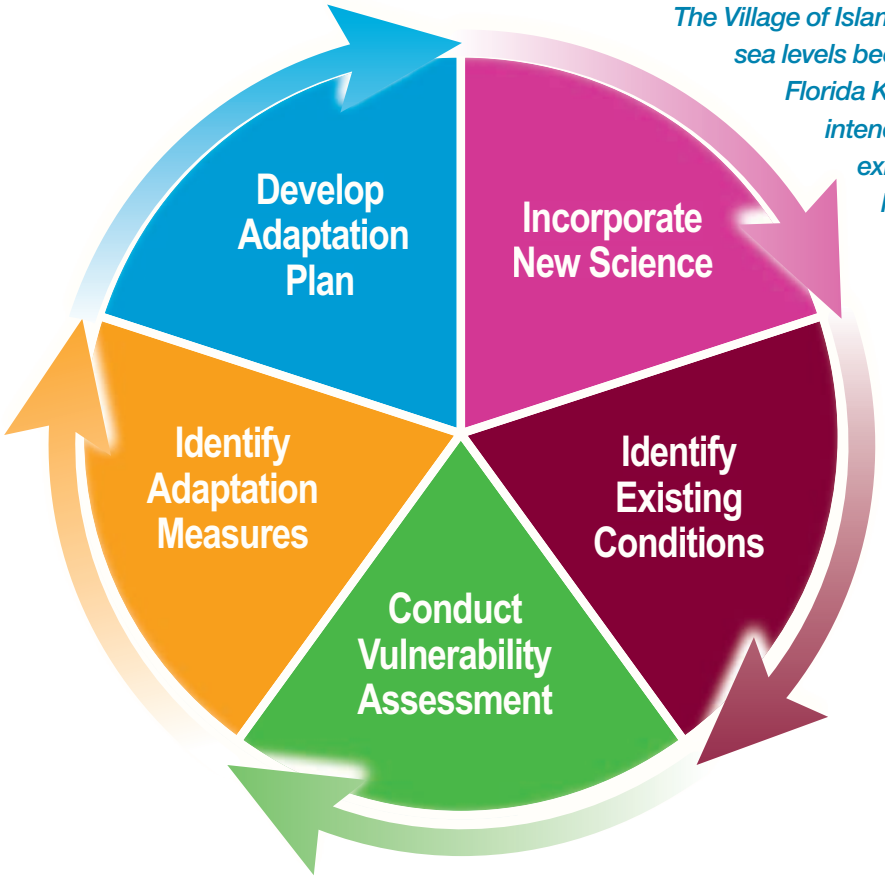
1. Executive Summary



The Village of Islamorada ("Islamorada" or "Village") faces unique challenges adapting to rising sea levels because of its low elevation and location in the island chain archipelago that is the Florida Keys. This Islamorada Matters Plan ("Plan") is the culmination of a project intended to begin the process of addressing these challenges while furthering existing efforts to make the Village more sustainable and resilient over the long term.

This Plan is the result of an ongoing public process and provides a summary of the activities conducted as part of the overall Islamorada Matters planning project, including results of the vulnerability assessment, sea level rise modeling, and an evaluation of the Village's current level of sustainability. More importantly, this document provides a comprehensive set of recommendations designed to put the Village on a proactive path towards increased sustainability and overall resilience to future sea level rise.

A key outcome of this planning process should be to better integrate decision making across multiple disciplines to incorporate sea level rise into the Village's policies and procedures. Integrated sea level rise adaptation and response will require harmonizing issues related to transportation, shoreline and buffer management, land use, building codes, infrastructure readiness and design, natural resource management and emergency preparedness.

Islamorada Matters
A Plan to Preserve and Protect Our Quality of Life

Sea Level Rise Planning

Sea levels rise as the earth gets warmer because (1) as ocean water warms, it expands and causes the average level of the ocean to increase, and (2) as glaciers and ice-caps melt, water empties into the oceans and causes the average level of the ocean to increase. This results in a local rate of sea level rise in the Village of Islamorada. While we cannot be certain the extent to which this will occur in the future, the consensus of the scientific community is that these processes are accelerating and thus we will see higher sea levels in years to come. Knowing this, the Islamorada Matters Plan focuses on addressing the impacts from sea level rise including (1) planning and implementing adaptation measures, and (2) building adaptive capacity based on knowledge gained from a vulnerability assessment. Both are needed for successful adaptation planning.

- Adaptation measures are actions that can be taken by the Village and property owners to prepare for sea level rise in a particular location. They can include restoring environmental areas, raising buildings above flood elevations and retrofitting infrastructure. These measures are described in more detail in Section 6(d) of this Plan. In general, these adaptation measures will ultimately be planned and implemented by landowners, business owners and the Village to address projected impacts of sea level rise.

- Building adaptive capacity means developing the data and ability to assess potential impacts of sea level rise and to select and implement appropriate adaptation measures. Capacity can mean a combination of elements, including: data and information to identify adaptation measures, technical review of that data to make informed choices, funding to implement adaptation measures, assuring laws and regulations do not create obstacles for implementing adaptation measures, information about the economic benefits of adaptation, and the ability to gain public support for implementation.

Sea level rise is just one of many challenges to living in an island community. Coupled with hurricanes, extreme storm events and flooding, residents and stakeholders throughout the Village and Florida Keys, including the real estate community, need to become educated about the impacts of sea level rise in order to make informed decisions about how to best adapt in their communities.

Tea Table Key, FL
Photo Source: Project Team

Working with Uncertainty

Inherent in this type of planning is some level of uncertainty due to the predictive nature of changing conditions related to sea level rise. While it is quite conclusive that sea levels are rising (for instance based upon National Oceanic and Atmospheric Administration ("NOAA") tide gauge data), the rate at which that change takes place is planned for based over a range of scenarios. Those ranges support the adaptation responses proposed in this planning effort. As more data becomes available, those ranges may narrow or new assumptions may be better to rely upon to make decisions in response. Revisiting the best data on sea level rise assumptions should be tied to a specific period of time, such as every (3) three years, or when an entity like the Southeast Florida Regional Climate Change Compact ("SFRCCC") updates their projections. The continual development of better data from which to make decisions is a constant theme in this Plan. Finally, this planning effort itself has resulted in improved datasets for use in future mapping and decision making, but there will continue to be some level of uncertainty associated with sea level rise planning that must be proactively managed.

Islamorada, FL
Photo Source: Project Team

Guiding Principles for Islamorada Matters

This planning effort is based on best available data, existing sustainability and planning initiatives, and current strategic Village goals and objectives. As a result, the following "Guiding Principles" have driven this planning effort:

- The time is now to begin adaptation planning and implementation, we can adjust and make improvements into the future as more information becomes available;
- Incorporate adaptation into existing Village programs and initiatives including procurement, design of capital improvements, land acquisition/management, and planning decisions;
- Engage the public in adaptation decisions;
- Educate Village stakeholders, including the public and business communities, as better science and Islamorada-specific data becomes available;
- Use the best available science for decision-making and adaptation actions;
- Balance protection of homes, infrastructure and conservation of natural resources;
- Strive for equity in selection of adaptation measures benefitting as many people as possible; and
- Funding options should be user-related, as appropriate.

Five Focus Areas

The recommendations in this Plan are separated into five Focus Areas with specific relevance to the Village. These Focus Areas were identified as important to the Village because of its unique geography, population and ecological significance. Additionally, these Focus Areas align well with Village priorities for future planning and project implementation.

Habitat

The Village consists of many unique habitats including coral reefs, tidal wetlands, mangrove forests and sea-grass beds. The Village is home to many threatened and endangered species.

Infrastructure & Built Environment

Because of the Village's low elevation, Village infrastructure is particularly vulnerable to sea level rise.

Village Buildings and Key Facilities

Sea level rise has the potential to impact Village buildings and key facilities. Proper planning is critical for wise economic investment.

Adaptation Strategies

The Village is committed to proactively identifying ways to increase its resiliency through adaptation to a changing environment.

Sustainability

The Village has a long history of promoting sustainable practices and remains committed to educating residents about green practices and increasing its overall level of sustainability.

What Can We Expect?

Sea level rise in the Village will produce many impacts, including nuisance flooding, fluctuations in storm severity and changes in ecosystem composition and species migrations. Climate change is also likely to have impacts on average daily temperatures, annual precipitation rates and volume, and human health. With proactive planning and informed decision making, the Village can minimize these impacts to ensure its environmental and economic viability for decades to come. Proactive planning is proven to be more effective than reacting after impacts occur. Hazard mitigation expenses typically provide very positive returns on those investments. For example, the National Institute of Building Sciences found that for every dollar spent by the Federal Emergency Management Agency ("FEMA") on natural hazard mitigation, the result was $4 in future benefits.[1]

Nuisance Flooding

One of the many impacts of sea level rise is the increase in minor flooding events, often referred to as "nuisance floods." Nuisance flooding events are typically associated with little or no permanent damage to human assets and recede quickly with the outgoing tide. Two (2) typical consequences of nuisance flooding include temporarily slowed or stopped traffic flow through low-lying roads and damage to saltwater intolerant landscaping plants in low-lying yards. However, it is well-known that nuisance tidal flood events can also lead to temporary, but sometimes significant, loss of stormwater drainage potential. Assessment of the Vaca Key tide gauge from 2010-2014 indicates that the 1.08 feet above mean higher high water ("MHHW") threshold is currently being exceeded approximately four (4) times per year which is the threshold for that type of flooding at that location. In terms of increased flood inundation, we can particularly expect to see greater impacts during the Spring and Fall high tides (King Tides) which are the highest over the course of the year.

Storms and Precipitation

Rainfall levels are expected to fluctuate, though exact increases or reductions are much more difficult to predict given the number of factors at play. Islamorada has, and will continue to see, stronger storms with increased storm surge and wave heights during hurricanes as coastal water depths increase with sea level rise, amplifying the damage potential of these hurricanes. In lower lying areas, stormwater drainage will be increasingly problematic with heavy rainfall during hurricanes and other severe storms. Floods, hurricanes, and tropical storms, all of which are expected to become more frequent, will likely have tangible impacts.

Exotic Species

Changes in annual temperature and rainfall patterns, along with the movement of vegetative ecosystems due to higher sea level and increased salinity, will likely contribute to more and new invasive, exotic pests and plant/animal species becoming established throughout the Keys. Efforts to control the movement and overall distribution of both exotic plant and animal species will be crucial to the health of existing ecosystems and people in Islamorada.

Health Impacts

Within the Village, several human health impacts could occur including heat impacts, vector borne diseases, extreme weather events, air quality, and waterborne diseases. Vector borne diseases should be an important consideration in Islamorada due to the already warm climate and established vector populations (mosquitoes). Furthermore, a number of additional diseases may be able to prevail in new environments as the natural barriers of inhospitable environments to the vectors of such diseases are diminished in a warming climate. Air quality impacts may result in heightened levels of allergies and respiratory disease. Additionally, pathogens and pollutants from runoff and flooding have the potential to enter water supplies, while increased temperatures will support pathogen growth, and concentration of these agents under drought conditions will increase the threat of waterborne disease.

Heat

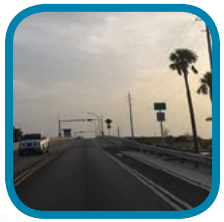
As the global climate changes, average annual temperatures are expected to rise in South Florida. Extreme heat, more days with temperatures over 95° F, and a longer summer season will have impacts on the Village. These impacts will range from human health impacts, increased incidence of heat-related illnesses, to increased demands for electricity. Heat stress affects human health in serval ways, most frequently exacerbating chronic conditions like respiratory and cardiovascular disease. Increased temperatures will also lead to higher electricity consumption rates and resulting greenhouse gas ("GHG") emissions. These impacts may also affect the health care system.

Erosion

Analysis shows that there is a correlation between long-term erosion rates and sea level rise rates. Therefore, we can expect that areas already exhibiting signs of erosion will continue to do so and accelerate as the amount of rise accelerates.[2]

Specific Focus Area Impacts and Strategies

Habitat. Tidal wetlands grow vertically by capturing sediment brought in by the tides, and by maintaining high plant production above ground and slow decomposition rates below ground. By accumulating dead plant matter and inorganic sediment, established marshes generally accrete at a rate sufficient to keep pace with sea level rise. However, the predicted accelerated rates of sea level rise will challenge this natural process. When marshes do not accrete enough sediment to keep pace with rising sea levels, vegetation may die and portions of the marsh may become open water. This results in diminished flood storage capacity and reduced marsh habitat. Coral bleaching and coral/seagrass die offs and migrations of less salt-tolerant flora are also expected as temperatures increase and the sea level rises.



Infrastructure and Built Environment. As the impacts of sea level rise continue to be felt, Islamorada's infrastructure - roads, buildings (non-publicly owned), stormwater, water, wastewater and power supply – will be tested. Systems once adequate to provide the level of service needed for the Village will become diminished as vulnerability and susceptibility to sea level rise are magnified. This will necessitate renovation, elevation, and even relocation of the most vulnerable infrastructure in the short term while intensifying the need to incorporate predicted impacts to all infrastructure improvements and planning in the long term.

Village Buildings and Key Facilities. Existing Village buildings and key facilities will become increasingly vulnerable as sea level continues to rise in the Florida Keys. For example, two (2) facilities currently show the most near-term vulnerability to enhanced flood risks by 2030 from sea level rise, the wastewater pump station located at 142 Sunshine Boulevard and the Fire Station #19 located at 74070 U.S. Highway 1. Other public facilities show susceptibility to extreme event flooding within the 2060 planning horizon, including the Islamorada Master Repump Station and Monroe County's Roth Building. Additionally, Founders Park and the S & H Inc. Debris Site, because of their elevations, show a potential for nuisance flooding impacts by 2030 (under a high sea level rise scenario) or 2060 (under a low sea level rise scenario). Because of these vulnerabilities, we can expect an increased need for the Village to consider sea level rise in future capital planning expenditures.

Adaptation Strategies for Homes and Businesses. In the shorter term, Village planning activities will increasingly need to focus on adapting to sea level rise impacts through the avoidance, accommodation and protection adaptation strategies. As more visible impacts of sea level rise occur, "managed retreat" or planning for projected increases in sea levels by relocating vulnerable buildings, infrastructure and public facilities before significant inundation occurs will need to occur. There are several ways to adapt, with a few notable strategies illustrated below.

Adaptation Strategy				
Short-Term	Increase setback distances. Identify opportunities for voluntary conservation easements or increased buffering.	Improve evacuation plans. Conduct additional study on floodproofing or elevating at-risk structures.	Identify areas with greatest vulnerability. Continue discussing vulnerability with stakeholders and residents.	Identify areas with greatest vulnerability and relocate away from them.
Medium-Term	Implement conservation easements. Monitor setback compliance.	Require elevation of new homes above base flood elevation. Floodproof or elevate existing at-risk structures.	Replenish mangroves. Strengthen rebuilding restrictions for non-conforming uses.	Create special fund for voluntary purchase of frequently flooded structures.
Long-Term	Continue monitoring setback compliance. Increase conservation easements.	Develop incentive program for adaptation strategies.	Continue modeling efforts that consider adapting roads and buildings.	Voluntarily purchase frequently flooded areas from willing sellers and remove structures. Monitor rolling easement compliance.

Sustainability. As impacts continue to be felt within the Village, increased focus will likely be placed on improving sustainability to help offset conditions contributing to sea level rise. These will include shifts in initiatives under the social, economic and environmental "legs" of the sustainability stool. Tourism, fishing and coastal recreation are important components of Islamorada's economy and quality of life. Village parks and fisheries are significant assets and are a draw for tourism, new residents and businesses alike. Accelerated rates of sea level rise may necessitate larger or more frequent coastal restoration projects to preserve recreational opportunities and uses.

What's In This Plan?

This Plan contains the following sections:

Summary of Plan Recommendations

As part of the Islamorada Matters Plan, the Team developed a comprehensive set of recommendations to help the Village continue the transition to becoming more sustainable and more resilient to sea level rise. Recommendations were developed for each of the five (5) Focus Areas in the short-, medium- and long-term.

Habitat

Habitat. Recommendations include changes to Village policies and regulations to better identify and protect living shorelines and ecological buffers, improved habitat analyses to identify priority habitat conservation and adaptation areas, better mapping of inundation areas, reduced pollutant loading and runoff to nearshore waters, and more comprehensive consideration of sea level rise in habitat management within the Village.

Infrastructure & Built Environment

Infrastructure and Built Environment. Recommendations include improved data collection for properties and infrastructure facilities, identification and documentation of road segments requiring retrofit, new policies to establish adaptation action areas, updates to best management practices ("BMPs") to reduce adverse water quality impacts from Village infrastructure, and a comprehensive review of Village regulations and incentives to address future flood risk.

Village Buildings and Key Facilities

Village Buildings and Key Facilities. Recommendations include consideration of sea level rise impacts in all capital planning efforts, flood audits for facilities currently identified as most vulnerable to sea level rise, development of long-term flood resilience alternatives or specific facilities, improving geographic information systems ("GIS") inventory of building footprints, and energy audits and efficiency upgrades to Village buildings and facilities.

Adaptation Strategies

Adaptation Strategies for Homes and Businesses. Recommendations include continued discussion with residents and stakeholders about sea level rise vulnerability, ensuring that future assessment and planning activities build upon the work of this Plan, continued intergovernmental coordination to increase regional benefits and strengthen the Village's adaptation efforts, additional study on the feasibility and cost of floodproofing and elevating buildings within the Village, and policy revisions to strengthen rebuilding criteria in particularly susceptible areas.

Sustainability

Sustainability. Recommendations include promoting a cultural shifts to reduce carbon emissions, increased education of currently available energy efficiency incentives, increased training for Village inspectors on energy and water conservation techniques, more energy efficiency standards, improved waste reduction efforts community-wide, and the creation of incentives to relocate residents from high hazard areas within the Village.

The top three (3) recommendations for each Focus Area are depicted in the graphic below.

Habitat

H.1: Update Stormwater Master Plan to include sea level rise assumptions and incorporate green infrastructure features as a priority.

H.2: Conduct a habitat analysis to document species, condition, size and location of trees within the Village.

H.3: Identify areas where living shorelines are most appropriate and develop guidance for implementation, monitoring, and evaluation.

Infrastructure & Built Environment

I.1: Improve data related to properties and infrastructure facilities including digitizing all building footprints.

I.2: Identify key road segments for retrofits with coordinating agencies. Develop a database of real-time flood impacts.

I.3: Establish adaptation action areas or zoning overlays where enhanced design criteria will be developed.

Village Buildings and Key Facilities

VB.1: Consider sea level rise impacts in capital planning by identifying critical assets (habitat and infrastructure) over time.

VB.2: Conduct detailed site-level flood exposure audits for the wastewater pump station (142 Sunshine Boulevard) and Islamorada Master Repump Station, and access to wastewater infrastructure.

VB.3: Develop long-term flood resilience alternatives for Fire Station #19, located at 74070 U.S. Highway 1.

Adaptation Strategies

AS.1: Continue discussing sea level rise vulnerability with residents and stakeholders.

AS.2: Develop and implement a GIS database for Village employees/interested residents to document nuisance floods.

AS.3: Ensure that future flood vulnerability assessments build upon the work in the Islamorada Matters project.

Sustainability

S.1: Promote a cultural shift aimed at saving money and reducing carbon emissions.

S.2: Consistently highlight available/pending incentives for residents desiring to perform energy retrofits or renewable energy deployment.

S.3: Adopt more energy efficiency for buildings within the jurisdiction.

Outreach, Education and Next Steps

Education of residents, business owners and Village staff will continue to be critical in ensuring the Village is best prepared to adapt to sea level rise. Results of the Islamorada Matters planning project should continue to be highlighted in future outreach activities hosted by the Village. This will keep residents informed about changing conditions and engaged in the process of adapting to predicted impacts. Pilot projects could also be used to demonstrate or to study the effectiveness of particular recommendations in this Plan. For example, a pilot project on the effectiveness of BMPs could be used to provide guidance to land managers to better adapt to sea level rise. Similarly, pilot projects on the feasibility of floodproofing or elevating structures within the Village could be useful in the prioritization of future adaptation strategies implemented in Islamorada.

To further build upon the success of the Islamorada Matters project, the Village will also be involved in a NOAA grant entitled: ***Advancing Understanding of Risk: Increasing Accuracy of Hazard Damage Assessment Tools by Improving Base Data and Analyzing Opportunities and Barriers for Use in Adaptation Planning*** to be implemented in 2016-2018. This is a collaborative project involving four (4) communities from four (4) different states in the Southeast, including Florida, Georgia, South Carolina and North Carolina. This project will involve several components, including: 1) collection of stakeholder input to determine local resilience priorities, 2) creation of digital data to improve local planning capacity related to the priorities identified, 3) performance of legal and policy research to improve the implementation of adaptation measures identified by the communities, and 4) pre- and post-project knowledge assessments to evaluate the success of this method in communicating hazard vulnerability and resilience information on a regional scale. The Village of Islamorada will directly benefit from this project through continued community outreach on adaptation and resilience, creation of better base data, more accurate hazard damage assessments, and improved knowledge of local vulnerabilities and resilience.

Islamorada Matters Workshop
Photo Source: Project Team