



Resilient by Design

A Blueprint for Flood-Resilient Communities

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Hazen & Sawyer

Agenda

- 🌿 Overview and Considerations
- 🌿 Dynamic Prioritization
- 🌿 Case Study – Broward County
- 🌿 Case Study - Boston
- 🌿 Conclusion



Planning for Stormwater?



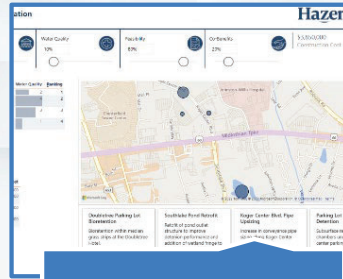
Varied Master Plan Objectives



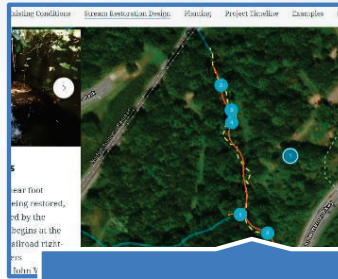
Masterplan Considerations



Tracking Opportunities and Constraints



Dynamic Prioritization



Visualizing Projects



Achieving Multiple Objectives



Considering Private Development



Field Assessment Tools



Considering Maintenance Needs

Development of Digital Masterplans

Vision

- Decisions to be supported
- Processes to optimize
- Efficiencies to be gained

Data Model Development

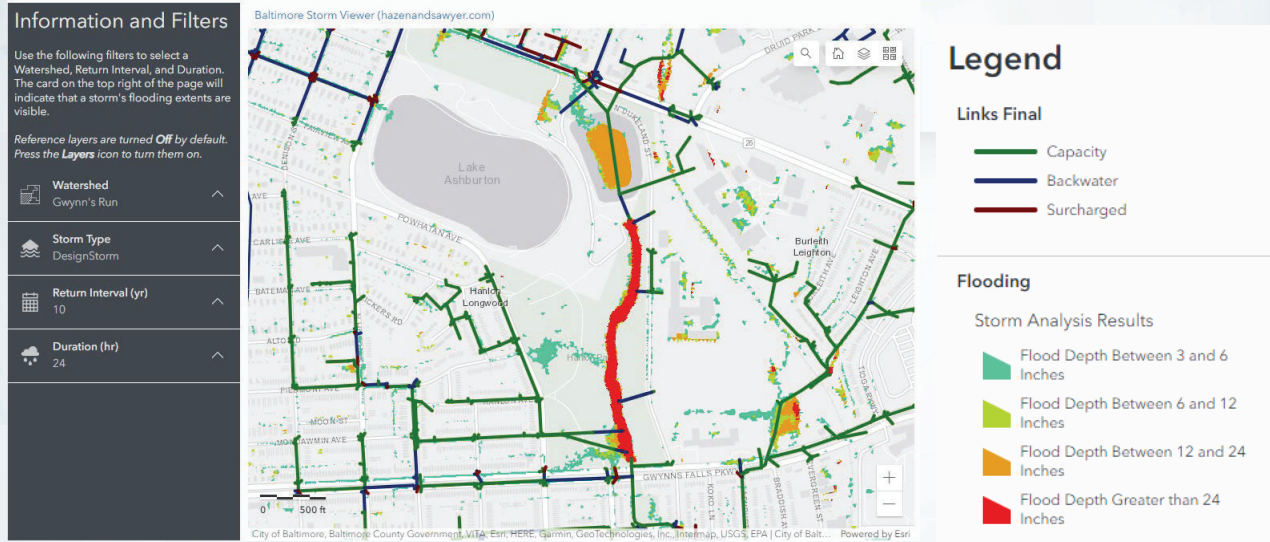
- Database relationships
- Efficient, flexible, and repeatable data model structure

Visualization Development

- Appealing AND meaningful
- Facilitating communication and understanding



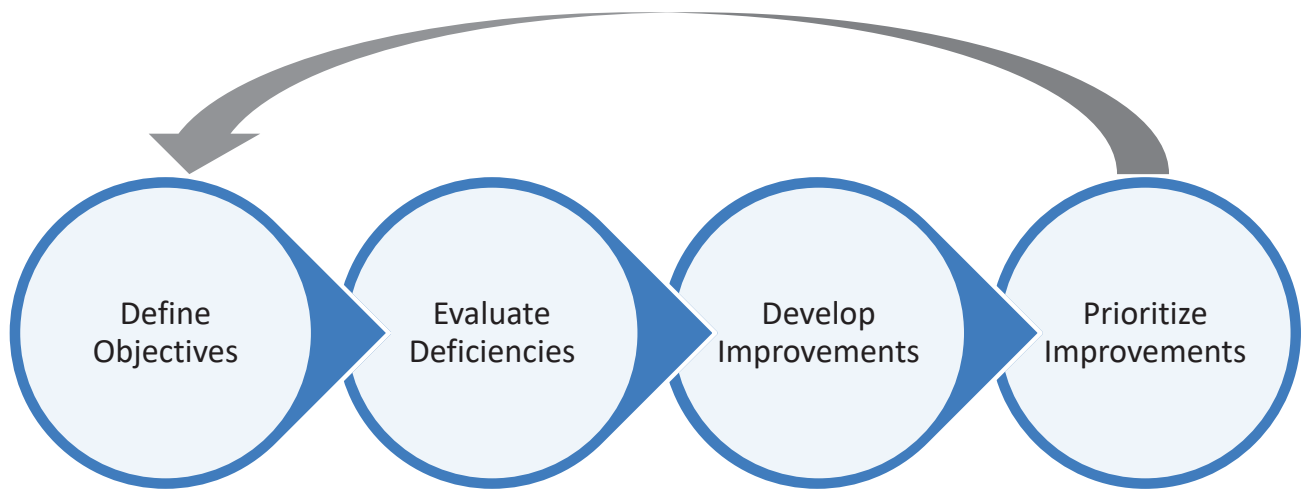
Common Steps in Stormwater Master Planning



Dynamic Prioritization

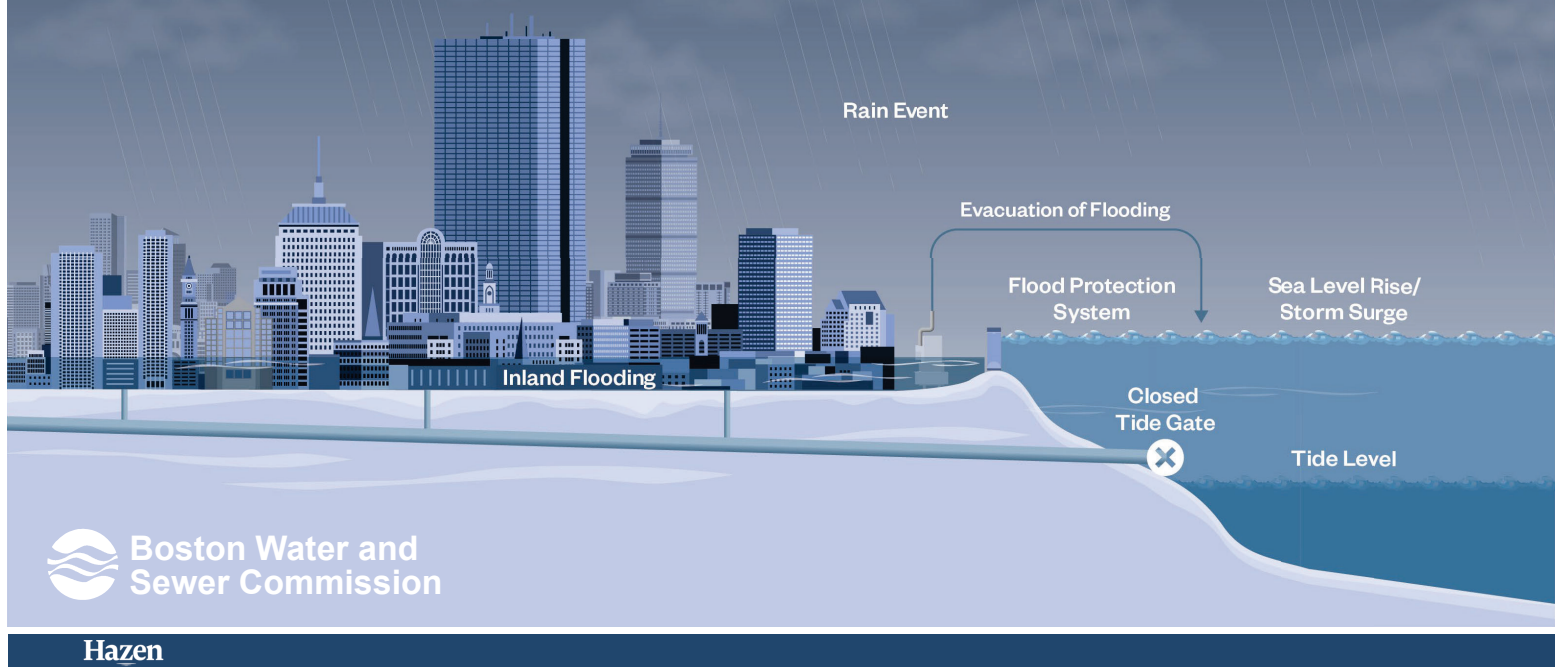


Conventional Approach

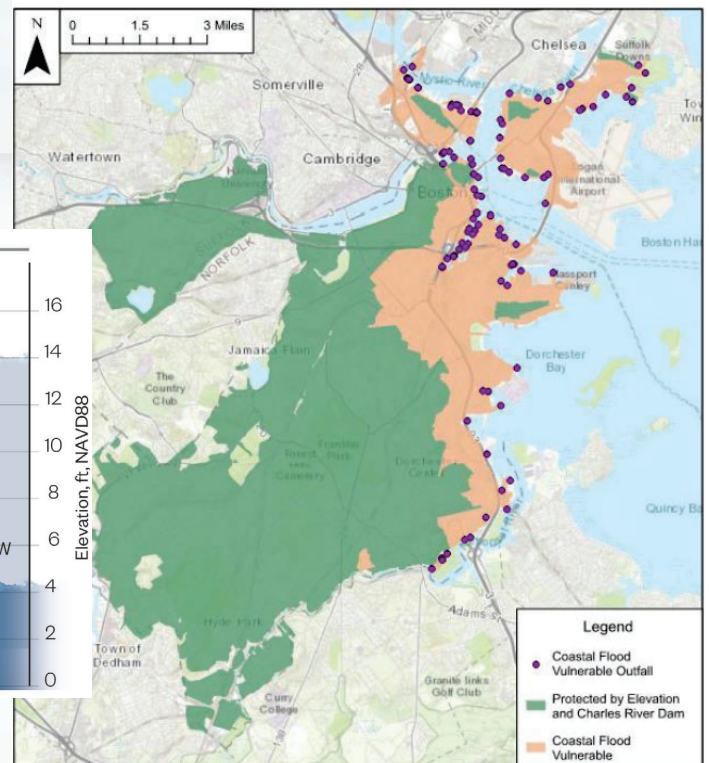
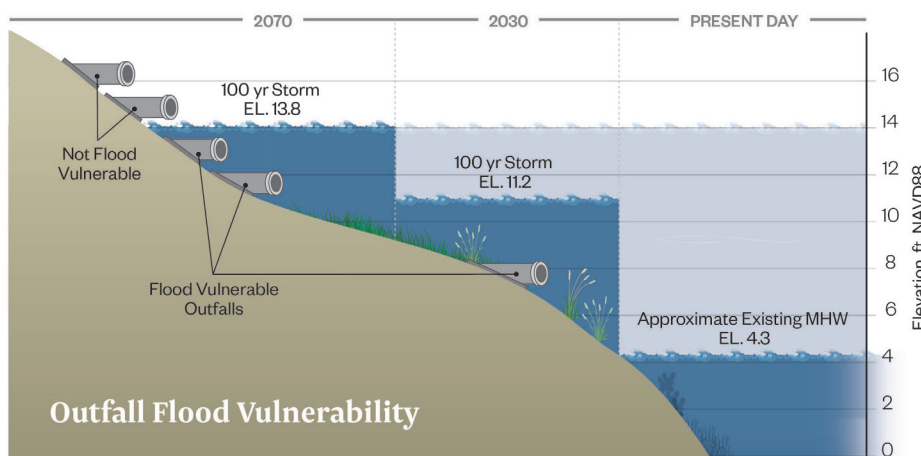


Adapting to Changes
In Priorities
In Funding / Resources
Scenario Building
Sensitivity Analyses

Strategies and Conceptual Designs for Adaptation and Coastal Stormwater Discharge in Boston

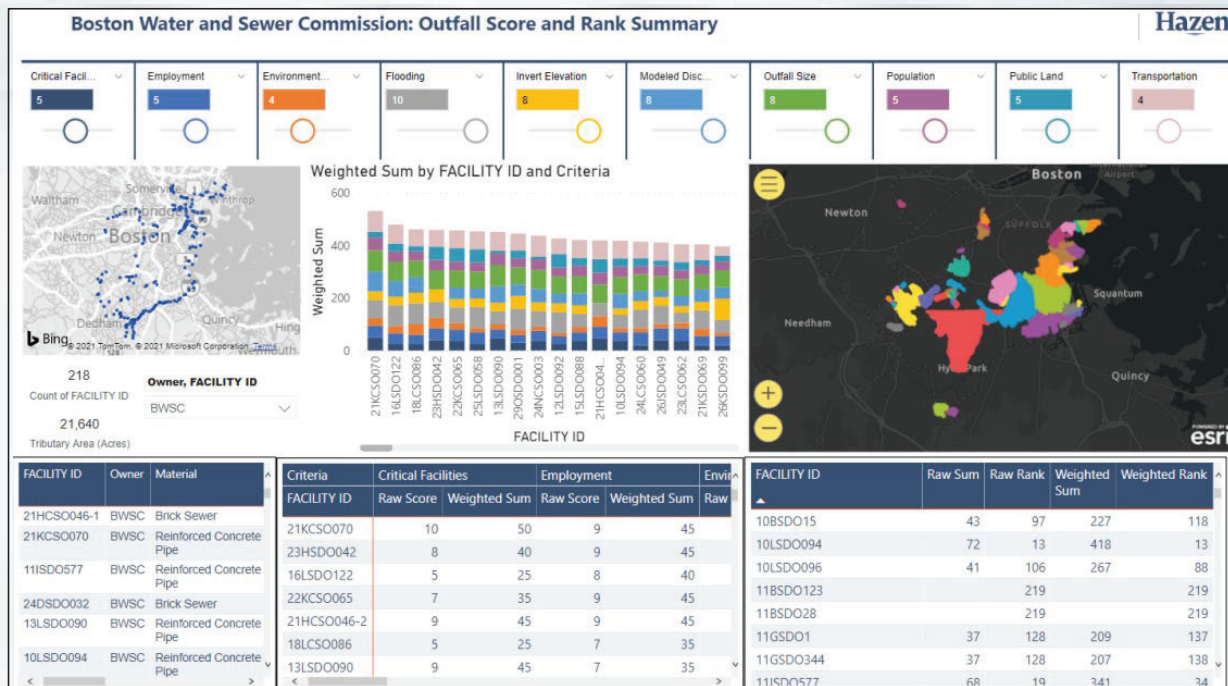


Boston Water and Sewer Commission

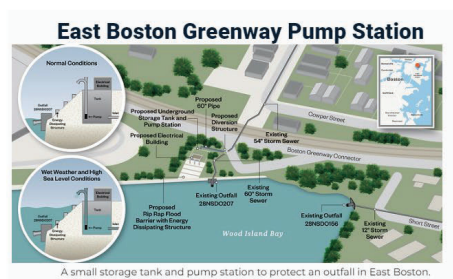
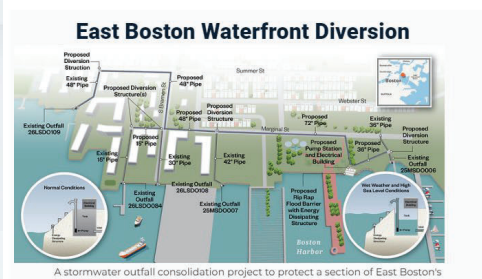
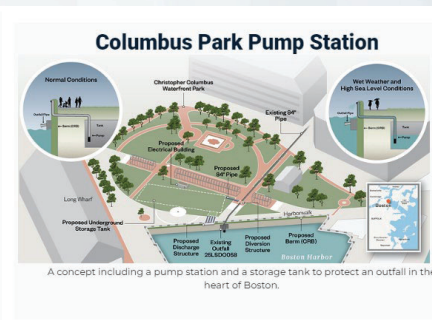
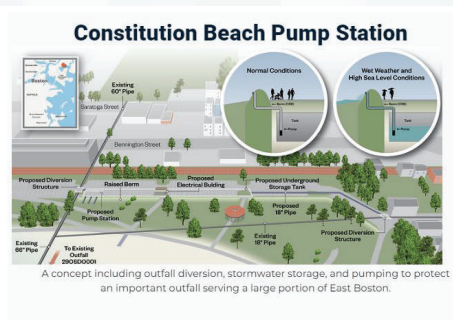
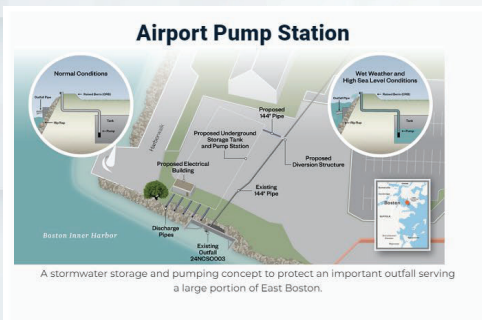


Outfall Ranking Criteria

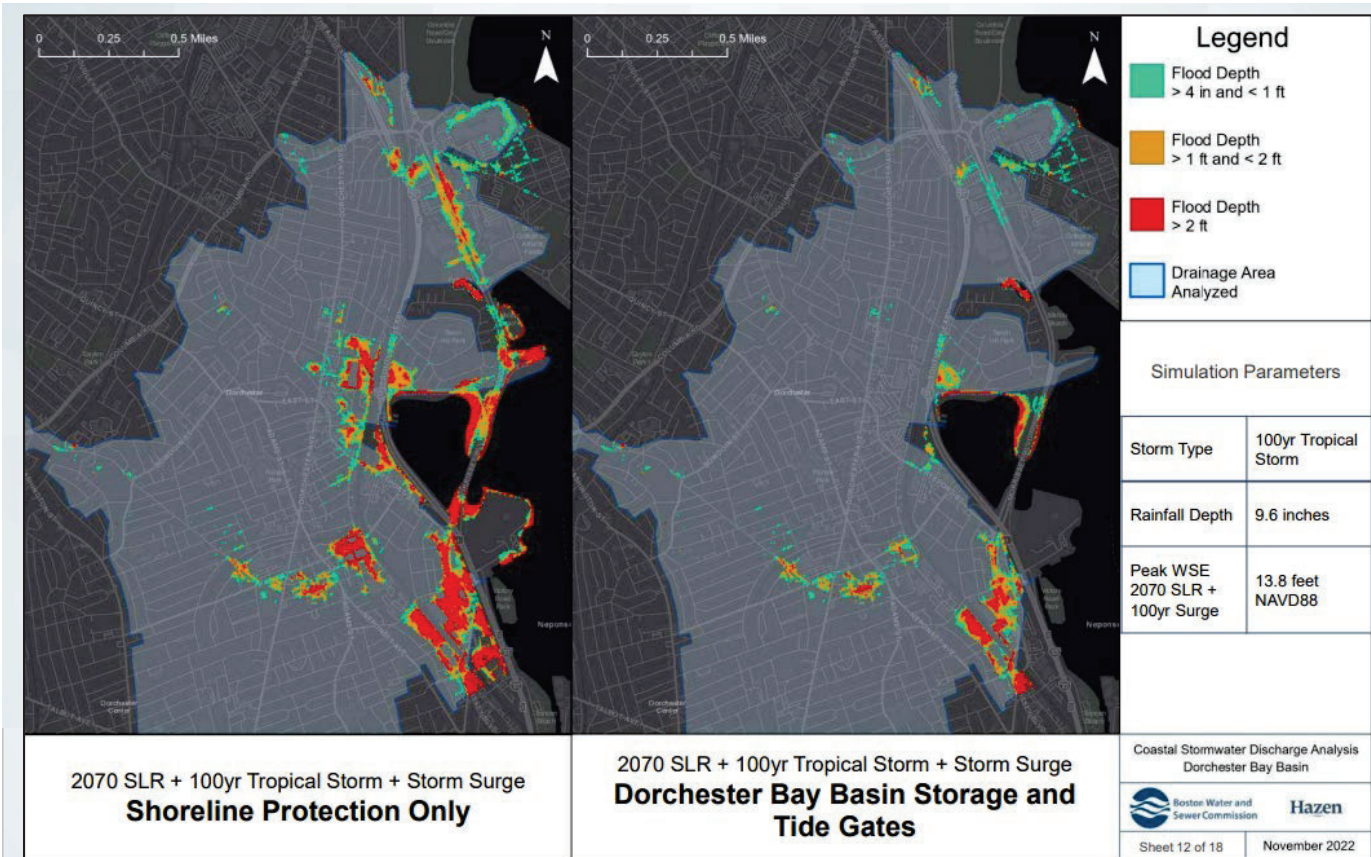
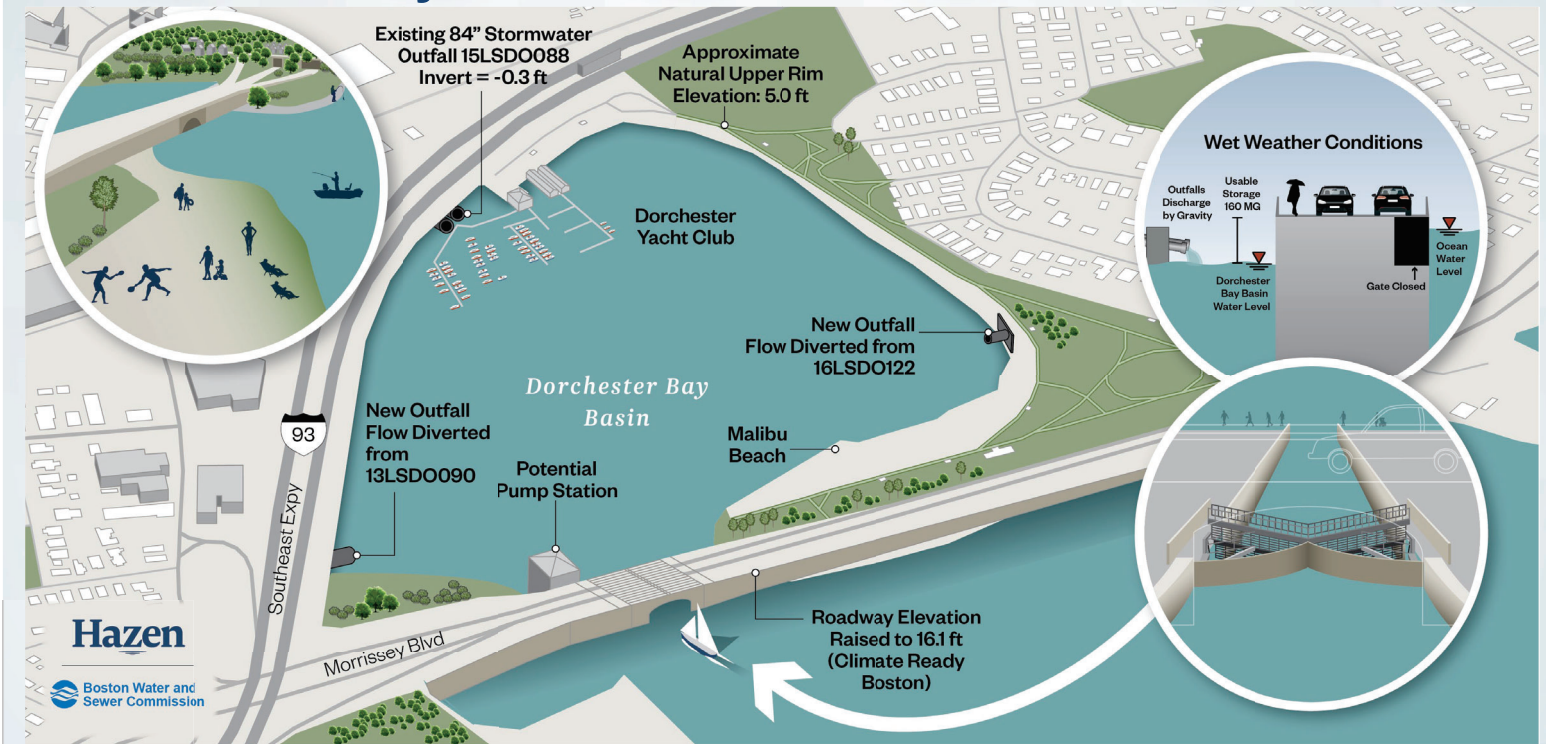
- Physical Considerations
 - Discharge Volume
 - Invert Elevation
 - Outfall Size
- Tributary Area Characteristics
 - Flooded Area
 - Transportation Routes
 - Critical Facilities
 - Population
 - Economic Importance
 - Land Use
 - Environmental Justice/Social Vulnerability



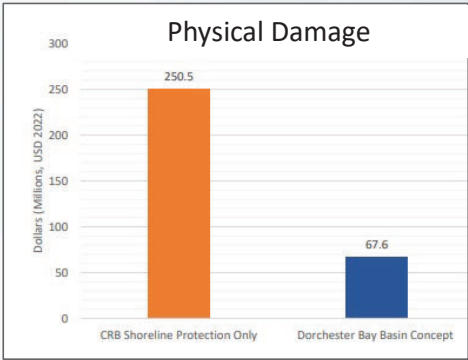
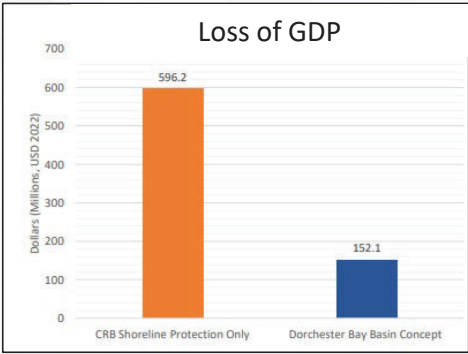
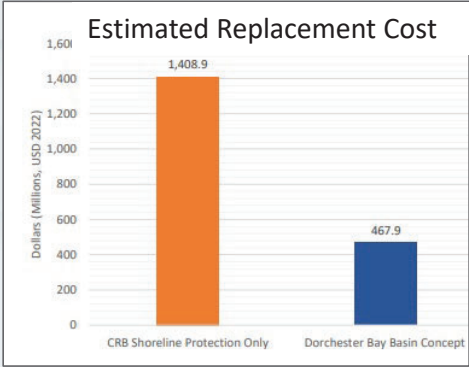
Adaptation Solutions



Dorchester Bay Basin



Flood Modeling and Damage Analysis

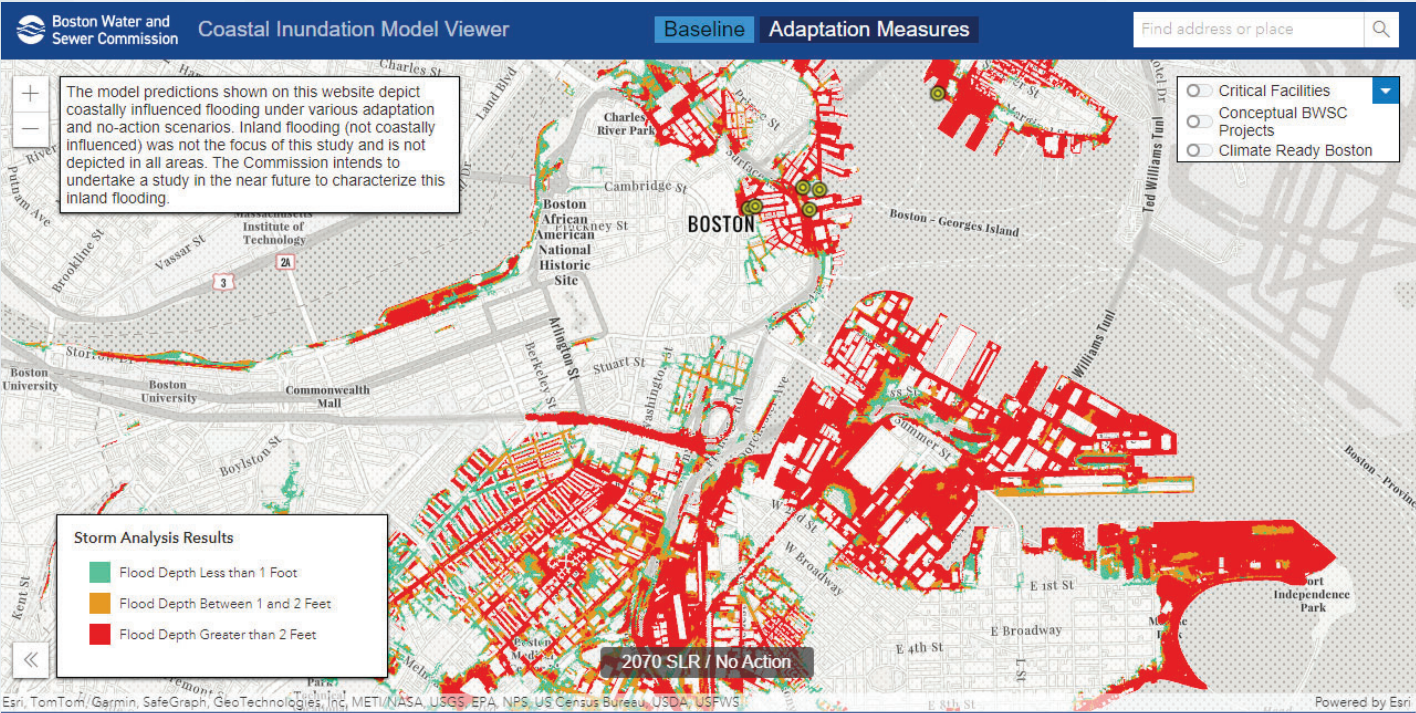


Analysis performed by
risQ/Intercontinental
Exchange, Inc.



Coastal Inundation

<https://www.bwscstormviewer.com/>





Educating the Public on Risks and Benefits



Storm Analysis Results

- Flood Depth Less than 1 Foot
- Flood Depth Between 1 and 2 Feet
- Flood Depth Greater than 2 Feet

100 year / 2030 SLR + 100 Year Storm Surge

1 Extreme Weather Event

2 Amount of Rainfall

10 year 100 year

5.84 in 9.58 in

500 year

13.9 in

(over a period of 48 hours)

3 Sea Level Rise (SLR) and Storm Surge from Baseline Condition

4.5 ft 7.0 ft

2030 SLR 2070 SLR

+ Storm Surge + Storm Surge

100 Year Storm Surge

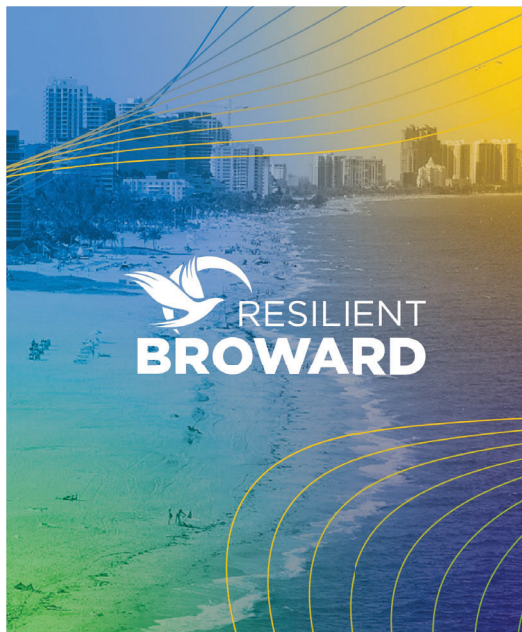
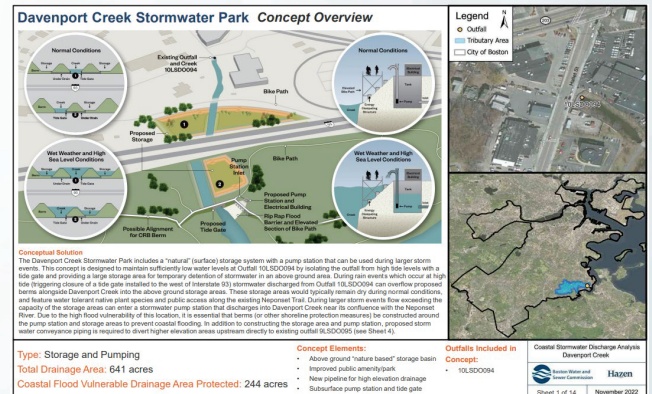
Compare 2030 & 2070

4 360 Tour

Click on Map

5 Impact Forecast

Facility	Impact
School	46
Health Facility	28
Police Department	8
EMS/Fire Station	13
MBTA Station	18

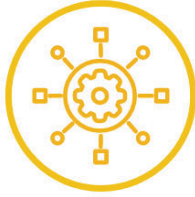


We started with the County's vision...

Vision for Resilience



Integrate Robust Risk Analytics and Economic Analyses



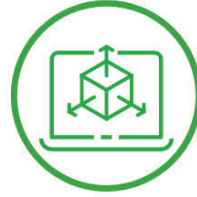
Include Resilient County Infrastructure Improvement Strategies



Encourage Opportunities and Partnerships among Municipalities and Districts for Future Funding



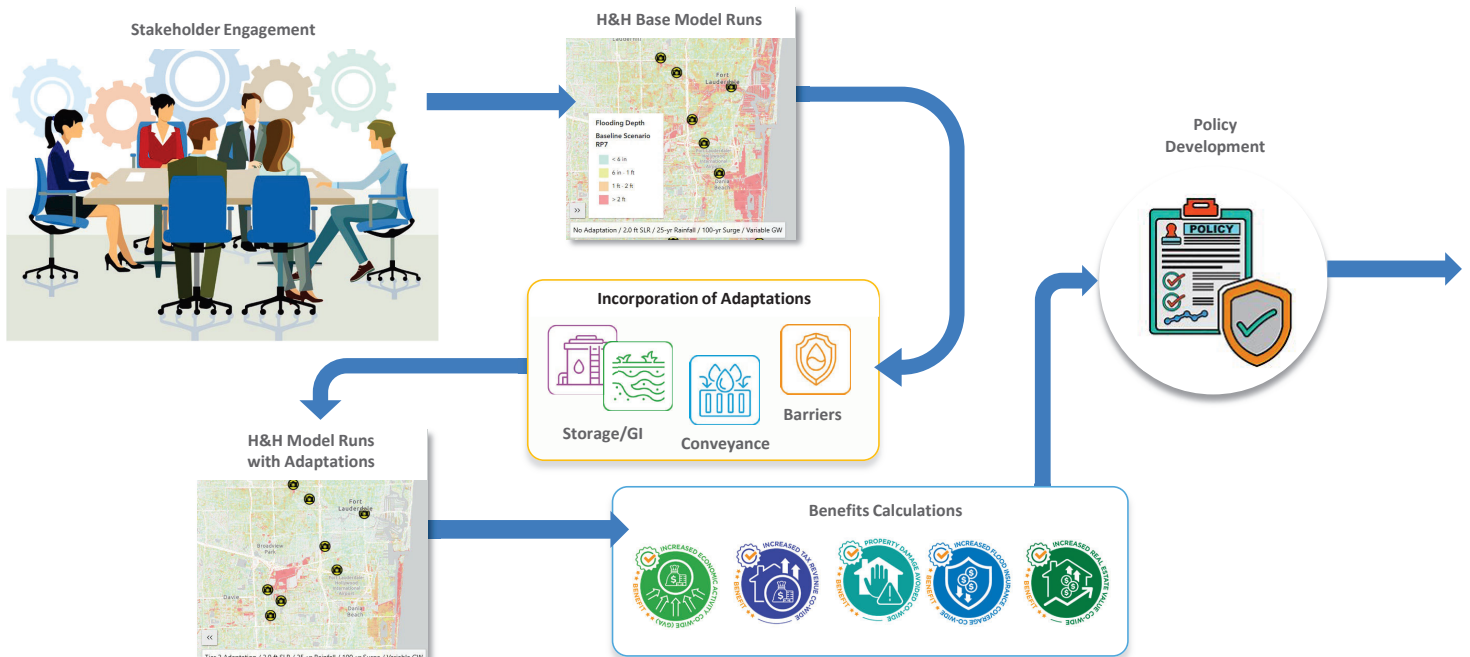
Form the Foundation for the Collective Mitigation of Future Flooding



Provide a Visualization Platform/Plan to Aid Regional Planning and Project Tracking



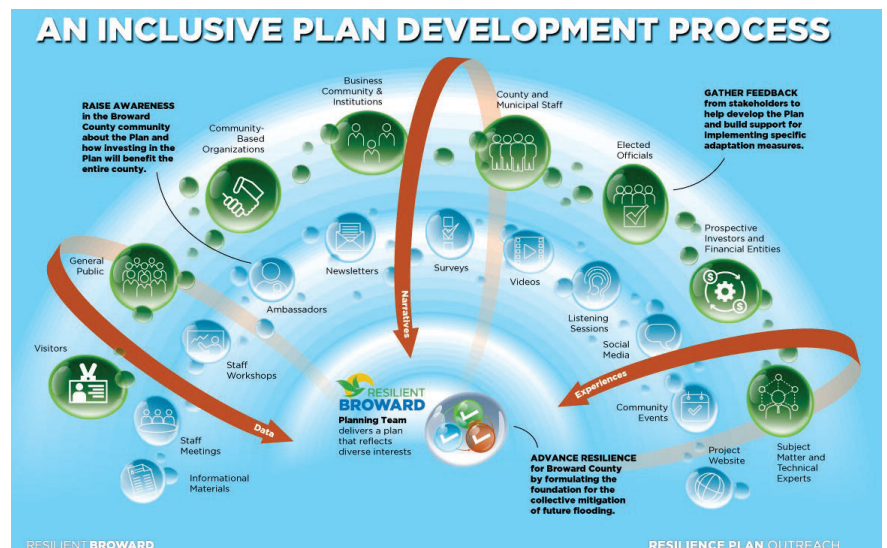
Present Resilient Redevelopment Strategies



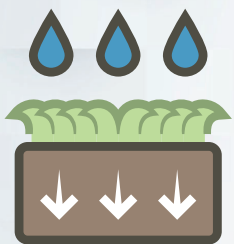
The Resilience Plan Development was inclusive with multiple feedback loops



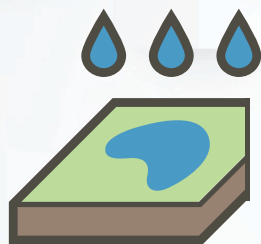
- Listening Sessions
 - Impacts
 - Concerns
 - Priorities
- Adaptation Scenarios
 - Sub-regional approach
 - Sensitivity Analyses
 - Feedback
- Economic Modeling
 - No Action Scenario Completed
 - Paired with Adaptions Next



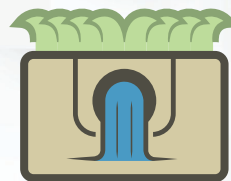
Primary strategies were developed around four major concepts (to be delivered in multiple ways)



Runoff
Reduction



Runoff
Storage



Strategic
Conveyance/
Discharge

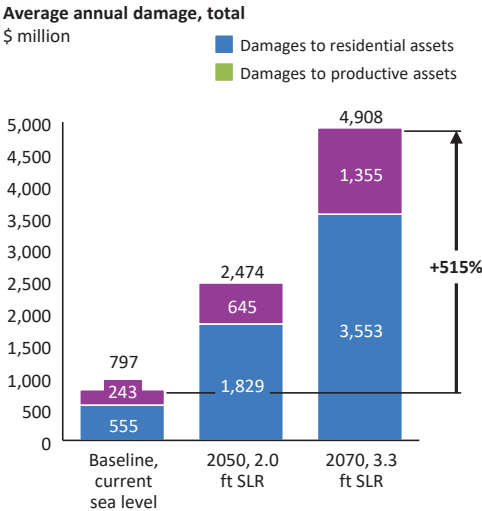


Adapting to
Water

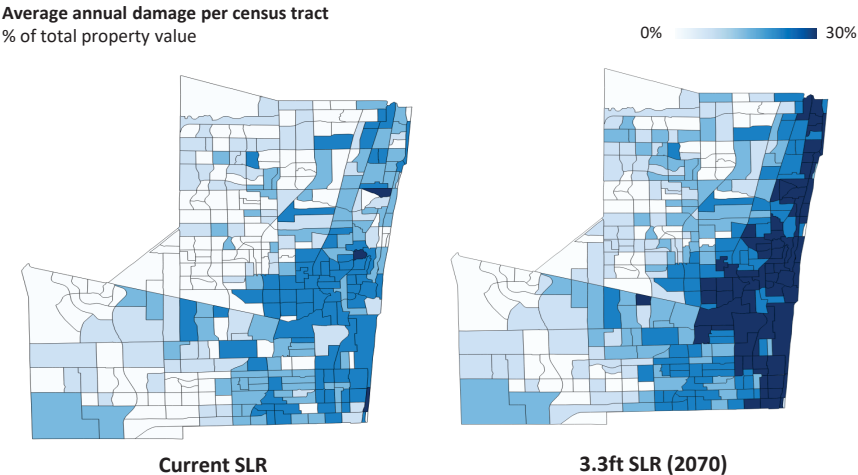
Without adoptions, flood-related damages are likely to increase in Broward County due to climate change.

NO ADAPTATION INCLUDED

By 2070, residential/productive asset damage could increase 6.4x/5.6x times compared to baseline



Most flood damage is concentrated along the coast

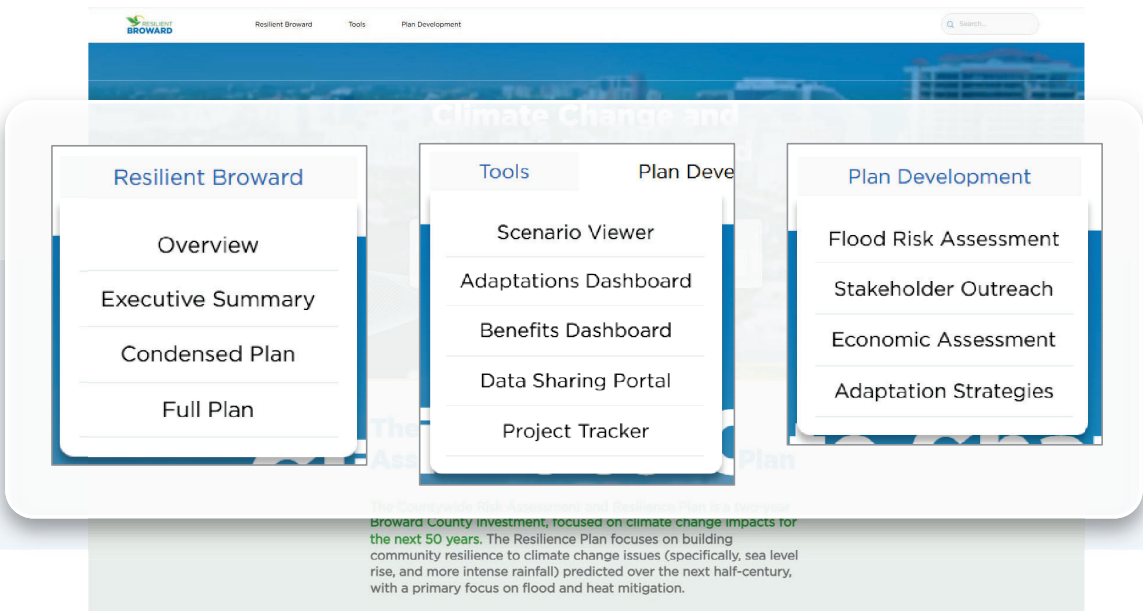


Interim Results (Baseline/No adaptation actions considered)

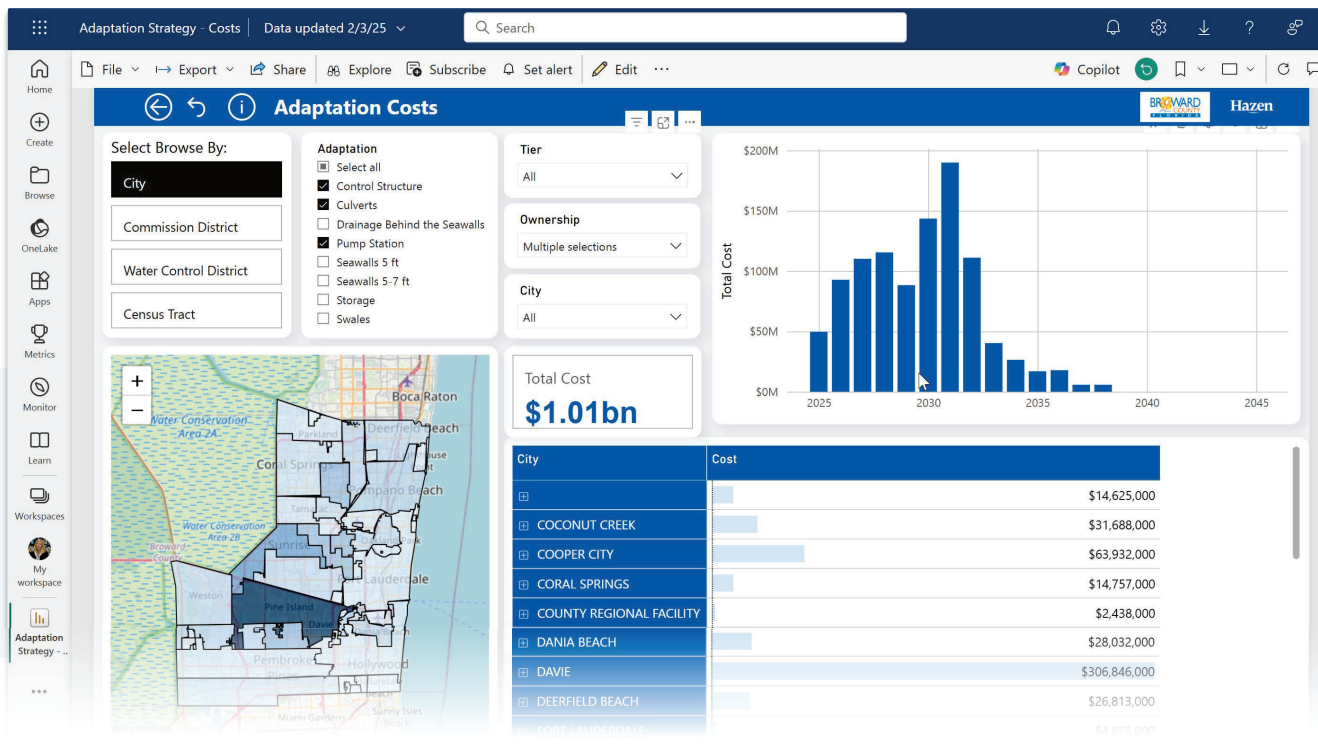
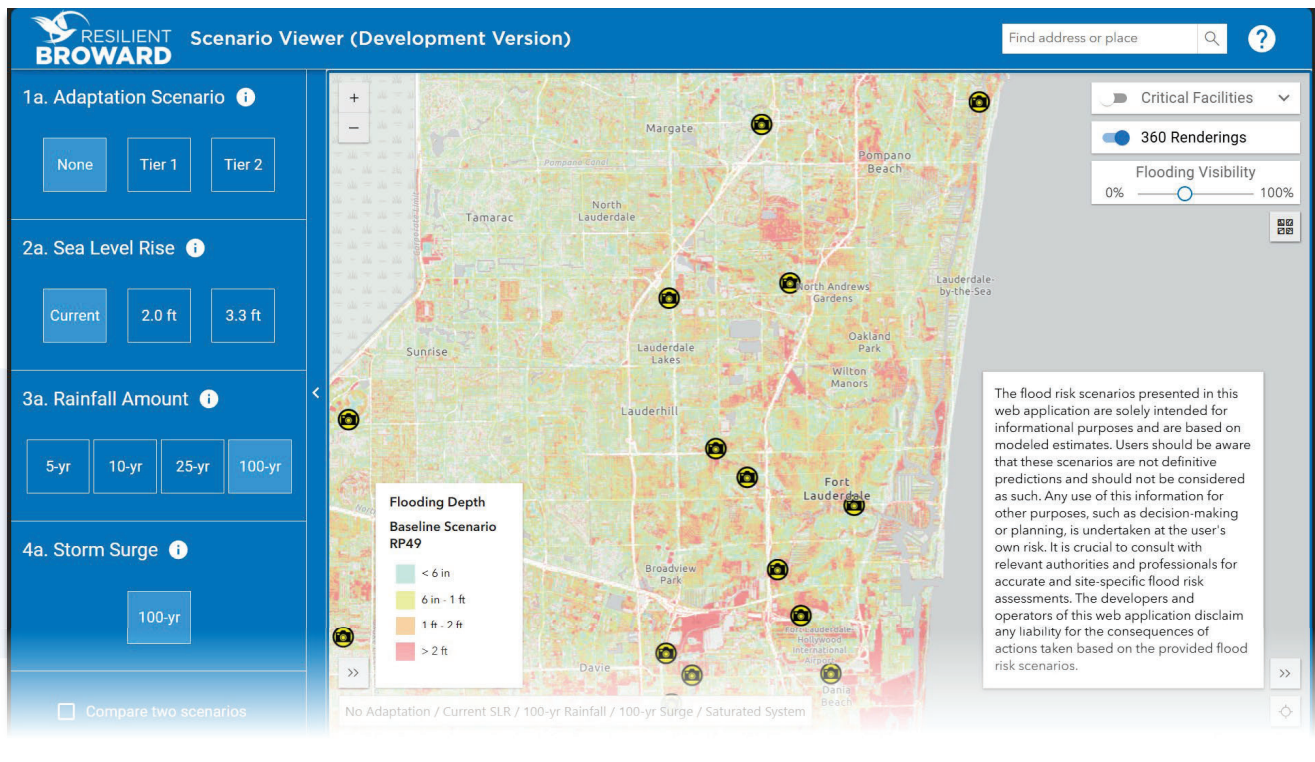


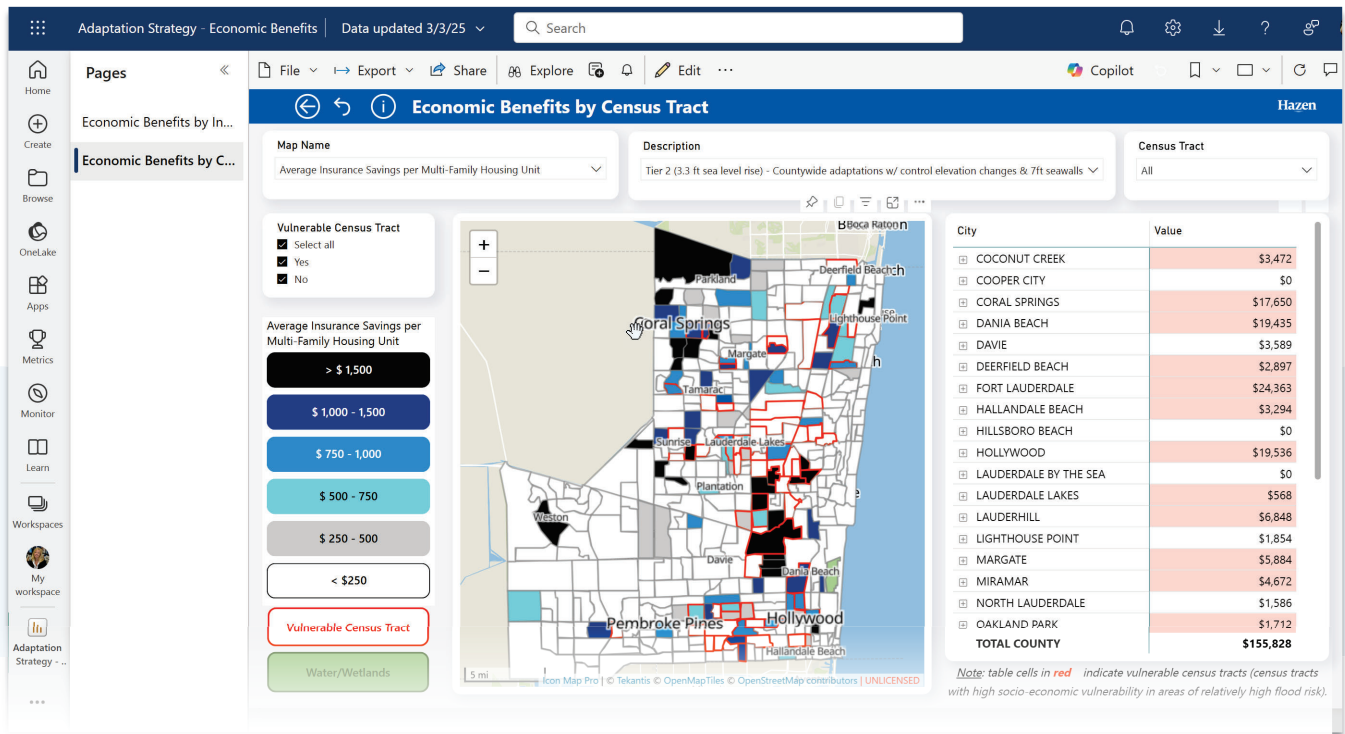
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The Platform hosts the Plan, Scenario Viewer, and Dashboards



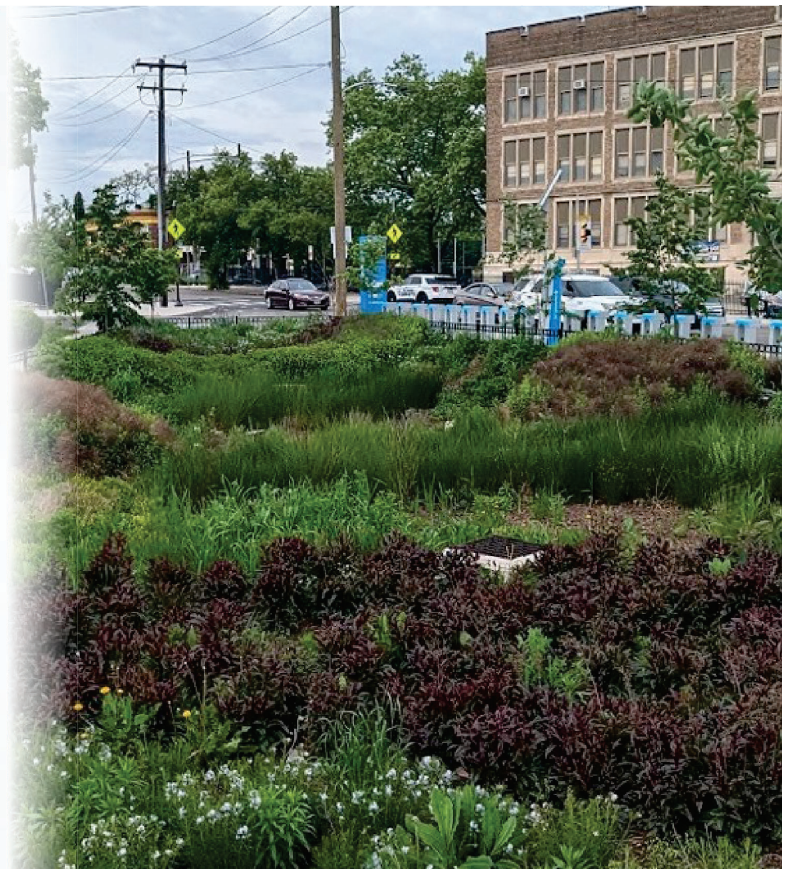
Hazen





Conclusion

- Storms are changing - the way we plan also needs to change
- Adaptable and updateable frameworks create opportunities for long-term holistic planning & implementation
- Internal interactive system management can connect departments and improve the use of the capital funds for future planning
- Educating the public and communicating need is the BEST way to get buy-in



Questions?

all
things
water[®]
Hazen

The logo for Hazen and Sawyer, featuring a stylized graphic of three horizontal lines of decreasing length, resembling a water droplet or a stylized 'H'.

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