

Village of Key Biscayne: Climate Vulnerability Assessment and Adaption Strategies



February 16, 2017

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Objectives

- Provide credible and actionable information on the vulnerability of the Village of Key Biscayne to sea level rise.
- Outline adaption strategies to address impacts of sea level rise.
 - What are the current risks?
 - How will these risks change as sea level rises?
 - How do hypothetical adaptation scenarios lessen impacts?

Effective Adaptation Planning

- Based on models developed for other cities (Boston, Miami Beach, etc.).
- Four key components:
 - Community Engagement
 - Policy Review
 - Green Adaptation Options
 - Infrastructure Improvement

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 - Community Engagement
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 - Green Adaptation Options
 - Infrastructure Improvement
 - Storm Drainage Improvements
 - Raising Sea Walls
 - Raising Roads / Property

Community Engagement

Examples:

- Climate Education Program for Residents / Businesses
- Citizen Science Volunteer Program
- Resiliency Audit Program for Property Owners



Policy Review

Examples:

- Freeboard Ordinances
- Raising of seawalls
- Eliminate below-grade parking
- Finance programs



"Green" Adaptations

Examples:

- Beach Renourishment
- Mangrove Restoration
- "Green" Roofing
- Permeable roadways



Infrastructure Improvements

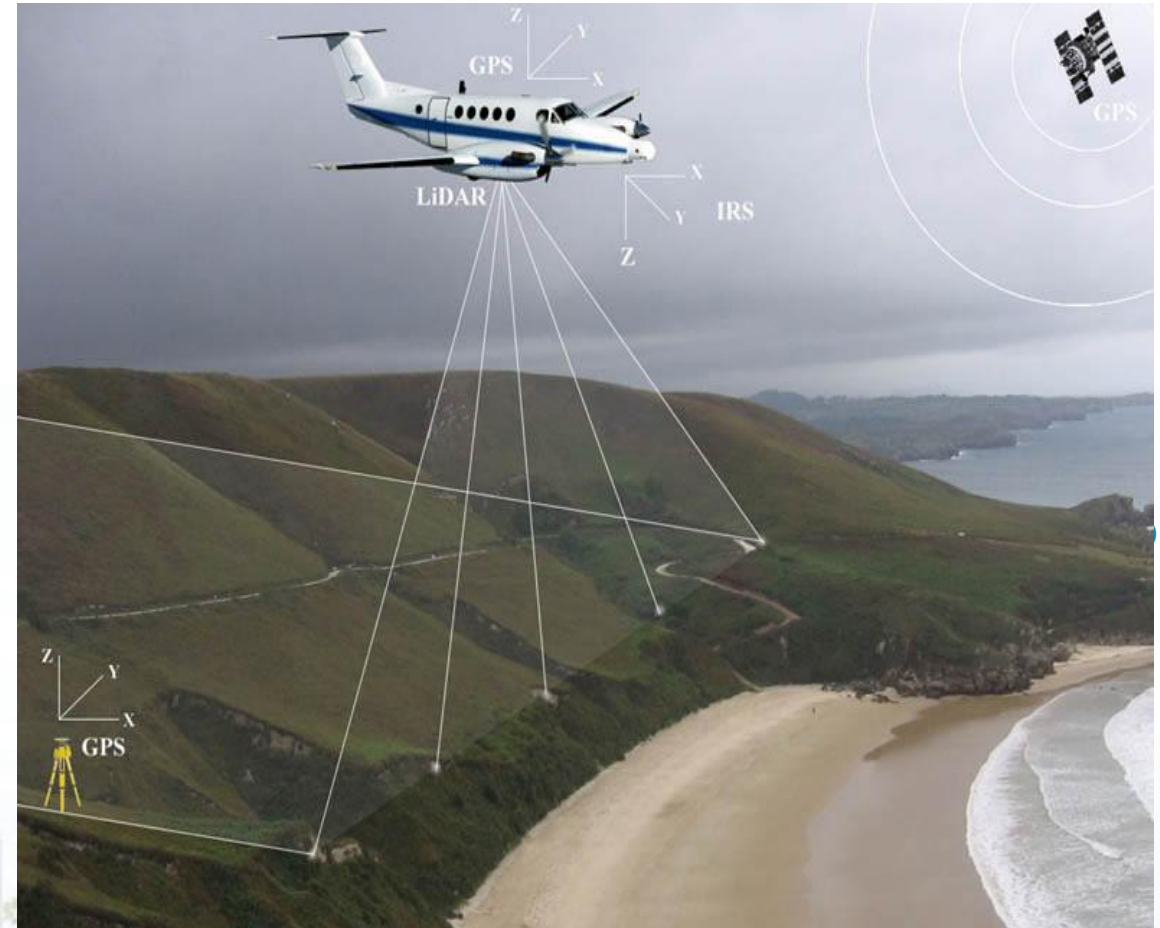
Examples:

- Storm Drainage Improvements
- Raising Sea Walls
- Raising Roads / Property
- Pumping Systems



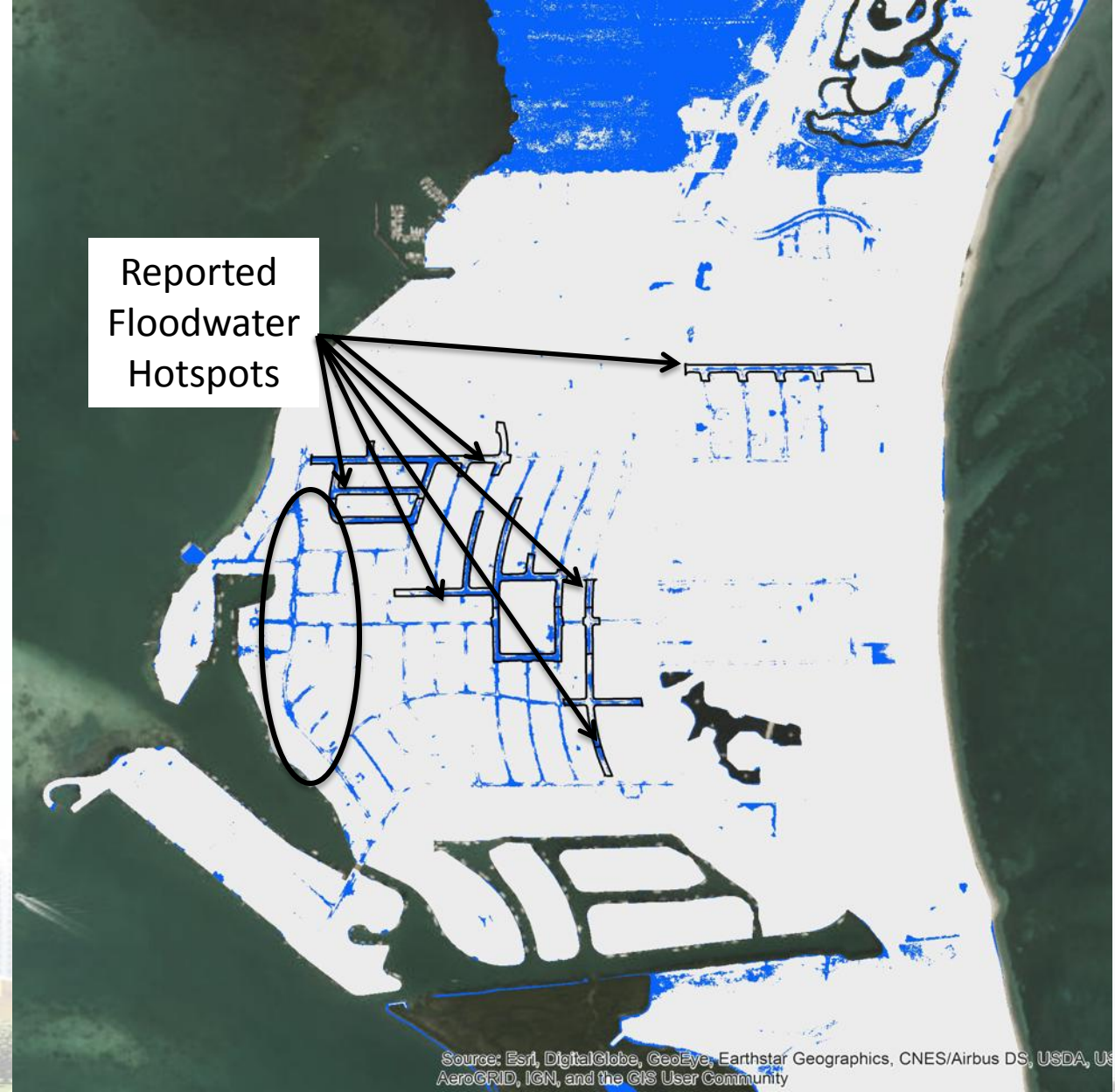
State of the Art Flood Modeling

- High resolution lidar topography
- Local tidal records
- Projections of sea level rise



King Tide Flooding Today

CRC Model Predictions and VKB Reports



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, US AeroGRID, IGN, and the GIS User Community

What's the Problem?

Drainage Under Average Tidal Conditions

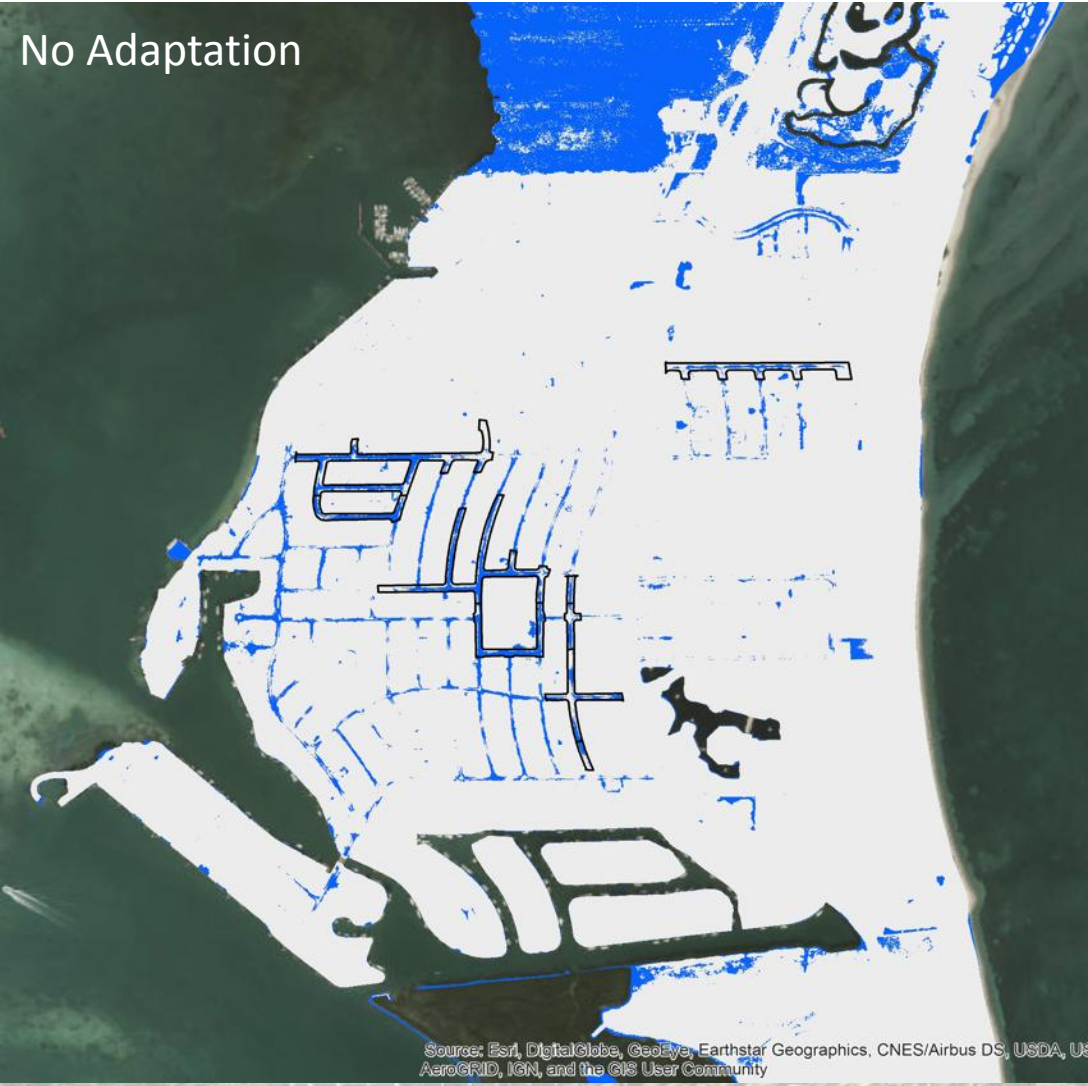


What's the Problem?

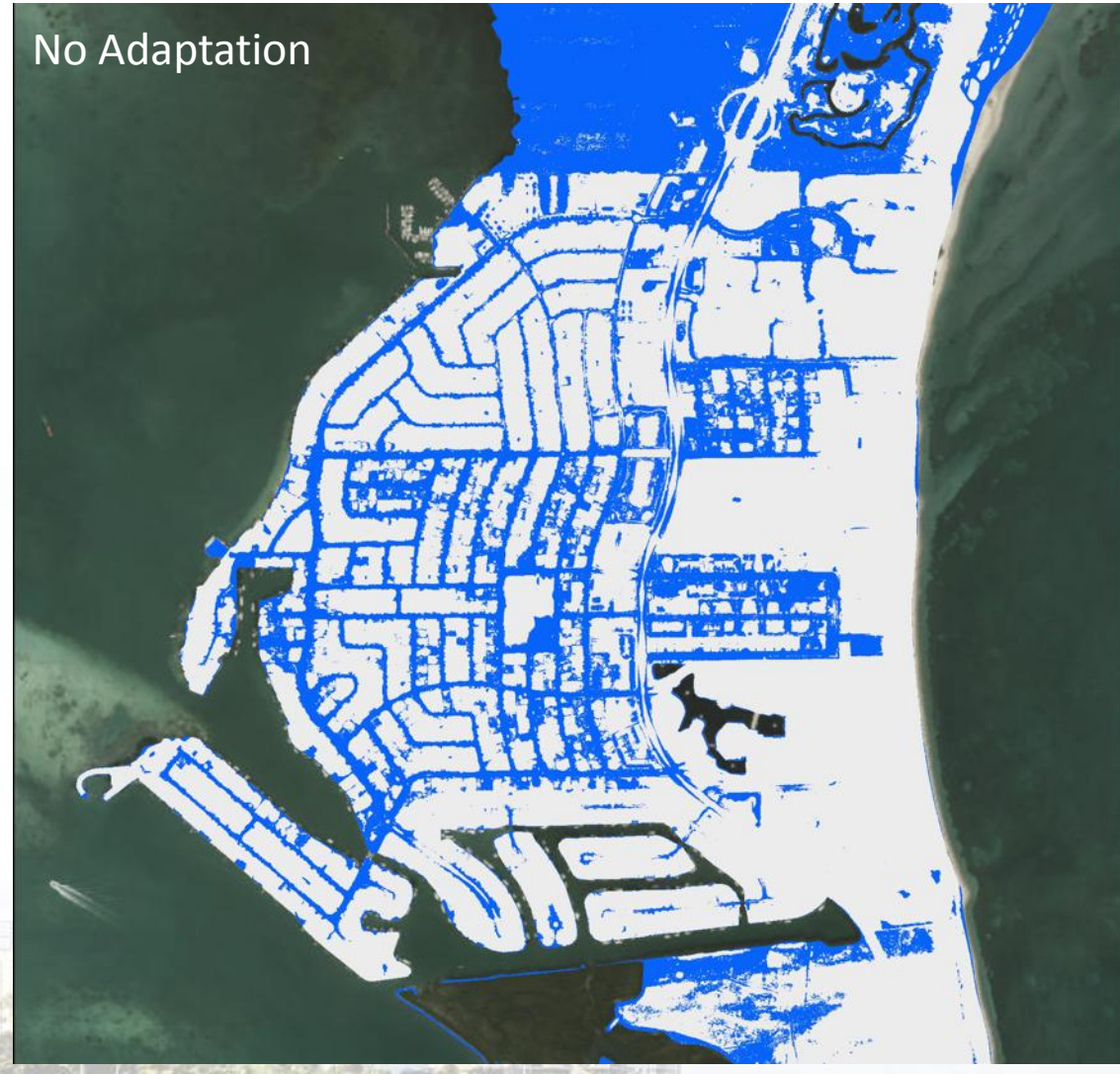
Drainage Under King Tide



King Tide Flooding Today



King Tide Flooding 2045



2045: No Adaptation



2045: Seawall and Storm Drain Improvements



Rising Sea Level Elevates The Water Table Underground



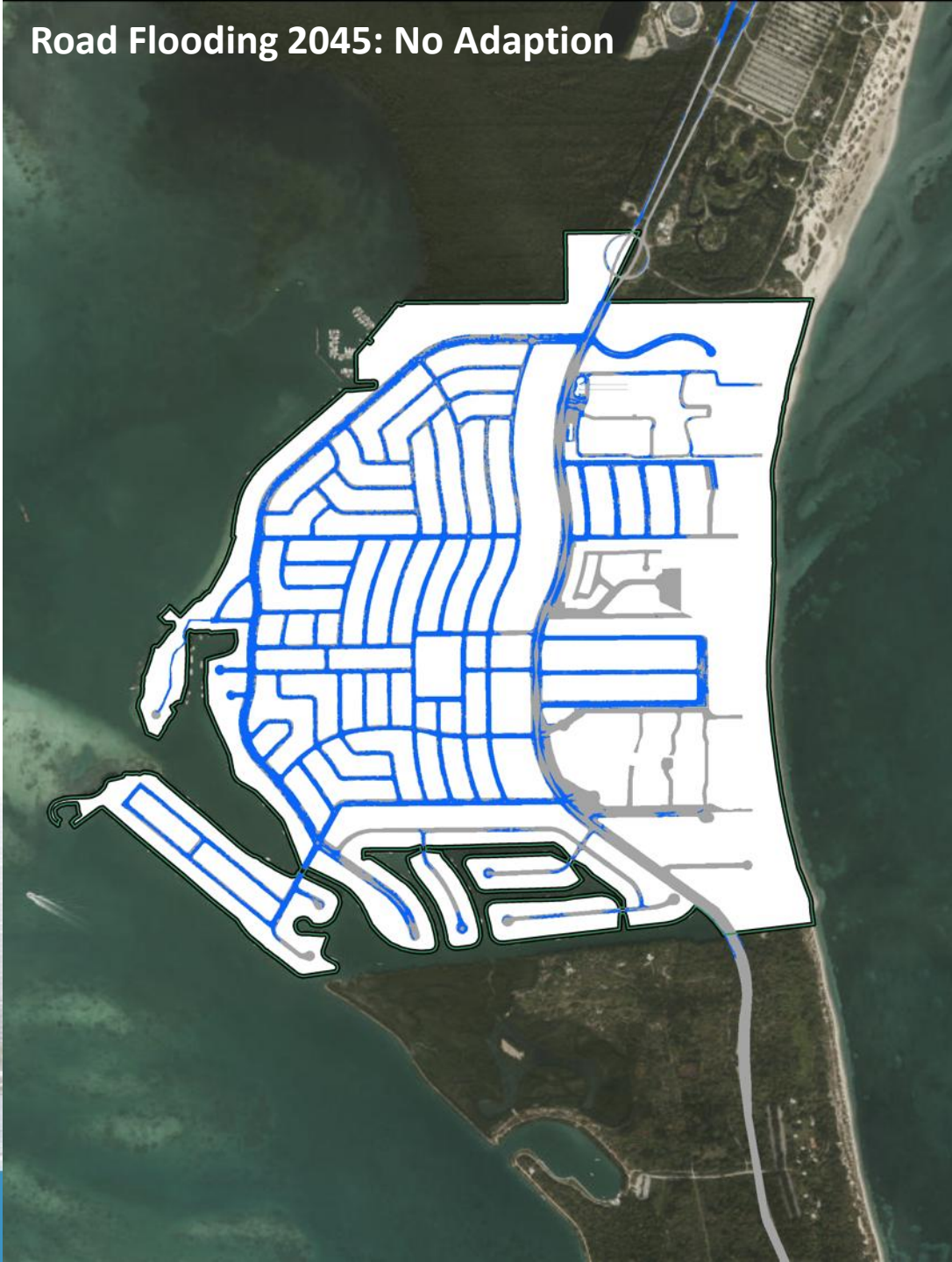
➤ **Perimeter defenses are insufficient due to highly porous bedrock**

Roadway Elevation

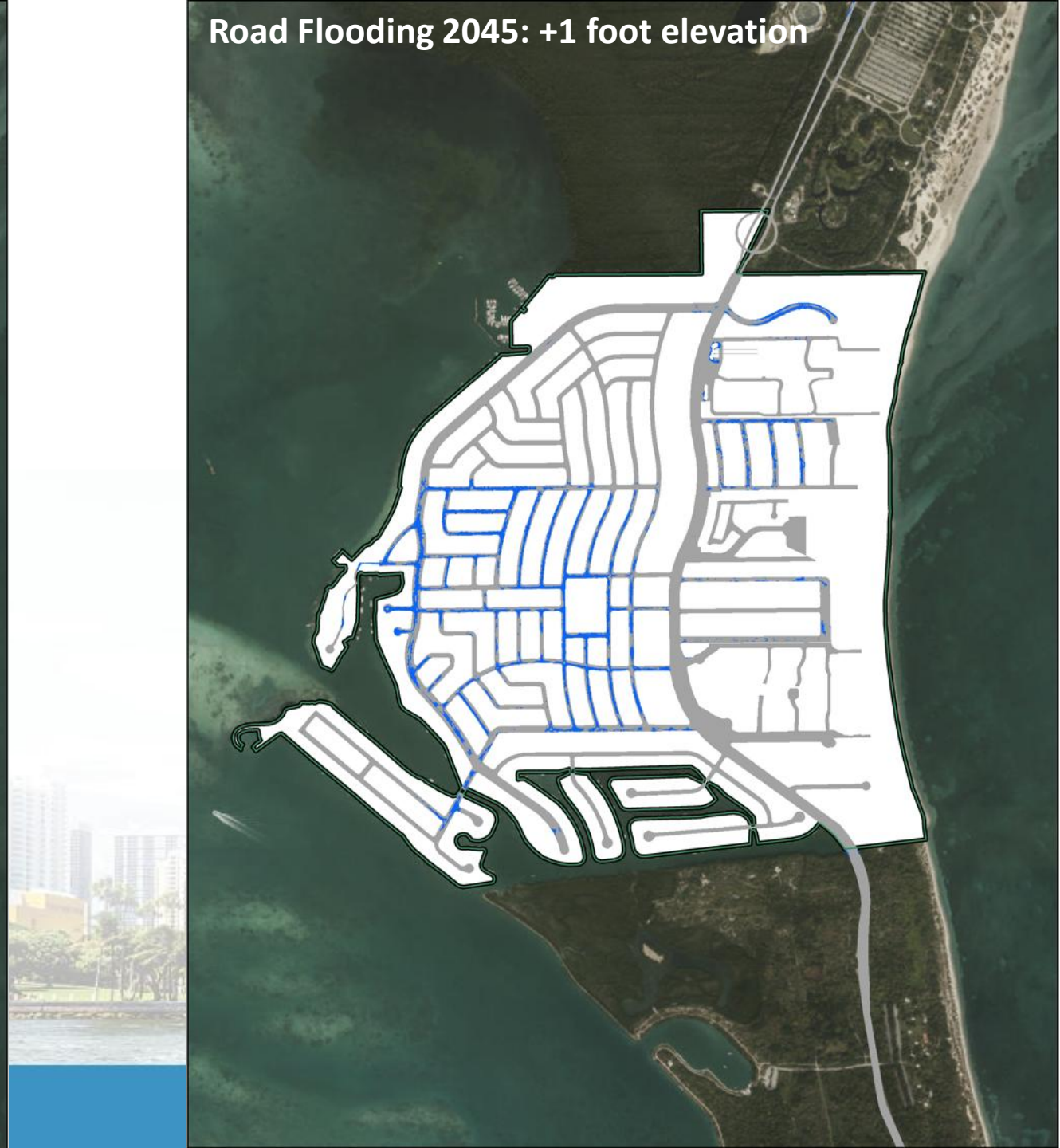
- Roads are lowest and most vulnerable to flooding
- Integrated with storm drainage
- Important for emergency response



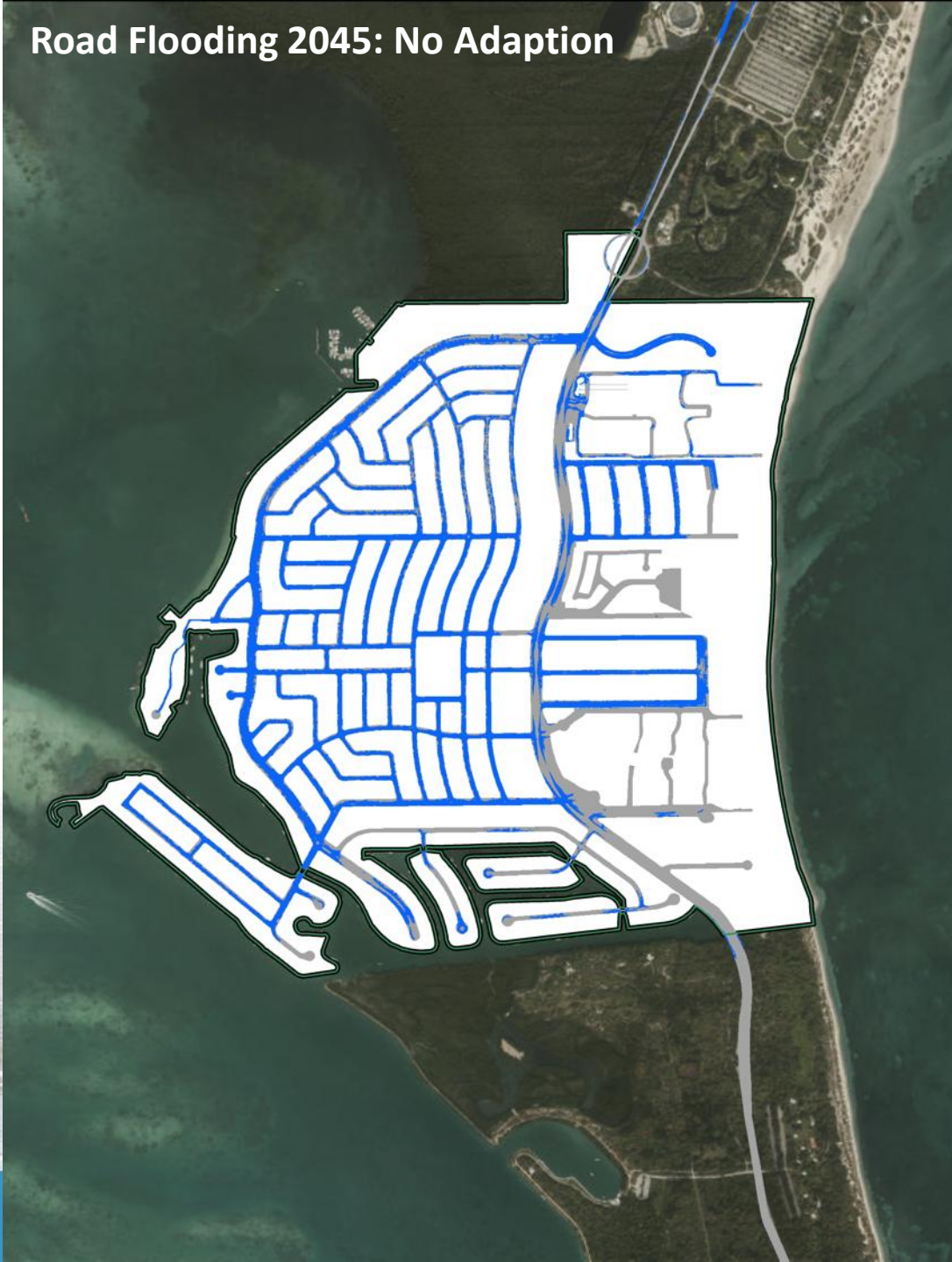
Road Flooding 2045: No Adaption



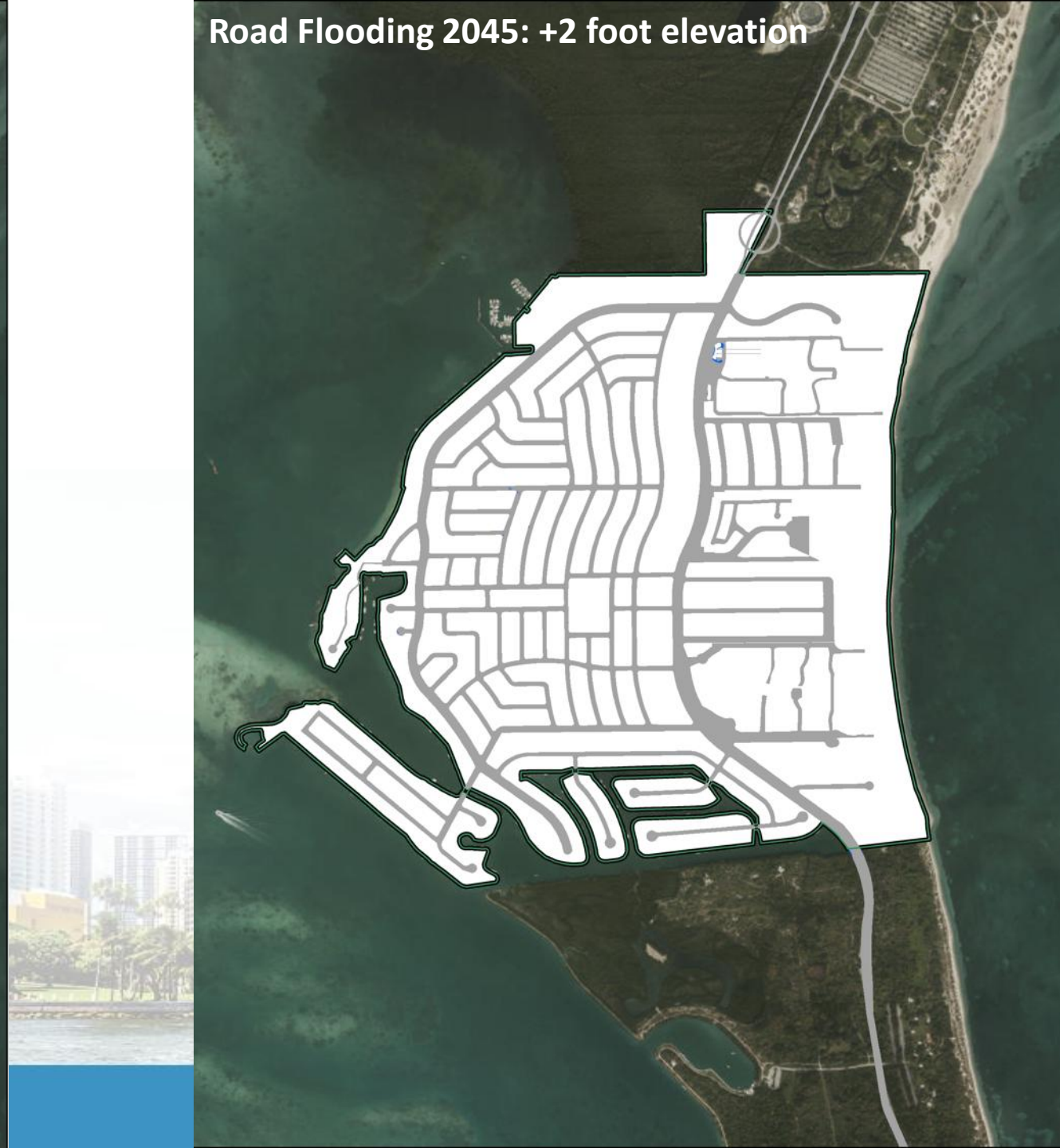
Road Flooding 2045: +1 foot elevation



Road Flooding 2045: No Adaption

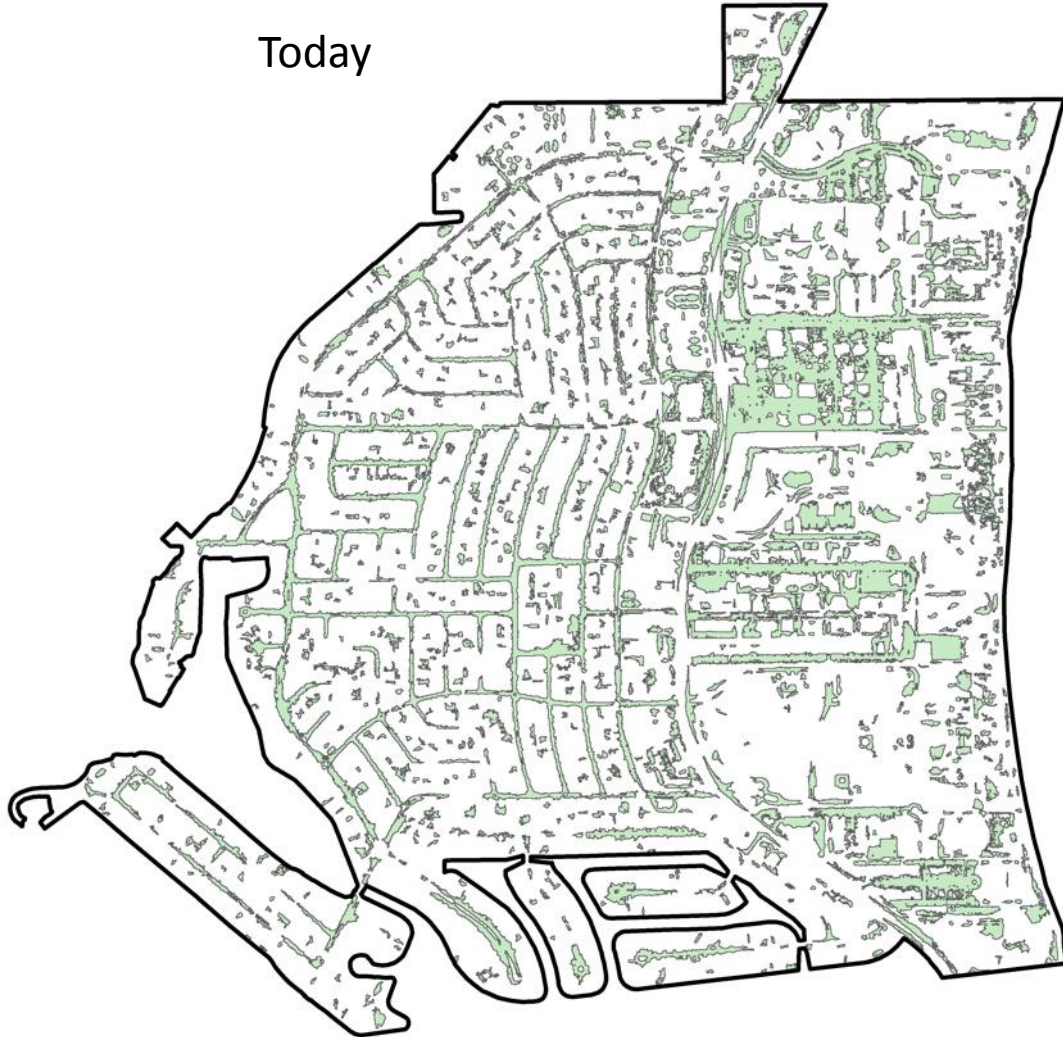


Road Flooding 2045: +2 foot elevation



Areas of Rainfall Run-off Accumulation

Today



With Elevated Roads



- Elevated roads alone will shift run-off from roadways to properties
- Requires coordinated implementation with property owners and other adaption/infrastructure improvements

2045: No Adaption



2045: +1 Foot (vulnerable property)



2045: +2 Foot (vulnerable property)



2045 No Adaptation

2045: Seawalls/storm drains + 1 foot road elevation



➤ **CRC tools enable customized adaptation scenarios for local governments and property owners**

SUCCESSFUL CLIMATE ADAPTATION IS “U” SHAPED

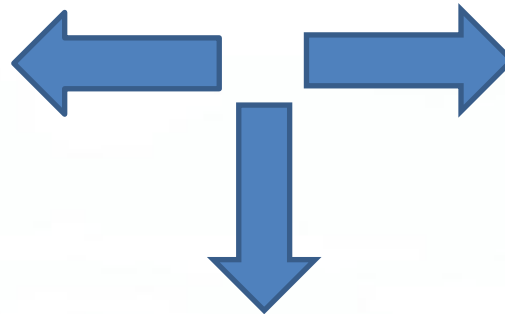
City/Government

Large scale climate adaptation infrastructure designed and built by city/govt

Community

Private climate adaptation actions taken by homeowners, businesses, neighborhoods

Coastal Risk’s Climate Adaptation Technology
www.floodscores.com



“Top Down”

“Bottom Up”

Public engagement by citizens with actionable data and analysis concerning their properties and their neighborhoods

“Side to Side”

Crowd-sourced and other self-help information between individuals, neighborhoods, etc.

Adapted from work by Peter Williams, IBM

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Final Remarks

- Adaptation is dynamic. Requires participation and coordination of county, municipal, and private stakeholders.
- No single solution.
- Infrastructure improvements are interconnected and need to be considered within a holistic framework that considers integrated effects.
- Cost effective tools are available to facilitate planning and cost/benefits analysis of specific adaptation scenarios.