

Our Story

- 1. Valuable, vulnerable, resilient
- 2. Using the best science and engineering
- 3. Case Studies
 - Business Case Analysis of Stormwater Program
 - Buoyant City
 - Urban Forestry Master Plan





Miami Beach is

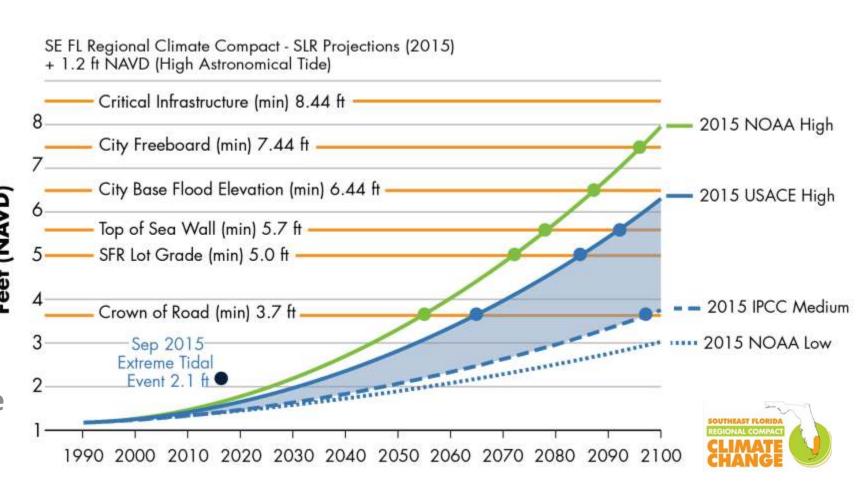
- Highly valuable with \$39 billion in taxable assessed value
- 7-sq. miles
- 100-years old
- Densely built and populated
- Low elevation close to sea level

SOUTH BEACH CROSS SECTION



Science and Engineering

- Miami Beach participates in the Southeast Florida Regional Climate Change Compact.
- The Compact convenes scientists to develop unified sea level rise projections for Southeast
 Florida.
- Miami Beach adopted the projections in 2016 for planning purposes.







Business Case Analysis for the City of Miami Beach Stormwater Resiliency Program

Key Assumptions & Scenarios Evaluated

- This study evaluated the business case for the City's 2013 stormwater improvement program policies and plans
 - This includes an assumption of 1 foot of sea level rise from 2013 (nominally a 30-year planning horizon)
- We evaluated proposed investments against the following scenarios (with and without sea level rise):
 - King Tides
 - 5-year, 24-hour rainstorm (occurring at King Tide)
 - 10-year, 24-hour rainstorm (occurring at King Tide)
 - Moderate Hurricane (~25-year storm surge and rainfall)



BUSINESS CASE ANALYSIS OF THE STORMWATER PROGAM

HURRICANE **FLOODING:** THE ISLAND



PUBLIC INFRASTRUCTURE EFFECTIVENESS:

PIPES + PUMPS + ROADS TIDAL FLOODING + RAINFALL + GROUNDWATER

ECONOMICS:

INVESTMENTS + PROPERTY VALUES + DAMAGE AVOIDANCE

PUBLIC AND PRIVATE COSTS AND BENEFITS

STORM SURGE **MODELING**



DRAINAGE **MODELING**



ECONOMIC MODELING

MIAMI **BEACH** UNIQUE **FORMULA**

Without investments, storm surge losses increase significantly.

Public infrastructure investments reduce flooding levels.

Individual homeowners will require less investments to protect their homes.

Home prices are higher for parcels with higher elevations. Increase 8.6% to 11.5% for each one-foot increase in average parcel elevation.

Home prices are also higher for parcels with more elevated surrounding roads. Increase 4.9% to 14.1% for each one-foot increase in nearby road elevation.

Hedonic Model Application: Sunset Harbour

- Use the models to estimate home value improvements from infrastructure investments
- Sunset Harbour application:
 - Using "Condos Only" model nearby homes primarily condos
 - 1,349 condos with a total assessed value of \$346.12 million
 - Estimated effect of road elevation
 project on assessed condo values:
 11.9% increase, or \$41.2 million



Sunset Harbour post-elevation (Source: Wade Trim)



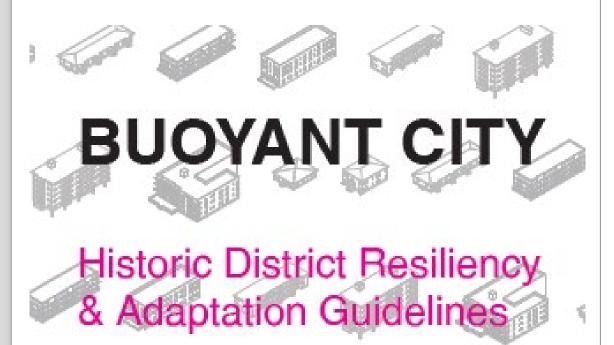
City-wide Business Case Summarized

- If the City does not invest in the stormwater program, the damages associated with sea level rise are significant.
- Investments of at least \$1 billion over the next 30 years would be costbeneficial to prevent surge-related flood damages.
- In addition, raising roads to 3.7' NAVD across the city could conservatively increase property values citywide by over \$1 billion in assessed value.
 - This is a \$6.6 million annual increase in tax revenue to the city.
- Therefore, city-wide public and private investments of at least \$2 billion would be cost-beneficial.

\$2B

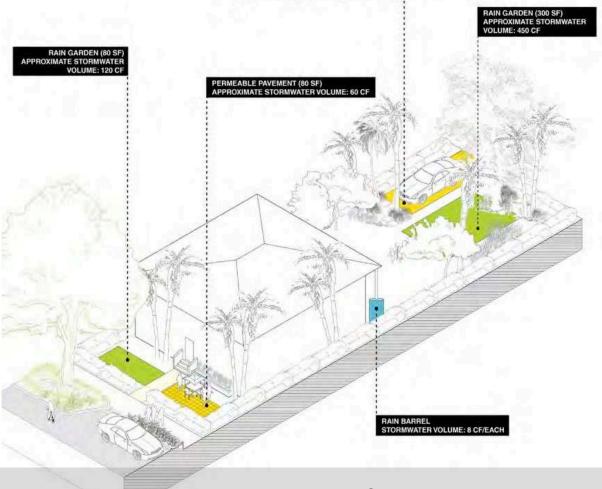
for road elevation and storm protection would be cost-beneficial











Buoyant City Elements

- **Quantify Water**
- Define Current Conditions
- Best Practices
- Resilience Approaches & Strategies
- Resiliency Guidelines



RISING ABOVE

MIAMI BEACH URBAN FORESTRY MASTER PLAN

06/17/20

1. Selecting the Right Tree

Criteria that impact adaptability and resilience in an urban condition

2. Tree Planting – An Urban Strategy

Specific corridor information and planting strategy



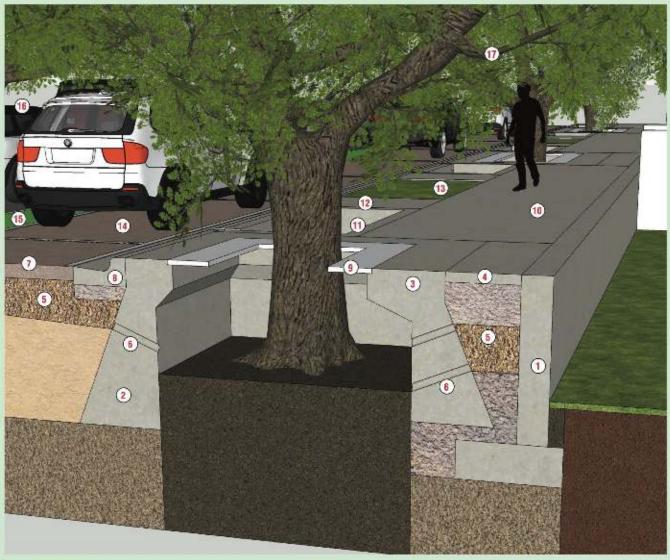








Toolkit: Meridian Avenue Existing Mahogany Trees



The following assumptions were made:

- It assumes that Meridian Ave will need to be raise total of 4 feet as part of its adaptation strategy. Becan the predictions of the ultimate impact of sea level i and climate change are dynamically changing, the c study assumes a worst-case scenario situation. Wh this scenario may be more than what is currently be contemplated, it serves the purpose of forcing the ne for innovation in design to meet the challenges i manner that can be adapted to many different situation along the corridor.
- It assumes that the cultural and environmental value the existing mature tree stock is such that it will rem
- · It assumes that a one-size-fits-all strategy incompatible with the needs to innovate and to engin a custom solution for this unique condition. Read available typical sections in both the Transportat Master Plan (adopted 2016) and the Street Des Guidelines (adopted 2016) were analyzed and found be insufficient for their application in climate adaptation.
- It assumes that while the need to adapt to c change is a dynamically, complex one, the opport to engineer solutions to meet the future design of can be most implementable if they employ or a acceptable standard construction methods a in-place and adopted by various agencies, such Florida Department of Transportation. This facthe use of a readily-acceptable standards that are t by agencies and professionals whose recommend are subject to liabilities, and it provides a basis which to prognosticate the cost impact of such co engineering strategies.

LEGEND

- 1. Retaining wall
- 2. Modified FDOT Index 520 gravity wall
- 3. Modify gravity wall top to ensure 5-foot ADA access
- 4. Pervious concrete slab
- Pervious asphalt or concrete dramage layers
 C-inch diameter PVC drain
- 7. Pervious asphalt
- 8. FDOT Type D 2-foot Curb and Gutter
- 9. Custom tree grate, measured to specifics of each tree
- 10. Concrete slah
- 11. Bioswale
- 12. Access sidewalk connector to parking spaces
- 13. Landscape planting area
- 14. Curbside parking strip
- 15. 4-foot wide bike lane
- 16, 2 qty, 11-foot travel lanes
- 17. Crown-raise low branches (not shown)

Toolkit: Urban Tactics for Planting Trees

112 City of Miami Beach Urban Forest Master Plan 20 "TO ADDRESS IMMEDIATE AND LONG-TERM CLIMATE AND WEATHER RELATED RISKS...IN OUR VIEW, THE CITY MAINTAINS AMONG **THE MOST ROBUST PLANS** ATTEMPTING TO ADDRESS THESE RISKS THAT WE'VE REVIEWED FOR U.S. LOCAL GOVERNMENTS." March 29, 2019

S&P GlobalRatings



