sea Grant. This team was responsible for the final review of the various documents and providing insight and direction and technical assistance. In addition, a Technical Advisory Committee (TAC) was established which included the project team, engineering consultants, emergency management, planning and natural resource staff from Volusia County and Brevard County, the Transportation Planning Organizations, NOAA, and the U.S. Army Corps of Engineers. The TAC provided guidance on developing the sea level rise scenarios and planning horizons as well as support during the development of the Adaptation Action Area policies, recommendations, and strategies. The TAC areas of expertise were vital for these tasks and also provide a method of transferability of knowledge as information and methodology is moved to other jurisdictions in the region and state.

While the project had numerous tasks and deliverables, many of the efforts overlapped in terms of timing, input and expertise. In order to prepare for the Community Kick-off Workshop, the team began to assess the vulnerabilities of the City of Satellite Beach to provide more in-depth information at the meeting.

The **vulnerability assessment update** was based upon the Brevard County's Local Mitigation Strategy vulnerabilities and methodology in an effort to provide consistency across plans and jurisdictions. The analysis analyzed the following vulnerabilities: sea level rise, flooding, storm surge, and coastal erosion. The assessment utilized hazard-specific data to determine the short and long-term vulnerabilities facing the residents and critical infrastructure within the City of Satellite Beach.

Utilizing Geographic Information System (GIS) data provided by Brevard County GIS, the Brevard County Property Appraiser's Office, the National Oceanic and Atmospheric Administration (NOAA), HAZUS and the Federal Emergency Management Agency (FEMA), the project team was able to determine vulnerabilities from five perspectives:

1. Financial Exposure: The financial exposure hazard analysis determines the total land value, building value, assessed property value and taxable property value located

within each hazard zone. For example, for the Category 1 Hurricane Storm Surge zone, the financial exposure analysis determines the cumulative financial values of all parcels located partially or entirely within the Category 1 Storm Surge Zone.

2. Exposure to Built Parcels by Build Year: This analysis summarizes the build year of all parcels within all hazard zones by decade. With this analysis, the City can gauge the number of parcels within each hazard zone that may have been constructed before critical building code or infrastructure ordinances, further expanding the detail provided within the financial exposure analysis.

3. Land Use Exposure: The land use exposure analysis summarizes the land uses of all parcels located within all hazard zones identified in the hazard analysis. The land uses analyzed include Low Density Residential, Medium/High Density Residential, Commercial of Office, Industrial, Institutional (or Publicly-Owned) and Recreational.

4. Critical Facility Exposure: This matrix details the hazard zones that each critical facility within the City of Satellite Beach is located in, utilizing the four hazards identified above.

5. Environmental and Ecological Exposure: This analysis determines the critical ecological and environmental areas located within each hazard zone identified within this report.

To assess sea level rise, the TAC determined that the FDOT Sketch Tool would be utilized as the model platform with Army Corps of Engineer low, medium and high projection rate curves for the years 2040, 2070 and 2100.

Specific findings of the analysis can be found in the Natural Hazard Risk and Vulnerability Analysis Report.

Data, maps and findings from the Vulnerability Analysis were utilized in the Community Kick-Off Workshop that was held on September 23, 2014 at 6:30 PM at the City Community Center. The agenda included an overview of how the City has been addressing resiliency and sea level rise, as well as the purpose of the DEP CPI grant. Additional speakers included representatives from Florida Sea Grant, the City of Ft. Lauderdale and the City Emergency Management Director/Fire Chief. After presentations, there were numerous questions and comments from the public. Following questions and comments, attendees were asked the following questions and staff recorded responses on boards:

1) “When you think about the environmental, social and economic aspects of the City, what are the biggest opportunities over the next 50 years?”
2) “When you think about the environmental, social and economic aspects of the City, what are the biggest challenges over the next 50 years?”
3) “What approaches would you like the City to take to address the opportunities and challenges identified in the previous questions?”

Attendees were asked to then take sticky dots and place the dots next to the comments for each question that they felt most strongly about. They were also asked to place dots on 2 maps of the City labeled as label maps as “Vulnerable Areas” and “Valued Areas” and

identify the areas of the City that they felt are the most vulnerable to natural risks and areas they felt are the most important or valued areas or functions of the City.

The input from the public during this meeting was used to drive the questions and strategies presented in the online public engagement activity which utilized Metroquest as the interactive public survey platform. The survey was accessible via computer, tablet, and smartphone and was made available to the public from November 19, 2014 to January 19, 2015. The City sent a letter to the entire community encouraging their participation and also staffed a booth at a community event and at the community center. Screen 2 which posed the first question of the survey: "Which Vulnerabilities are of Most Concern to You?" included vulnerabilities based on the Brevard County Local Mitigation Strategy, recent stakeholder participation, and local experience. The participants were asked to rank their top three vulnerabilities of concern facing the City over the next 50 years in order of importance to the respondent. After ranking vulnerabilities in order of importance, Screen 3 asked respondents to rate up to five (5) strategies for each previously ranked vulnerability. Screen 4 asked participants to rank up to five (5) of their top priorities they wish to see the City focus on when creating a resilient community. The eight opportunities listed on the screen were derived from the stakeholders at the public kick off meeting held on September 23, 2014.Participants were able to provide comments on each screen as well as provide other vulnerabilities, strategies, and opportunities in addition to the ones already provided.

Based on the findings from the public survey as well as the data analysis of vulnerabilities, the project team and TAC developed proposed Adaptation Action Area (AAA) Policies for the City to consider for their comprehensive plan. The team determined the best avenue for the City to implement AAAs is to develop one AAA for Flooding and one AAA for Erosion. The project team researched existing policies and strategies implemented across the U.S. to assist with the development of these policies and strategies. The final proposed policy language was vetted by all TAC and project team members. Additionally, in order to provide additional information on the how and why of the policy development, a resolution was also developed for the City. Finally, based on the many of comments and the results of the public survey and strategies across the U.S., a recommendation document was developed that focuses on each of the vulnerabilities identified in the public survey and strategies for the City to implement through planning, policies, further analysis or by other means.

On June 9 from 6-7:30 PM, the project staff held an Open House to showcase the findings of the project and silicate additional public comments. Tables were set up around the City Civic Center that highlighted each area of study or vulnerability and provided maps, charts, tables and the proposed policies. Boards were provided at each station to allow for additional public comment. Additionally, Brevard County Natural Resource Division hosted a table to provide education to the attendees concerning natural vegetation for erosion control and current projects. Finally, the project team from Monroe County (Florida Sea Grant, Deady Law, and Dr. Jason Evans) was in attendance with information from their work in South Florida. In addition to public comment forms and comment boards throughout the room, staff provided attendees the opportunity to

indicate on maps, which contained overlays of the various vulnerabilities to be included in the Adaptation Action Areas, where the AAAs should be designated. Thirty-nine attendees signed in at the public meeting.

The project staff and TAC continue to coordinate to determine avenues to continue resiliency efforts within the City of Satellite Beach and across the region.

Outcome

Specific findings of the analysis can be found in the Natural Hazard Risk and Vulnerability Analysis Report.

Survey - The results of the survey showed support for investigation and collaboration to ensure better resiliency of infrastructure such as power and utilities, as well as stormwater. Based on results of the strategy ranking and opportunities for the City, the respondents support natural defenses for the coastline and policy implementation to address development in vulnerable areas while also diversifying and growing the tax base in a manner suitable for a small city such as Satellite Beach. Many of the "opportunities" and "strategies" rankings are relatable and provide a strong opportunity for the City to address resiliency while moving forward with opportunities and priorities identified by its stakeholders. The City should continue to work with the community to develop an action plan to address and refine the strategies, policies and opportunities identified through this survey. Additionally, the comments provided by the respondents are of great value and offer additional insight into their preferences.

Specific findings of the analysis can be found in the Creating a Resilient Community Public Input Analysis Report.

The policies developed for consideration by the City of Satellite Beach are below. These Policies are considered proposed and are presented to the City of Satellite Beach for further development and public input.

Inland Flooding Adaptation Action Area

Definition Policies

Proposed Policy: The Inland Flooding Adaptation Action Area is a designation to be used as a tool for assisting the City in the prioritization of infrastructure funding and policy implementation for flood alleviation improvement and mitigation projects, to protect public and private property, and to protect the safety, health and welfare of the City's citizens. The Inland Flooding Adaptation Action Area includes those areas west of South Patrick Drive, including the roadway itself, that are also:

1. located within the Coastal High Hazard Area or FEMA 100 Year Flood Zone; or

2. vulnerable to periodic flooding from tidal and rain events, storm surge category 3 MOM, or sea level rise by the year 2070. Vulnerable to sea level rise is defined as the areas which are expected to be inundated with water using the best available data and the range of impact between the USACE medium and high curve projections (USACE document EC-1165-2-212 or ER 1100-2-8162) for the determined planning horizon (current 2040 and 2070) and the following parameters: MHW for the Atlantic Coast, MHHW for River Coast.

Proposed Policy: Map XX depicts the Inland Flooding Adaptation Action Area.

Proposed Policy: During the City's comprehensive plan update period ending in 20XX, the City shall determine if the Adaptation Action Area has functioned as a viable tool for the City. If the City deems the AAA has not been beneficial to the City, the City may remove the designation or modify its boundary. Criteria for determination may include, but is not limited to: a Cost Benefit Analysis; project implementation and success in mitigating flood impacts and others to be determined by the City.

Horizon and Projection Policies
Proposed Policy: The City shall utilize a 2040, 2070 and 2100 planning horizon as well as the range of inundation associated with those years between the USACE medium and high curve for sea level rise, where applicable to the life span of the infrastructure and decision process. 2070 year projections shall be utilized for new infrastructure with life spans over 50 years and anticipated to be built by 2025. These ranges and projection curve model shall be updated based upon the newest data projection curves, when available, or at least every 5 years.

Proposed Policy: Collaborate with stakeholders at least every 5years or earlier to analyze the best available data, to maintain the designated Inland Flooding Adaptation Action Areas' alignment with, to the extent possible, relevant and current coastal hazard vulnerability projections and maintain the City's efforts to identify and understand the risks, vulnerabilities and opportunities for strategies within the 25 to 100 year planning horizons.

Implementation Policies
Proposed Policy: By 2018, the City shall update city processes and city-wide plans to incorporate the Inland Flooding Adaptation Action Area where appropriate.

Proposed Policy: The City shall determine how to identify the circumstances, timeframe or other indicators in which the City will only maintain infrastructure within the AAA and will not utilize public funds to improve or enhance infrastructure.

Proposed Policy: Develop a methodology for prioritizing infrastructure project expenditures based on a cost-benefit analysis, feasibility, determination of applicability to City policies and short- versus long-term benefits associated with projects located within and external to the AAA.

Proposed Policy: Determine a procedure to review vulnerable critical facilities and assets and rank them relative to importance, level of vulnerability, and life expectancy.

Proposed Policy: Pursue private and public funding sources for the implementation of adaptation strategies both internal and external to the AAA to move forward adaptation projects and strategies identified by the City and its stakeholders.

Proposed Policy: Work with floodplain managers and stakeholders to identify areas within the Inland Flooding AAA which may benefit from inclusion in Floodplain Management Plan projects, identify initiatives within the Brevard County Local Mitigation Strategy that focus on Inland Flooding AAA areas, and educate property owners about mitigation strategies they can implement to protect their property.

Proposed Policy: The City shall adopt a mechanism to evaluate and recommend new design and development standards for infrastructure projects proposed for implementation within the designated Inland Flooding Adaptation Action Area. From 20XX onward, all public infrastructure projects shall be required to meet the Federal Flood Risk Management Standard.

Proposed Policy: Sea level rise, based upon current planning horizon and inundation ranges, and the Federal Flood Risk Management Standard shall be included in all infrastructure projects within the Inland Flooding Adaptation Action Area and considered among design strategies for all storm water management projects.

Proposed Policy: New development within the AAA will be required to meet new building standards as determined by the City and or State as applicable.

Proposed Policy: The City shall develop a strategic plan to address recurring flooding issues within the AAA which takes into account an anticipated increase in flooding from excess rainfall, storm surge, and sea level rise.

Proposed Policy: Adaptation tools the City will consider for use within the Inland Flooding Adaptation Action Area may include, but are not limited to:

- Public infrastructure planning, siting, construction, replacement, operation and maintenance
- Stormwater Management
- Green Streets
- Rain Gardens/Bioswales
- Vernacular Streetscapes and Plant Placement (Water-Dependent Species)
- Grass Pavers (Driveways; Main Streets; Ponding Areas)
- Ecological Asset Preservation (Dunes, Natural Areas, Mangroves, Plants, Animals)
- New Building Code Standards/Form-Based Codes
- Land Development Regulations
- Comprehensive Planning

Erosion Adaptation Action Area

Definition Policies

Proposed Policy: The Erosion Adaptation Action Area is a designation to be used as a tool for assisting the City in the prioritization of infrastructure funding and policy implementation for erosion control and adaptation projects, to protect public and private property, and to protect the safety, health and welfare of the City's citizens. The Erosion Adaptation Action Area includes those areas east of A1A that are:

1- located within or surrounded by Coastal High Hazard Area;

2- located within the FEMA 100 Year Flood Zone or eastward of the Coastal Construction Control Line, or

3- is a beach front parcel prone to erosion, in an area identified as "critically eroded" by the State or is susceptible to the impact of sea level rise by the year 2040, 2070, or 2100. Vulnerable to sea level rise is defined as the areas which are expected to be permanently inundated with water using the best available data and the range of impact between the USACE medium and high curve projections for the determined planning horizon (current 2040 and 2070) and the following parameters: MHW for the Atlantic Coast, MHHW for River Coast.

Proposed Policy: Map XX depicts the Erosion Adaptation Action Area.

Horizon and Projection Policies

Proposed Policy: Collaborate with stakeholders at least every 5 years, or earlier, to analyze the best available data, to maintain the designated Erosion Adaptation Action Area's alignment with, to the extent possible, relevant and current coastal hazard vulnerability projections and maintain the City's efforts to identify and understand the risks, vulnerabilities and opportunities for strategies within the current 25 to 100 year planning horizon.

Implementation Policies

Proposed Policy: By 2018, the City shall update city processes and city-wide plans to incorporate the Erosion Adaptation Action Area where appropriate.

Proposed Policy: During the City's comprehensive plan update period ending in 20XX, the City shall determine if the Erosion Adaptation Action Area has functioned as a viable tool for the City. If the City deems that the AAA has not been beneficial to the City, the City may remove the designation or modify its boundary. Criteria for determination may include, but is not limited to: a Cost Benefit Analysis; project implementation and success in erosion reduction and others to be determined by the City.

Proposed Policy: Projects involving public funding within the Erosion Adaptation Action Area that utilize natural systems and features shall be considered for priority for funding purposes.

Existing Policy: Objective 1.3- In order to direct development and population concentrations away from the Coastal High Hazard area, the City will continue to prevent use of public funds and discourage use of funds by other levels of government as

financial assistance for new, private development or redevelopment that result in increased densities or intensities.

Existing Policy: Policy 1.3.2 - The City shall coordinate with service providers to replace and mitigate damaged infrastructure, as appropriate within the Coastal High Hazard Area.

Existing Policy: Policy 1.3.1 - No public infrastructure or public buildings will be constructed east of the Coastal Construction Control Line (CCCL), with the exception of minor structures. Such structures are customarily provided to support recreation and open space activities, pedestrian access facilities (in accordance with dune protection design standards), and infrastructure and roadway improvements within already developed public rights-of way as required to meet minimum level of service standards.

Proposed Policy: Armoring or other shoreline stabilization efforts by property owners shall not disrupt or harm adjacent or nearby properties.

Proposed Policy: The City shall partner with appropriate entities, agencies, non-profits, and others to obtain input from and educate citizens about the interconnectedness of human activity and natural processes and how to best balance private property rights and the public interests of all citizens within the City.

Proposed Policy: The City shall work with stakeholders to pursue private and public funding sources for the implementation of adaptation strategies both internal and external to the AAA that advance adaptation projects and strategies identified by the City and its stakeholders.

Proposed Policy: The City shall engage stakeholders, county departments and other agencies to increase planning and implementation of natural erosion prevention and hazard mitigation.

Proposed Policy: Funding for the protection and restoration of natural coastal features (e.g. reef, beach, dune and vegetation) adjacent to and within the Erosion AAA shall be included in the funding prioritization as they provide the first natural line of protection from coastal erosion, storm surge and flooding.

Proposed Policy: The City shall require beach front property owners to maintain a viable amount of sea oats, and other natural vegetation approved by the City in an effort to reduce impacts on infrastructure, private property and human life. The City, in collaboration with the County, IFAS and other agencies, shall establish a program to assist property owners with planting and maintenance of these areas.

Proposed Policy: The City shall identify City projects within the Erosion Adaptation Action Area to be prioritized for project funding based on project goals to reduce coastal erosion and improve the long-term integrity of the Atlantic coastal area of the City.

Proposed Policy: An Erosion AAA prioritization project list will be implemented in the City's CIP, in collaboration with coastal resource managers, by 2018, in an effort to obtain specialized resiliency grant funding.

Proposed Policy: Adaptation strategies supported within the Erosion Adaptation Action Area include but not limited to:

- Public infrastructure planning, siting, construction, replacement, operation and maintenance
- Increase of Set Back Line for Coastal Properties
- Increase of Base Flood Elevations
- Natural Dune Restoration
- Vernacular Plant Placement
- Building Codes
- Land Development Regulations
- Comprehensive Planning
- Water Flow Diversion Strategies
- Grass Pavers (Parking Lots)
- Rain Garden Building Buffers

Proposed Policy: The City shall adopt a mechanism to evaluate and recommend new design and development standards for infrastructure projects proposed for implementation within the designated Erosion Adaptation Action Area.

Further Recommendations

At the time of this final report, the project team, in partnership with Stetson University, has partnered to submit a proposal to Sea Grant to continue public engagement in policy

and strategy development and implementation, as well as conduct further site analysis of sea level rise impacts on critical facilities by developing building foot print data for additional site level assessment. This proposal is currently under review.

The project team and technical advisory committee reviewed the strategies and recommendations supported by respondents to the Satellite Beach Resilient Community Survey as well as best practices provided by NOAA and other reports and studies concerning strategy and policy practices throughout the United States. Recommendations and strategies are listed below, by vulnerability analyzed for this study, for the City of Satellite Beach to consider in its resiliency planning. Policy options should be expanded to assist the community in planning and preparing for vulnerability impacts, especially flooding, erosion, storm surge, and sea level rise, as well as protecting utility infrastructure.

The strategy and policy recommendations below have been developed through best practice research the project team, technical advisory committee input, and comments generated through the public engagement activities.

City staff should conduct case studies of various coastal jurisdictions similar in nature to the City of Satellite Beach or addressing similar strategies the City may be pursing. While every community is different and there is no "one size fits all" solution or strategy for addressing coastal resiliency, these case studies may present creative and viable tools, strategies and recommendations for the City.

Consistency between the City's various plans and procedures is vital as the City continues its efforts toward resiliency. The City should review all plans and procedures to determine gaps and areas to incorporate resiliency strategies and policies determined to be appropriate for the City. City plans and procedures should be updated to address areas that are most vulnerable to flooding, storm surge, coastal erosion and rising seas based on inundation modeling. A matrix of updates may be developed to ensure appropriate plans are consistent in policies, strategies and regulations.

Although the City is mainly built out, as redevelopment occurs, the City should encourage higher densities and/or mixed use in appropriate and less vulnerable areas within the City, especially along the A1A corridor or pockets of undeveloped property. This may require changes to the City's comprehensive plan, land development codes and other plans within the City. The City may also consider conducting an analysis of the A1A corridor built environment and work with stakeholders to determine a vision for the area in an effort to increase the tax base away from the high hazard areas.

While a large amount of the City's tax base is located in the vulnerable areas, it is important for plans to be made to create a larger tax base outside the high hazard areas, especially those vulnerable to coastal erosion and flooding. An effort should be made to determine opportunities, scale, and vision of redevelopment in order to maintain a small town feel while diversifying the tax base in areas external to vulnerabilities.

The City may wish to investigate the potential of developing special taxing districts related to the AAAs and a redevelopment/business district area around the A1A corridor or other areas determined by the City. These taxing districts could be established for improvements to infrastructure within those areas deemed most critical for adaptation measures and/or appropriate enhancements.

With only a score of 8 in the Community Rating System, the City should explore measures to increase its score in the CRS to assist with Flood Insurance Rates, especially as it relates to public education. As the City updates its Flood Management Plan, the goals and actions should seek to balance supporting existing development and access needs of the City with development strategies that protect life and property. Additionally, a series of actions should be outlined for the City to implement in an effort to engage and educate the public and officials on the subject of resiliency, vulnerabilities and adaptation measures and tools.

Outreach information should, at a minimum, address coastal erosion, flood insurance, mitigation activities and programs, storm surge, and sea level rise materials. The city should continue to host tables at various events and festivals providing an outreach and educational opportunity for stakeholders. The City website should be updated and provide a page expressly dedicated to resiliency efforts, education materials, and links to resources.

Coastal erosion not only impacts those living along the shoreline, but also the City as a whole due to the tax base associated with these properties, users of the beach, tourists, and environmental aspects and protection impacted by eroded shorelines. It will be important for the City, in order to protect the property rights and interests across the City, to work closely with all stakeholders to appropriately address this issue in an effort to protect the life, health and safety of the City as a whole. It is recommended that the City, in conjunction with the County and other agencies, host a series of workshops, targeting specific stakeholders for each workshop, to discuss strategies, host speakers for educational purposes, and obtain buy-in and feedback, for addressing coastal erosion/beach front issues.

The City may create a Resiliency Task Force to help drive the educational and outreach efforts for the City as well as provide input on strategies under consideration. The efforts associated with public engagement are also taken into account in the Community Rating System, in which the City is already actively engaged. This Task Force should be composed of private businesses, public/non-profit agencies, and residential stakeholders. The task force should also be comprised of a variety of age groups and outreach should also target the under 55 population as they are generally the under showing demographic. At the time of this study, The Federal Government was in the process of developing a Federal Flood Risk Management Standard which proposed adding 2-3 feet to the base flood elevation, depending upon critical versus non-critical actions. It will be necessary for the City to follow the potential implementation of these standards for compliance issues and the potential funding and impacts that may be associated with the standards.

In an effort to reduce the impact of surge and flooding on private and public property, and protection of life and safety of residents, the City, in conjunction with their floodplain manager, contractors and engineers, should develop higher standards and innovative designs that offer additional flood protection in the most vulnerable areas. The implementation of these standards may be conducted on a rolling basis, as well as voluntary, as the areas of sea level rise and surge impacts increase. The City should develop a framework to help private property owners navigate the process of implementing mitigation strategies to their home using private funds. Additionally, in areas within the Inland Flooding Adaptation Action Area, the City should strategically retrofit the existing storm water system with state of the art, innovative facilities to reduce flooding after heavy storms while addressing water quality objectives.
In conjunction with this effort, the City should investigate potential strategies or tools to keep residents in the City as their property becomes unusable, especially those within the highly vulnerable areas. This may include developing a type of transfer of development rights or other housing options within less vulnerable areas of the City. Additionally, as properties become un-usable, they could be utilized by the City to create buffers, green space, and water dependent uses that may be serve as a buffer to protect property from vulnerabilities as well as provide revenue for the City for a period of time. As evident from responses in the survey, these mechanisms for property transfer should not be shouldered solely or mainly by the City but should be mainly the responsibility of the property owners and should only occur after a property has been destroyed or is unusable. The City may wish to engage property owners in highly vulnerable areas to determine their potential response if they are no longer able to sustain their property in an effort to plan for migration of these owners to other parts of the City and how to structure a potential property transfer program.

Using the information from this resiliency project, the City should review vulnerable critical facilities and assets and rank them relative to importance, level of vulnerability, and life expectancy. This information can be utilized in potential adaptation measures related to infrastructure, especially utilities as deemed a priority for the stakeholders. The strategies below are broken into the areas of vulnerability used in the public engagement exercise and reflect the top supported strategies by vulnerability. All the strategies, their ranking and overall percentage of support and opposition can be found at the end of this document for further use by the City.

Loss of Power/Utilities

Loss of power and utilities was ranked as the number one vulnerability by respondents to the public engagement exercise conducted by the City. The strategy "Work with Utility companies to determine the feasibility of moving pole-mounted utilities underground" was not only the ranked #1 option within the Loss of Power/Utilities vulnerability but also #1 when normalized across all vulnerability strategy options. This should be one of the priority areas of concentration for the City as it moves forward. The feasibility and cost benefit of this option should be discussed prior to and considered in conjunction with any major roadway or other infrastructure project.

As the City reviews site specific analysis of critical facility/infrastructure in relation to hazards including storm surge and sea level rise, the City should develop a process for determining the feasibility, benefit, and strategy for relocating infrastructure to higher ground, west of A1A. This process may include a cost benefit analysis, determination of the life of the structure, and prioritization of the infrastructure at risk across the City. Respondents to the public engagement activity also supported the diversification of energy sources within the City such as rooftop-solar power, off-grid electric power, and other alternative power sources. This strategy may be more focused on the residential and commercial stakeholders as each individual sees fit. It is also recommended that the City conduct a study to determine potential cost savings in the implementation of various alternative energy strategies such as hybrid fleets, solar panels for government buildings and other power sources as well as provide citizens with resources to assist in their implementation of alternative energy sources.

Coastal Erosion

Coastal erosion was ranked #2 for vulnerabilities of concern to respondents to the public engagement activity (note: the difference in rankings between #2,#3, and #4 was 0.40% overall, thus indicating coastal erosion, storm surge, and flooding as equal concerns by the majority of respondents).

The results of the public engagement activity indicated support for planting native coastal vegetation such as sea oats in an effort to control coastal erosion. The City should work with surrounding communities, Patrick Air Force Base, IFAS, Brevard County Natural Resources, the Marine Resource Council, homeowners, and other stakeholders to develop and implement strategies for a living, natural coastline.

In an effort to create a sustainable and resilient economic base, it will be important for the City to create opportunities for economic growth outside of the highly vulnerable areas such as along the A1A corridor or other inland properties. With approximately 60% of the tax base located along the beach front, it is important for economic resiliency that the City implement policies to direct development away from high-risk areas to protect the health and safety of individuals, decrease potential damage to public and private property and to increase tax base and revenue generating opportunities in less vulnerable areas of the City. These policies may include increasing development and economic opportunities in less vulnerable areas as well as discouraging development (new and redevelopment) in the areas most vulnerable to coastal erosion of the City. This strategy is applicable under the storm surge vulnerability as well.

Storm Surge

Storm Surge was ranked as 3rd as a vulnerability of concern (note: the difference in rankings between #2,#3, and #4 was 0.40% overall, thus indicating coastal erosion, storm surge, and flooding as equal concerns by the majority of respondents).

In an effort to protect private properties from impacts associated for storm surge, in addition to adjusting the Base Flood Elevation standards for rebuilds, redevelopment, new construction to meet, at a minimum, the potential new Federal Flood Risk Management Standards, the City should determine the feasibility of increasing construction setbacks from the shoreline and encourage higher minimum elevations for

buildings and infrastructure where feasible in these vulnerable areas. This strategy may be limited on some properties due to lot sizes and the ability to set structures back a certain distance. This strategy would be applicable to rebuilds, redevelopment and new construction.

As with coastal erosion, in an effort to protect the health and safety of individuals, decrease potential damage to public and private property from storm surge and to increase tax base and revenue generating opportunities the City should begin the process to develop and implement policies that direct development away from high-risk areas. These policies may include, but would not be limited to increasing development and economic opportunities in less vulnerable areas, discouraging development (new and redevelopment) in the areas most vulnerable to storm surge, increasing business development opportunities in an economic district, utilizing unbuildable property for water dependent uses which can generate City revenue, and others.
As discussed earlier in this document, the City currently has a CRS rating of 8. It is recommended that the City takes action to reduce property owners' premiums for the National Flood Insurance Program.

Flooding
Flooding, although ranked 4th as a vulnerability of concern (note: the difference in rankings between #2,#3, and #4 was 0.40% overall, thus indicating coastal erosion, storm surge, and flooding as equal concerns by the majority of respondents) within the City of Satellite Beach, it is an issue that is currently impacting the City.

Stormwater capacity is and will continue to be an area the City will need to maintain and improve to mitigate for excessive rainfall, nuisance flooding, storm surge, annual high tides, and sea level rise impacts. Feedback from the public engagement survey indicated strong support for the installation of larger drainage pipes and structures as the system undergoes maintenance and repair. To ensure fiscal and environmental responsibility, the City should coordinate with the appropriate agencies, stormwater experts and others to design and install sufficient pipes and structures to support the current and future stormwater needs.

Strategies associated with roadway upgrades and stormwater reuse were extremely close in support within the flooding vulnerability that the City should work with stakeholders to determine feasibility of incorporating these strategies into stormwater projects and roadway upgrades, especially within the Inland Flooding Adaptation Action Area. This may be accomplished through a variety of techniques considered in "Green Streets", pavement, and other design or engineering techniques. This strategy would recognize periodic flooding may block access to the roadway, but the roadway would be built to withstand the prolonged exposure to water. Stormwater reuse may be accomplished by installing vaults for stormwater storage and reuse for non-potable purposes such as irrigation, toilets, and construction. As an additional strategy, the City may investigate the benefit and feasibility of installing pumps to alleviate flooding during rain events, storm surge, high tides, etc. These may be beneficial in key locations or during the annual high tide events. These strategies should be considered by the City as part of all roadway

projects and determine fiscal and engineering feasibility as well as cost benefit and mitigation of flooding impacts.

Sea Level Rise

Sea level rise strategies were only ranked by 27% of respondents. However, to provide a full report on strategies for the City to consider, as well as identify overlap between sea level rise strategies and those of other vulnerabilities, recommendations are provided below. Many of these strategies implemented for other vulnerabilities, in turn, may also mitigate impacts of sea level rise.

Through this project, the City has identified areas subject to hazards of rising sea levels. The City should utilize this information in an effort to identify those that would benefit from long term strategies. Many of these areas may include infrastructure or other facilities and areas that are also vulnerable to other hazards such as flooding and storm surge and may be identified for strategies.

Additionally, as the City considers flooding and storm surge in policies and plans for projects, sea level rise projections should also be considered especially as it pertains to a cost benefit of project standards, improvements or other techniques. The City should develop a policy that considers sea level rise projections regarding infrastructure, zoning and construction standards. This would also tie into the various strategies that address implementing policies to direct development away from high-risk areas, as this would include sea level rise impact areas as high risk.

INSTRUCTIONS FOR COMPLETING
FINAL PROJECT REPORT FORM

DEP AGREEMENT NO.: This is the number on your grant agreement that starts with CM_ _ _
GRANTEE NAME: Enter the name of the grantee's agency.
PROJECT TITLE: Enter the Title shown on the first page of the grant agreement.
NOAA AWARD NUMBER: Enter the NOAA award number as shown on the first page of the grant agreement.
MONTH & YEAR: Enter month and year of publication.

The Final Project Report must contain the following sections: Executive Summary, Methodology, Outcome and Further Recommendations. The Final Project Report must comply with the publication requirements in the Grant Agreement. A draft should be submitted electronically to the Department's Grant Manager for approval. After approval by the Florida Coastal Management Program, two (2) hard copies and an electronic copy shall be submitted to the Department's Grant Manager. Final payment will be held until receipt and approval of the Final Project Report.

Questions regarding completion of the Final Project Report should be directed to Toni R. Clanton at (850) 245-2184 or Toni.R.Clanton@dep.state.fl.us.