Monroe County Case Study on Planning for Sea Level Rise

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2010- Monroe County Comprehensive Plan

- Decision to create new Energy and Climate Element
- Two (2) specific references to sea level rise in the Coastal Management Element of their updated Comprehensive Plan
- SLR factor to consider in Capital Improvements Element
- Comprehensive Plan Amendment through 2030 approved by DEO June 2016





Decision Making Paradigm Shift



<u>Land and Infrastructure-</u> Species, Habitat considerations Adaptation/Mitigation for infrastructure

Policy Implementation-Departmental Collaboration, Comp Plan, Code, Legal Issues





Project Planning-

Addressing Priority Vulnerabilities, Budget Implications (New Cost Considerations), Also Departmental Collaboration

Overview of GreenKeys! Planning Process



Climate:

Forecasting Tools & Modeling

County Assets Infrastructure Habitat

Community Impacts Sustainability: GHGEs

Government Operations Natural Systems Built Environment Health & Safety Education, Arts & Community Economy & Jobs Equity & Empowerment

Data Collected: Climate/Sea Level Rise Analysis

Nuisance Flooding	NOAA Digital COAST 2030 and 2060 scenarios
Water/ Wastewater	 FKAA As Built Drawings and GIS 2030 and 2060 scenarios
Water Supply	 USGS Integrated surface - groundwater model to determine saltwater intrusion impacts for wellfields at 2030 and 2060
Roads	 FDOT Sketch Tool and County Pavement Condition Index (2014) 2030 and 2060 scenarios
Habitat	 Sea Level Affecting Marsh Model (SLAMM), the Florida Cooperative Land Cover Classification (FCLCC), the Critical Lands and Waters Identification Project (CLIP), Monroe County's "Habitat" shapefile and Strategic Habitat Conservation Area (SHCA)
Electric Utility	 FKEC and Keys Energy facilities data and GIS 2030 and 2060 scenarios
County Facilities	Point locations of County-owned buildings (2006 GIS Mapping) 2030 and 2060 scenarios
Elevation Data	 2008 Department of Emergency Management LiDAR (Light Detection and Ranging)

Increase in "Nuisance Flooding"



Big Pine Key and Vicinity, Present Day



Big Pine Key and vicinity, 24 inches Sea Level Rise (2060, High Scenario)



GreenKeys! Project Documents

- The following documents were completed as part of the project:
 - GreenKeys! Sustainability Action Plan At a Glance
 - GreenKeys! Sustainability Action Plan Executive Summary
 - Plan Doc with Technical Appendices
 - 5-Year Projects Plan (181)







GreenKeys! provides 165 recommendations for the County and its residents to become more resilient and sustainable.

5-Year Projects Plan

ADDENDUM



Year 1

REENKEYS! SUSTAINABILITY ACTION PLAN 5-YEAR

Year 1 Projects (2016)						
Recommended Projects		Year to Implement Projected Cost/Level of Effort		STAR Overlap	Grant Available ¹	Responsible Department
1-1	Hold three (3) community workshops to discuss sea level rise with	Ongoing	Staff time - 90 hrs.; \$1,500		N	Sustainability
1-2	Provide annual progress reports on the implementation of the GreenKeys! Sustainability Action Plan.	Ongoing	<u>Staff time</u> - 20 hrs.		N	Sustainability
1-3	Maintain and enhance programs, like canal restoration, to improve water quality nearshore and offshore to reduce environmental stressors exacerbated by sea level rise and increasing ocean temperatures.	Ongoing	Staff time - 200 hrs.+ cost of canal restorations		N	Sustainability
1-4	Address sea level rise and climate change resilience in annual County budgeting process.	Ongoing	Staff time - 40 hrs.		N	Sustainability Budget
1-5	Update annual legislative package to include sustainability and sea level rise practices.	Ongoing	<u>Staff time</u> - 30 hrs. Coordination		N	Legislative Affairs Sustainability
1-6	Continue canal restoration, sea level rise, and land acquisition programs.	Ongoing	Coordination		N	Sustainability IFAS Land Authority
1-7	Encourage worksite wellness programs that provide physical activity and weight loss programs at work.	Ongoing	Staff time – 30 hrs.		N	Employee Services
1-8	Create an internal and external Sustainability Newsletter for distribution.	Ongoing	<u>Staff time</u> - 40 hrs.		N	Sustainability IFAS
1-9	Continue supporting the implementation of traditional coral reef management actions as strategies for supporting the maintenance of functional coral reef systems under rapid climate change. Such actions should include decreasing nutrient and sediment loads, continued restoration of apex predator populations, and creation of physical reef structures that may enhance recruitment of hard coral species.	Ongoing	Coordination		N	All Departments
1-10	Continue cooperation with federal, state, and private partners in support of coral reef restoration initiatives to support the implementation of strategies that may promote long-term recovery and resilience of the Florida Keys coral barrier reef system in the face of future climate change.	Ongoing	<u>Staff time</u> - 100 hrs. Coordination		N	All Departments and Coordination with other Agencies
1-11	Continue invasive exotic species management.	Ongoing	Staff time – 50 hrs. annually		N	Land Authority

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- Provides the recommended projects (181) ٠ for implementation over the next five (5) years
- Projects provided in tabular format for • Years 1-5
- In addition to the project list, includes: ٠
 - Associated cost/staff time (hours) to implement
 - Department responsible for implementation
 - Availability of grants to assist with project funding
 - Cross reference to other initiatives like **Regional Climate Action Plan**

5-Year Projects Plan Details

Year to Implement	Number of Projects	Staff Time (Hours) Required to Complete All Projects	Financial Cost of Project Implementation*
Year 1	42	2,835	\$1,489,500
Year 2	49	4,265	\$2,866,500
Year 3	44	3,965	\$744,500
Year 4	24	2,035	\$936,500
Year 5	22	1,620	\$621,500

*Cost totals may not be completely accurate or all inclusive. Estimations used for select recommended projects (e.g. require per fixture energy and water conservation improvements, perform next round of energy audits, or those involving per facility feasibility assessments) for total cost generation purposes.

Workshop Overview- January 26, 2016

Goal: Overview and interactive discussion of GreenKeys! project, next steps

- Introduction
- Planning Approach summary of GreenKeys! Plan approach and GHG summary
- Executive Summary overview of GreenKeys! Plan results and vulnerabilities
- Two Part Workshop
 - Part 1: Sustainability
 - STAR Assessment
 - Sustainability Recommendations
 - 5 Year Implementation Plan (with Projects and Costs)
 - When to Implement, Cross Departmental Budgeting, Strategic Planning
 - Sustainability as a Part of Ordinary Planning
 - Part 2: Sea Level Rise Big Picture Issues
 - "Big Picture Issues" from the GreenKeys! Plan Development
 - Issue 1 Integrating Road, Stormwater, Tidewater Design
 - Issue 2 Land Acquisition Priorities
 - Issue 3 Where People Develop and How
 - Issue 4 How do we Collaborate, Plan for and Fund Issues
 - Future of Monroe County and Keys: Creative Adaptation, Smart Design, New Uses
- Wrap Up and Actions



BIG PICTURE Issues from GreenKeys! Plan Development

1. Integrating Road, Stormwater and Tidewater Design

- 2. Land Acquisition Priorities
 - Do we buy environmentally sensitive land subject to future sea level rise?
- 3. Where Do We Develop and How?
 - Do we avoid building on the coast or where SLR will inundate the property?
- 4. How Do We Collaborate, Plan for and Fund these Projects?
 - More than 300 miles of County roads may need elevation



Near Term Actions



- "Pilot" Roads project to establish design scenarios in Big Pine and Key Largo (with future LOS)- Completed January 2017
- NOAA grant for better vulnerability analysis (HAZUS)
- Elevation data LIDAR countywide (RFP currently under review)
- Countywide roads/stormwater/tidewater analysis (RFP in development)

October 2015 King Tide- Key Largo, Shaw Drive 15-18" of saltwater for 3 weeks

Integrating Road, Stormwater & Tidewater Design

- Roads flooding now, will <u>continue</u> in future
- 2. Rain driven road flooding to become more unpredictable
- Roadwork will impact <u>adjacent parcels</u> stormwater issues
- 4. Road design will need to factor in:
 - a) Additional tidewater impacts from extreme, more regular inundation
 - b) Reduced capacity for drainage
 - c) Additional environmental / regulatory constraints
- 5. Use adopted <u>Levels of Service</u> for varying infrastructure to manage County's financial responsibility and people's expectations
 - a) Some roads may be abandoned or have high levels of water several times through the year.

Road Miles Vulnerable to Nuisance Flooding by Sea Level Rise Scenario.

	Original Road Miles	2030 Low	2030 High	2060 Low	2060 High
US Highway 1	112.5	2.3	3.2	4.0	14.3
All Roads	830.0	143.6	188.0	217.6	449.9
			1.0	\smile	



Integrating Road, Stormwater & Tidewater Design

1. COUNTY'S CURRENT APPROACH:

- a) County currently *maintains* Levels of Service per Comprehensive Plan
- b) Road requirements in the Code:
 - CR905 & secondary roads level D
 - US Highway 1 level C
- c) Current approach does <u>not</u> consider impacts of sea level rise on Levels of Service

2. POTENTIAL SOLUTIONS:

- a) Environmentally Challenging Locations
- b) Minimum Maintenance Roads
- c) Flood Protection Level of Service
 - How many times a year will some level of flooding be allowed?



Implementation Considerations

LOCAL CONDITIONS AFFECTING FINAL DESIGN RECOMMENDATIONS



Appendix 1: Road Design Methodology

Appendix 1 narratively describes the steps in the process so they can be applied in other areas	Tidal datum based on current tidal epoch MHHW (NAVD88)	Elevation addition to not exceed 7 days of flooding annually based on 2015 sea level	Sea level rise estimate using IPCC AR5 Median (2015 to 2040)	Resulting target minimum elevation for roads (2040)** (NAVD88)
	-1.1"	<mark>6.0</mark> "	5.4"	10.3"
Sands Community	r _	\sim \sim		
Twin Lakes	-7.0" ՝	<u>6.0"</u> \	 5.4" 	4.4"
Community				

The negative values are in relation to the NAVD88 datum, where zero is a point approximately equal to the low point of the roadways in the two communities.

Initial Results – Conceptual Cost Estimates for

	Twin Lakes	s – Key Largo	Sands Community – Big Pine		
Elevation	Length of Roadway Elevated	Total Roadway <u>and Drainage</u> Cost	Length of Roadway Elevated	Total Roadway <u>and Drainage</u> Cost	
6"	0.25 miles	\$0.92 million	0.3 miles	\$2.22 million	
12"	0.7 miles	\$4 million	0.35 miles	\$2.63 million	
18"	0.8 miles	\$5.8 million	1.3 miles	\$8.9 million	
28"	0.9 miles	\$7.3 million	1.5 miles	\$10.5 million	

<u>Costs factored in</u>: Maintenance of traffic, mobilization, design, construction, 15% of costs for construction engineering and inspection, 25% contingency and stormwater features.

Costs not factored in: right-of-way (~12" is threshold), driveway improvements

Appendix 2: Draft Ordinance





Draft Ordinance Process Flow for Road Design



Local Conditions Analysis/Evaluation

- Physical site constraints;
- Current road conditions and elev
- Current elevation of adjacent pro
- Sensitivity of the land or mitigatic
- Water quality requirements;
- Right of way needs;
- Availability of land to accommod
- Elevation of water table in relation
- Impacts to access for private pro
- Future maintenance needs and costs including statting requirements; and
- Number of developed properties that the subject road services as the sole means of access.



Resolution #1: Approve Final Report and Move Forward with Pilot Communities Design

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Resolution Standard a

- Appendix 1 Meth Pilot Roads Projet as an appropriat <u>SLR by project y</u> project until a Re
- Move forward wi term roads subje
- The Board of Co in the FY17/18 b
 - GreenKeys Plan

King Avenue, Key Largo Rodriguez, 10/14/16

d Design de Roads

Aonroe County unities will serve <u>ooding + Median</u> ad improvement ire. It to identify neare flooding. If to budget funds sis project. 5 Year Work Plan



Thank You

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