

ERIN L. DEADY, P.A

CLIMATE CHANGE & SEA-LEVEL RISE: POTENTIAL IMPACTS ON LOCAL GOVERNMENT ROAD PROGRAMS

FLORIDA ASSOCIATION OF COUNTIES MEETING

JUNE 29, 2017 WEST PALM BEACH

Presented by Rhonda Haag, Sustainability Director and Judy Clarke, P.E., Engineering Services Director Monroe County, FL

Monroe County Administrator Roman Gastesi



OVERVIEW OF PRESENTATION

- 1. SEA LEVEL RISE EFFECTS ON COUNTY ROADS
 - 2. DEVELOPING A PLAN
 - **3. PILOT ROADS ANALYSIS**
 - 4. COSTS FOR ELEVATING ROADS
 - 5. NEXT STEPS: IMPLEMENTATION





MONROE COUNTY, FLORIDA





The Florida Keys

- 77,000 permanent residents
- 4 million visitors annually
- \$200 million in sales tax revenue
- Bahamas 311 Miles of County Roads
 - 144-188 road miles at risk by 2030

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FLORIDA COUNTIES AND MONROE COUNTY AMONG MOST VULNERABLE COUNTIES IN NATION



| Rank | County | | Population Dis | placed |
|------|----------------|---|----------------|-------------|
| 1. | Tyrell, NC | | | 45% |
| 2. | Hyde, NC | Land that's dry now that will go under water by 2060 in relation to the number of | | 42% |
| 3. | Monroe, FL | | | 36 % |
| 4. | Dare, NC | people living there | 21% | |
| 5. | Currituck, NC | | | 20% |
| * | Miami-Dade, FL | | | 3% |
| * | Broward, FL | | | 1% |

*National-scale analysis of over 300 coastal counties

Matthew Hauer, Applied Demography Program, University of Georgia

MONROE COUNTY SUSTAINABILITY AND CLIMATE MILESTONES

2007-2011

- US Mayor's Climate Agreement •
- Green Building/Green Initiatives Task Force
- EECB Grant/CCAC
- Sustainability Vision Statement
- GHG Inventories
- 1, 2, 3' SLR Scenarios

2012

- EAR for Comprehensive Plan (Energy & Climate Element)
- Communitywide GHGs
- EECS for County GHG reductions
- Compact's Regional Climate Action Plan

<u>2013</u>

- Climate Action PlanStart Sustainability
 - Action Plan (SAP)
- IG reductions

<u>2014</u>

- Launched GreenKeys!Data collection
- SLR modeling for 2030 and 2060
- Community SLR Modeling and Outreach
- Dutreach Dan Davida
- Plan Development

2015 & 2016

- Finalize GreenKeys! Plan
 - 5 year List of Projects
 - Begin implementing recommendations
- Collect mobile LiDAR
 elevation data

2017 & Beyond

Continue strategizing

necessary policy shifts

• Continue implementing

recommendations

Perform streets inundation
 analysis



PREPARING TODAY FOR TOMORROW

- 1. COUNTY DEVELOPED SUSTAINABILITY AND CLIMATE PLAN
- 2. SEA LEVEL RISE VULNERABILITY ANALYSIS FOR:
 - ROADS FLOODING IN NEIGHBORHOODS
 - **BUILDINGS / FACILITIES**
 - WATER / WASTEWATER
 - ELECTRIC UTILITIES
 - HABITAT
- 3. BASED ON SEA LEVEL RISE PROJECTIONS FROM THE SE FL REGIONAL CLIMATE COMPACT
 - COLLABERATION OF PALM BEACH, BROWARD, MIAMI DADE AND MONROE COUNTIES
- 4. IDENTIFIED "HOT SPOTS" FOR ROAD FLOODING
- 5. IDENTIFIED NEED FOR ADDITIONAL DATA:
 - MORE ACCURATE LIDAR ELEVATIONS COUNTYWIDE FOR ROADS
 - COUNTYWIDE ENGINEERING LEVEL ANALYSIS FOR ROAD BY ROAD INUNDATION ANTICIPATED AND LEVEL OF ADAPTATION REQUIRED



SEEING SEA-LEVEL RISE TODAY



Figure 1: Unified Sea Level Rise Projection. These projections are referenced to mean sea level at the Key West tide gauge. The projection includes three global curves adapted for regional application: the median of the IPCC AR5 RCP8.5 scenario as the lowest boundary (blue dashed curve), the USACE High curve as the upper boundary for the short term for use until 2060 (solid blue line), and the NOAA High curve as the uppermost boundary for medium and long term use (orange solid curve). The incorporated table lists the projection values at years 2030, 2060 and 2100. The USACE Intermediate or NOAA Intermediate Low curve is displayed on the figure for reference (green dashed curve). This scenario would require significant reductions in greenhouse gas emissions in order to be plausible and does not reflect current emissions trends.





From the Key West tide gauge. 9" increase in sea-level in the past 100 years.

Non-storm-related flooding



Photo by The New York Times

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TODAY

TOMORROW – 2060 PROJECTIONS

Best Case Scenario: 9" SLR

Worst Case Scenario: 24" SLR







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Red areas represent inundated land.

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FLORIDA COASTAL AND INLAND ROADS WILL EXPERIENCE EFFECTS

- 29,793 miles of Coastal Roads in Florida alone
- Sea Level Rise not just a coastal problem, inland communities also affected
- Monroe County seeing effects more each year





SOURCE: "Highways in the Coastal Environment: Second Edition, by the Federal Highway Administration



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PURPOSE OF THE PILOT ROADS PROJECT EFFORT

- 1. DEVELOP ROADWAY AND STORMWATER ADAPTATION ALTERNATIVES TO ADDRESS FLOODING IMPACTS IN TWO COMMUNITIES
- **2. DEVELOP COST ESTIMATES FOR ALTERNATIVES**
- 3. CREATE A STANDARD APPROACH AND POLICY TO EVALUATE AND ADDRESS ADAPTATION THAT CAN BE IMPLEMENTED COUNTYWIDE
- 4. DEVELOP CONCEPTUAL DESIGNS
 - NOT FINAL DESIGN, NOT FINAL COST ESTIMATES FOR COUNTYWIDE ROADS ELEVATION





PILOT PROJECT LOCATIONS



PROJECT ASSUMPTIONS

- 1. USED A 2040 PLANNING HORIZON TO MATCH 20-25 YEAR ROAD IMPROVEMENT PROJECT LIFESPAN
- 2. SOUTHEAST FLORIDA REGIONAL CLIMATE CHANGE COMPACT ADOPTED SEA LEVEL RISE PROJECTIONS
- 3. USED INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) AR5 MEDIAN ESTIMATE PROJECTION OF 5.4" SEA LEVEL RISE BY 2040
- 4. USED UNITED STATES ARMY CORPS OF ENGINEERS (USACE) HIGH ESTIMATE OF 10.1" BY 2040

Figure 1: Unified Sea Level Rise Projection. These projections are referenced to mean sea level at the Key West tide gauge. The projection includes three global curves adapted for regional application: the median of the IPCC AR5 RCP8.5 scenario as the lowest boundary (blue dashed curve), the USACE High curve as the upper boundary for the short term for use until 2060 (solid blue line), and the NOAA High curve as the uppermost boundary for medium and long term use (orange solid curve). The incorporated table lists the projection values at years 2030, 2060 and 2100. The USACE Intermediate or NOAA Intermediate Low curve is displayed on the figure for reference (green dashed curve). This scenario would require significant reductions in greenhouse gas emissions in order to be plausible and does not reflect current emissions trends.

TECHNICAL RECOMMENDATIONS FOR ELEVATION

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| | Inches N | Inches NAVD 88 | |
|------------------------------------|-------------------------------|-------------------------|-------------|
| | Twin Lakes Community | Sands Community | |
| 7 Days of Flooding Annually* (+6") | -1.0" | 4.9" | |
| Mean Higher High Water | -7.0" | -1.1" | |
| | | | |
| | *Not to Exceed an Annually | Average of 7 Days of Fl | boding |
| | | Not to | Exact Scale |
| | | | |

TECHNICAL RECOMMENDATIONS FOR ELEVATION

RECOMMENDATION FOR STORMWATER MANAGEMENT

CONCEPTUAL COST ESTIMATES FOR DESIGN SCENARIOS

| | Twin Lakes – 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.

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

PROJECT RESULTS

RAISE ROADS TO FINAL ELEVATION

- 5" FOR KEY LARGO
- 11" FOR BIG PINE
- TOTAL 0.7 MILES OF ROAD ELEVATION
- 2. COST, INCLUDES STORMWATER
 - DESIGN \$400,000 \$450,000
 - CONSTRUCTION \$3.5 MILLION
- 3. ADOPTED AN INTERIM POLICY STANDARD TO ELEVATE ROADS
 - \leq 7 DAYS TIDAL FLOODING/YEAR
 - INCLUDES IPCC MEDIAN SLR PROJECTION (5.4 INCHES BY 2040)
- 4. POTENTIAL COST TO ADAPT ROADS COUNTYWIDE TO ADDRESS SEA LEVEL RISE: \$500 - \$900 MILLION

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INFRASTRUCTURE ADAPTATION – NEXT STEPS

- 1. PERFORM MOBILE LIDAR SURVEY TO OBTAIN MORE ACCURATE ROADS AND FACILITIES ELEVATION DATA.
- 2. PERFORM COUNTYWIDE ROADS ANALYSIS TO IDENTIFY AT-RISK ROADS AND ADAPTATIONS NEEDED
 - 144-188 ROAD MILES AT RISK BY 2030
- 3. INCORPORATE SEA LEVEL RISE CONSIDERATIONS IN CAPITAL IMPROVEMENTS WHEN CONSTRUCTING NEW ROADS AND BUILDINGS

SEA LEVEL RISE IS NOT JUST A COASTAL PROBLEM

- Climate change and sea-level rise will impact every Floridian.
- Finding sustainable, long-term solutions to mitigate against climate change and prepare our communities for sea level rise must be a statewide priority.
- County managers and elected officials must be part of the solution
- Our communities, our constituents and our economy depend on it.

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Presented by Rhonda Haag and Judy Clarke

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