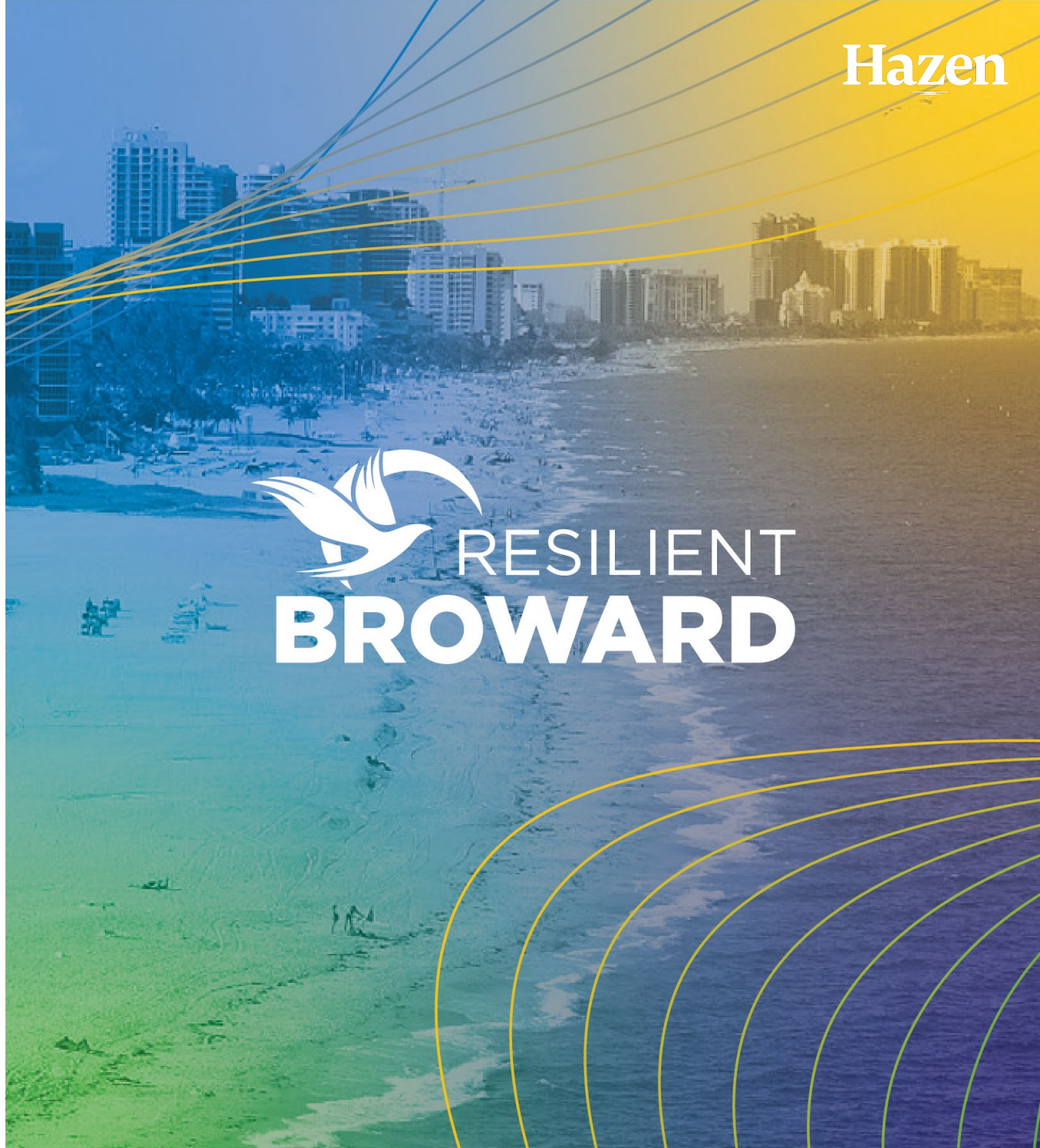
COUNTYWIDE RISK ASSESSMENT AND RESILIENCE PLAN

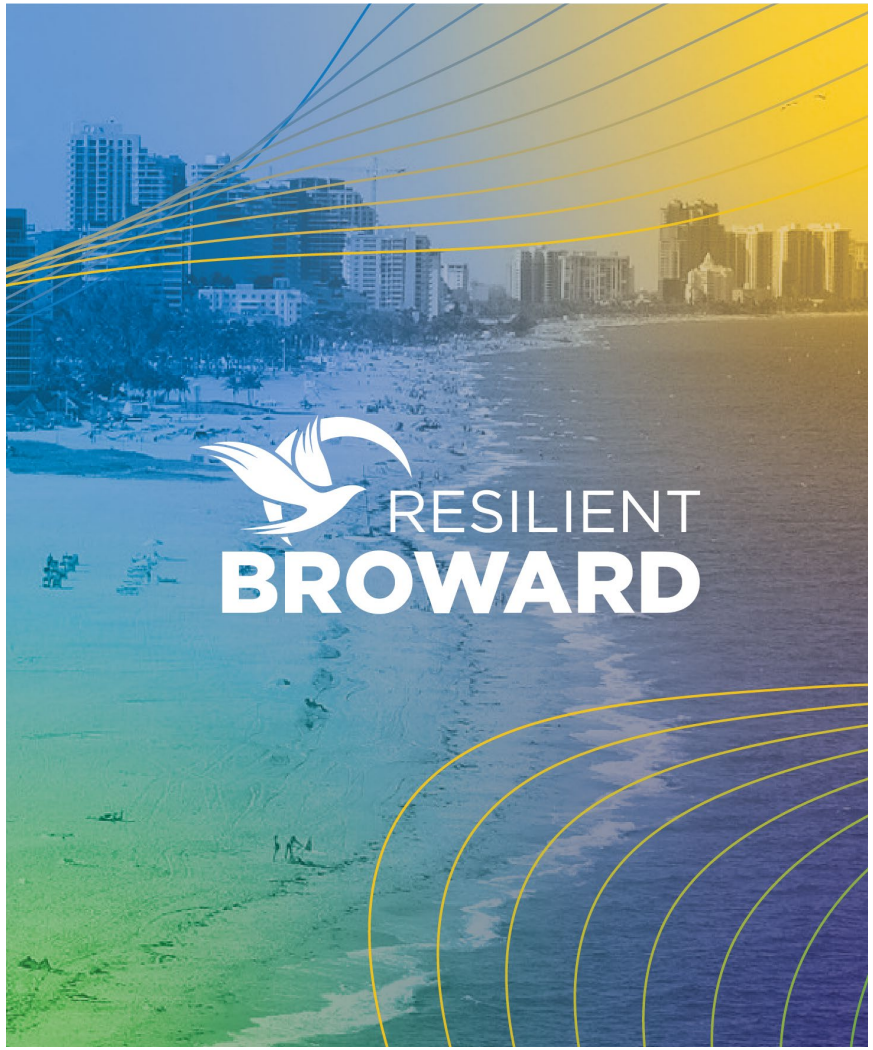
Resilience Steering Committee

April 10, 2024



Outline

1. Welcome
2. Roll Call
3. Summary of Stakeholder Adaptation Meetings
4. Next Steps in Adaptation Modeling/Analyses
5. Second Generation Viewer Demonstration
6. Upcoming Schedule
7. Adjournment



1

Welcome

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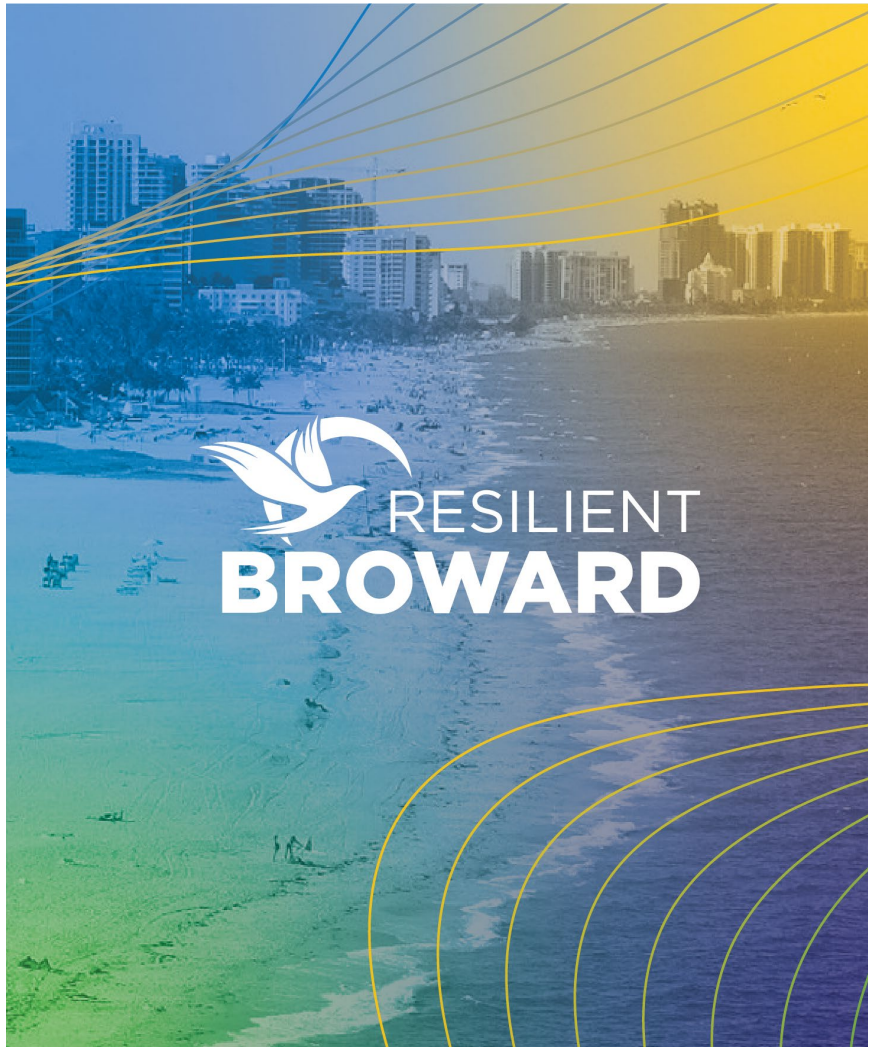

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Roll Call

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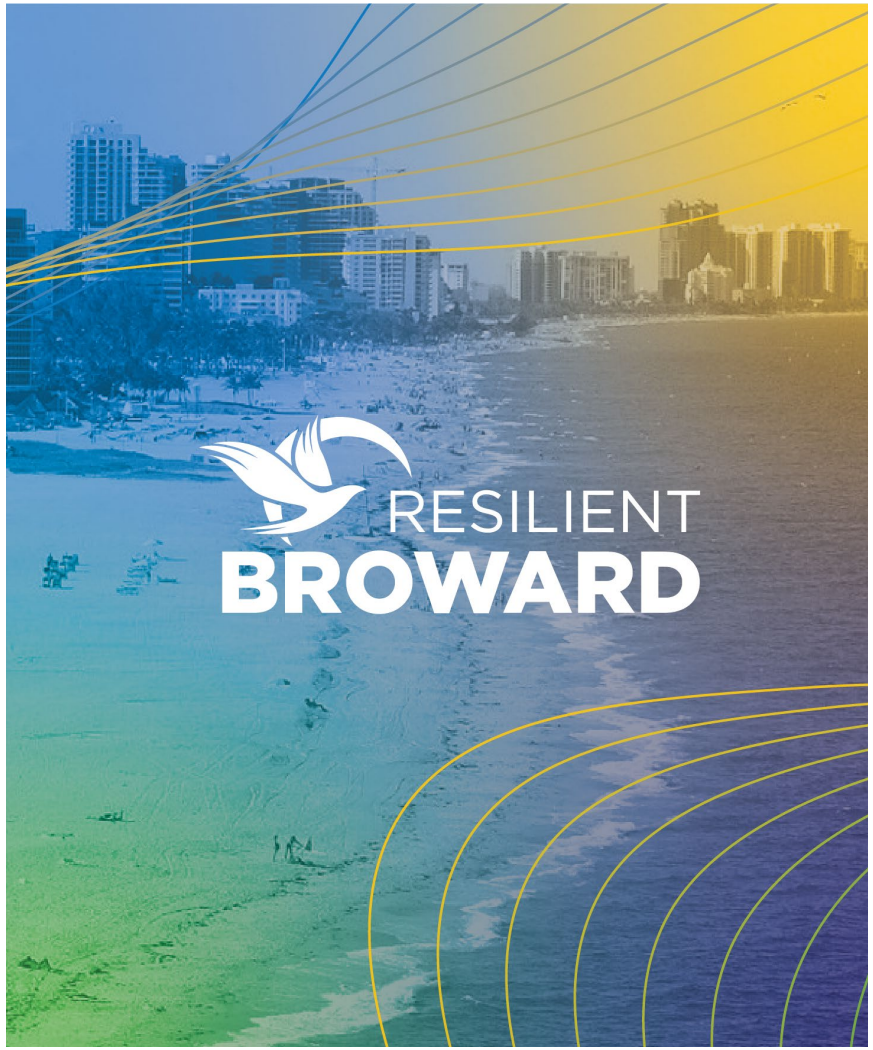

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Summary of Stakeholder Adaptation Meetings

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At the last RSC Meeting, we discussed Adaptation Strategies Evaluated

- **Green Infrastructure**
  - Increasing Pervious Areas - Swales
  - Increasing Pervious Areas – Localized detention areas
  - Increasing Storage – Swales
  - Increasing Storage – Localized detention areas
  - Nature base tidal protections

- **Gray Infrastructure**
  - Improving existing conveyance structures (canals, culverts, etc.)
  - Additional Pumping in Secondary System
  - Property Level Seawall protection
  - Pumping in Coastal Areas where gravity discharge is challenged by tidal levels
  - Large scale levees and surge barriers

- **Operational Improvements**
  - Implementing movable control structures in secondary and tertiary systems

- **Redevelopment**

: Potential **HEAT** reduction benefits

Performance Benefits of these Early Adaptation Investments

- **Green Infrastructure Benefits will include:**
  - Reduction in Heat
  - Reduced flooding in certain storm events
  - Groundwater recharge
  - Enhances access to funding opportunities
- **Seawall Benefits will include:**
  - Reductions in sunny day floodings due to King tides
  - Reductions in floodings during surge events
- **Pumping/Conveyance Benefits will include:**
  - Removing water faster
  - Reducing flood elevations
- **Storage Benefits will include**
  - Groundwater recharge

These can all be implemented through capital investment and/or policy updates (e.g. land use code revisions, etc.)

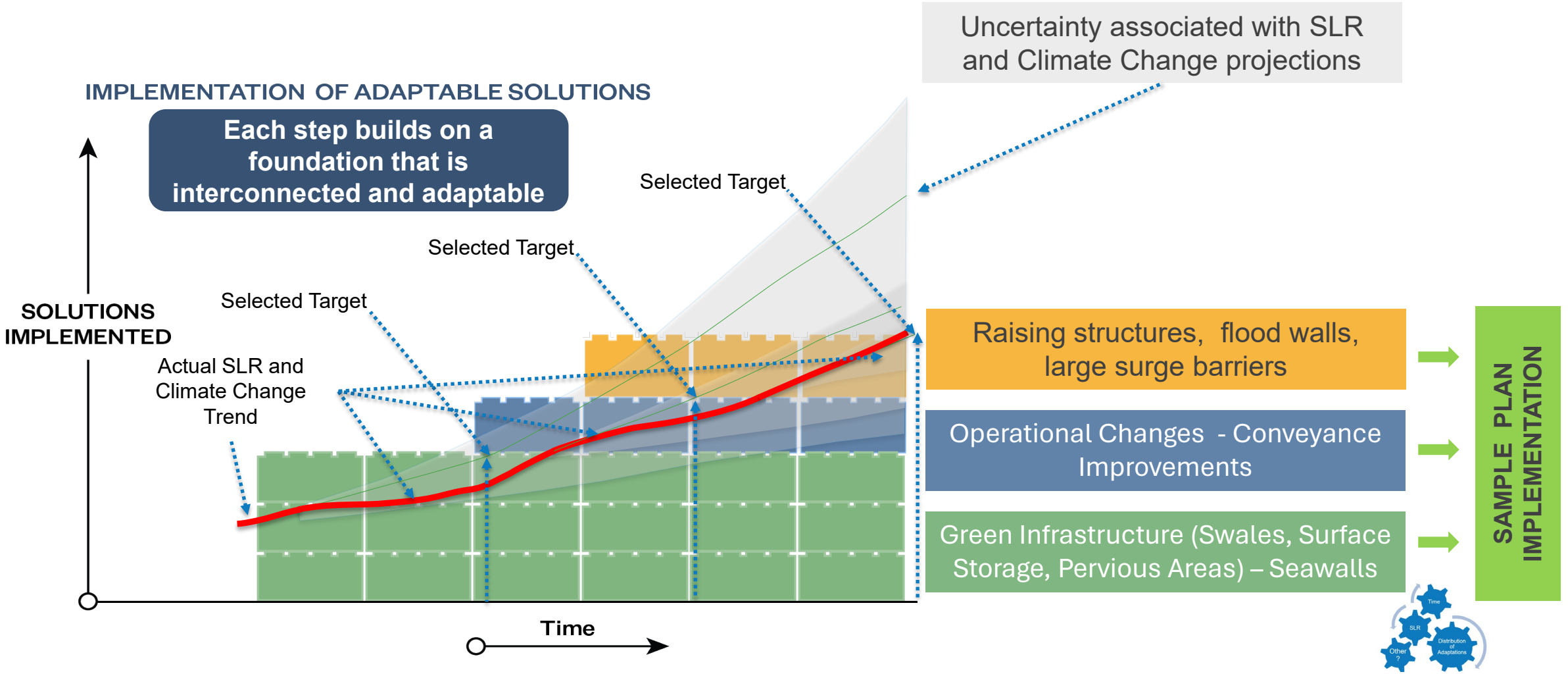
Adaptation Strategies at a Glance

Type	Description	Strategies in Numbers
Storage	Increasing groundwater Storage ahead of the storms	**169** control structures modified
Storage/Pervious	Converting to one-way roads, adding swales	**1,726** miles of two-way roads. **2,134** acres of swales created **1,247** acres-ft of storage
Storage/Pervious	Creating dry retention Areas/Storage Chambers	**154** storage areas identified in priority areas. More areas in progress
Conveyance	Adding pump stations in secondary canals	**28** new pump stations
Conveyance	Improvements in culverts and crossings	**50** upgraded crossings
Conveyance	Adding collection systems and pump stations in coastal areas affected by high tide and SLR (behind sea walls)	**190** miles of sea walls and enhanced barriers
Barriers	Implementing County Ordinance regarding seawalls at 5 ft NAVD	**36** systems of collection and pump stations added
Barriers	Adding large surge barriers and structures, complemented with natural and engineered surface and subsurface barriers	**4** major structures added at the intracoastal inlet
Redevelopment	Modifying the utilization of current structures to reduce damages and/or recovering areas for public use (modified land use)	To be defined after the economic evaluation

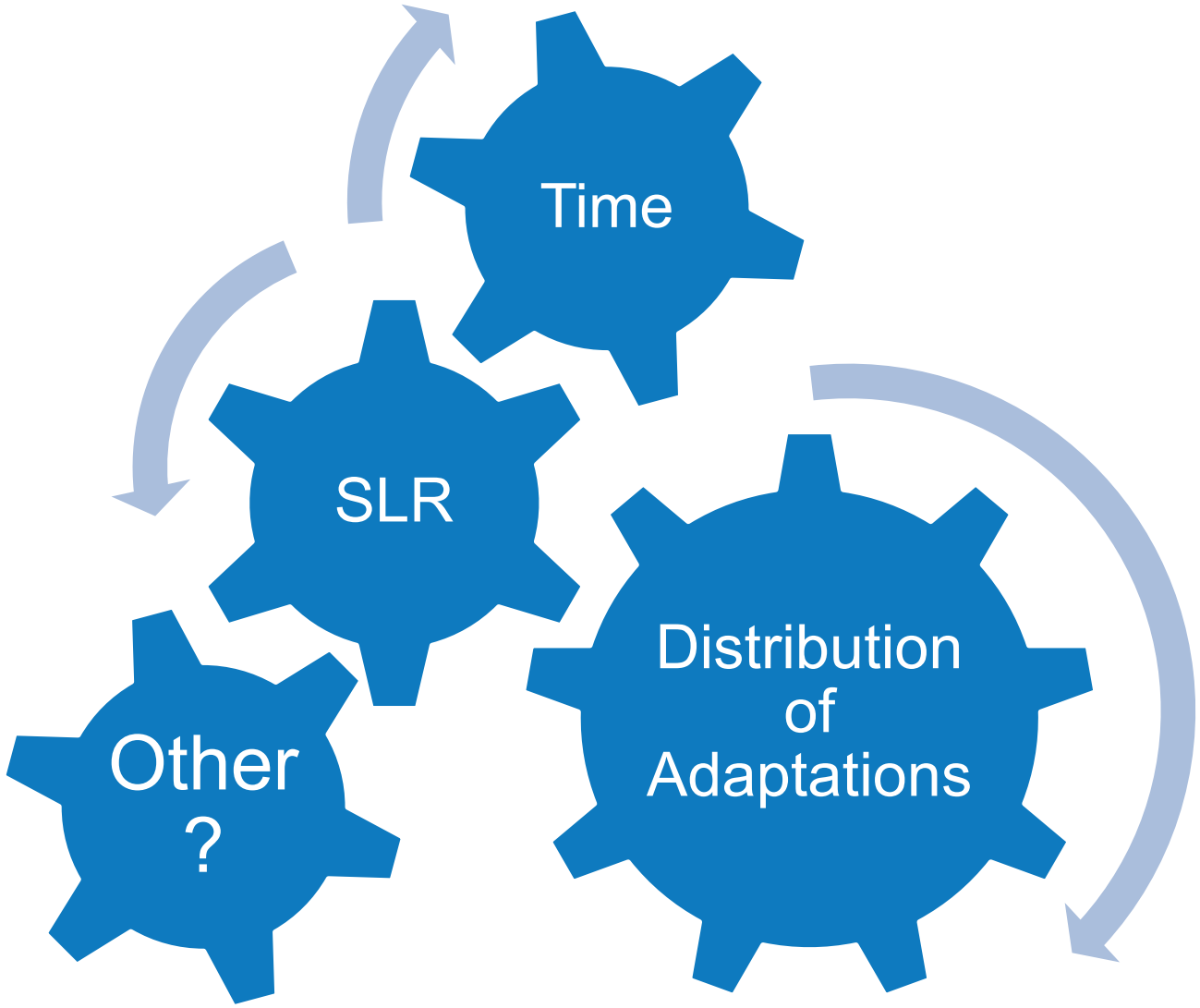
: Potential **HEAT** reduction benefits

RESILIENT BROWARD

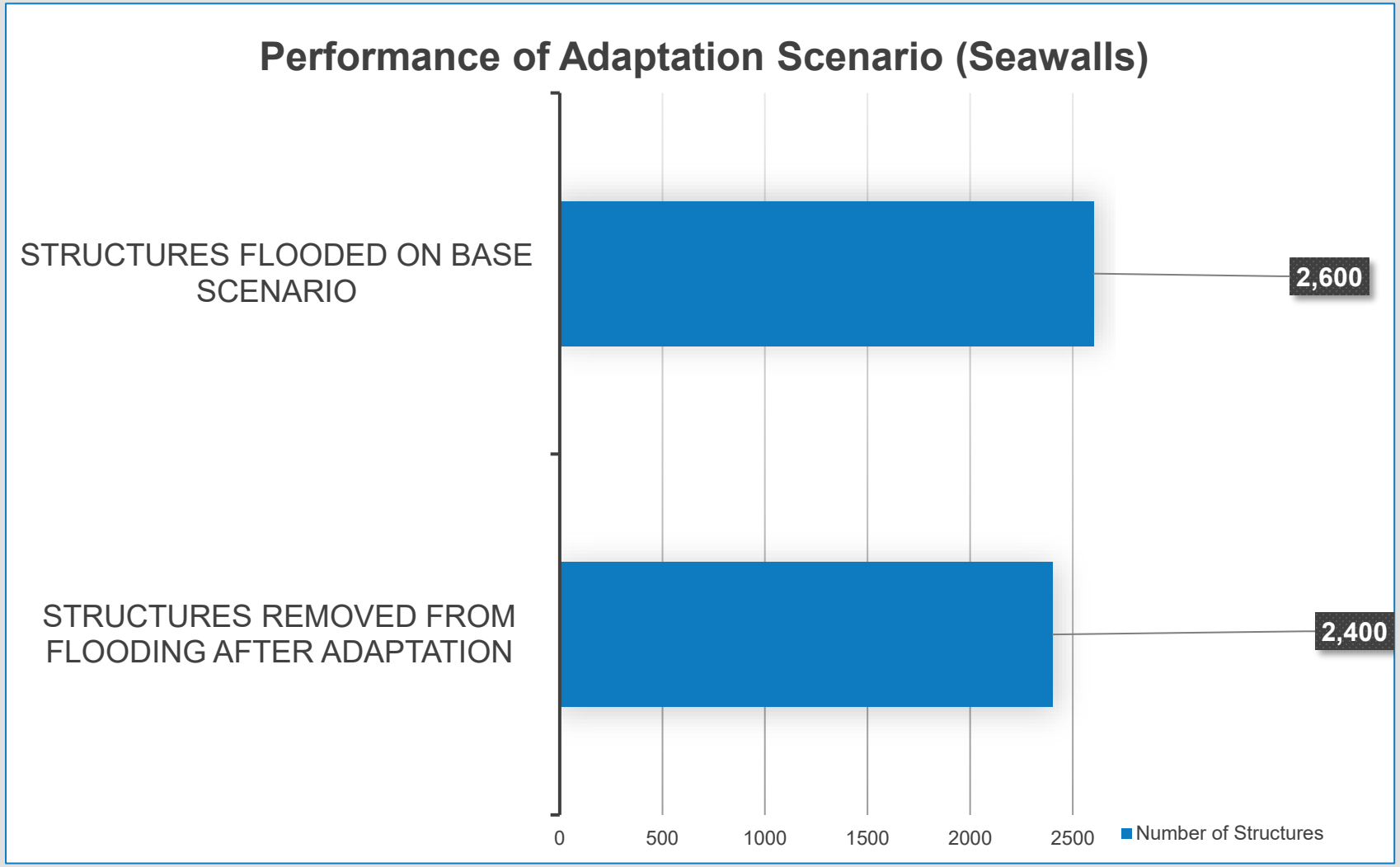
Adaptations will be recommended on a sequential basis, and adjusted in the future to adjust to updated data and to meet evolving priorities



How will we package these adaptations for the stakeholders?

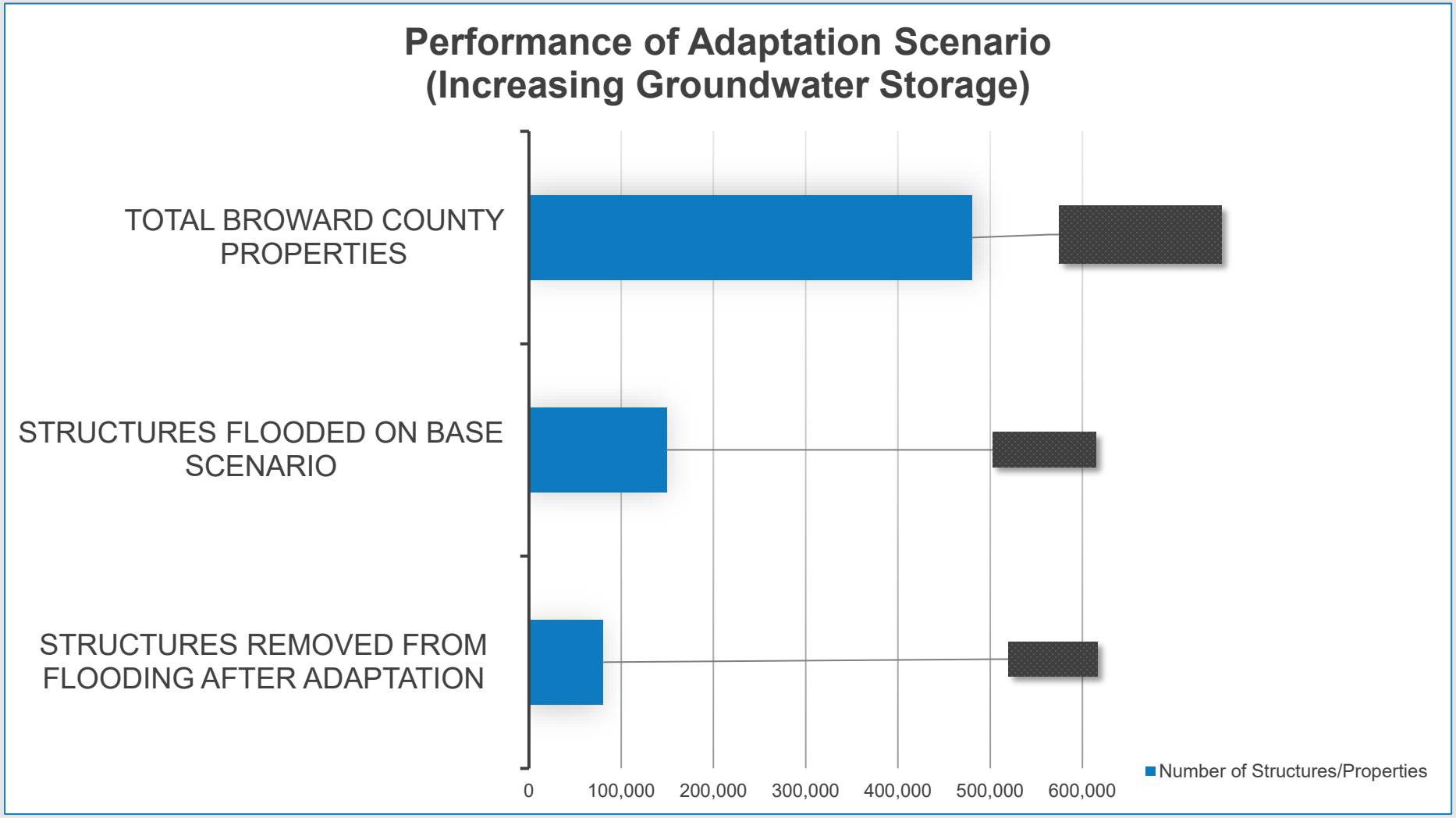


Construct Seawalls – Surge Event

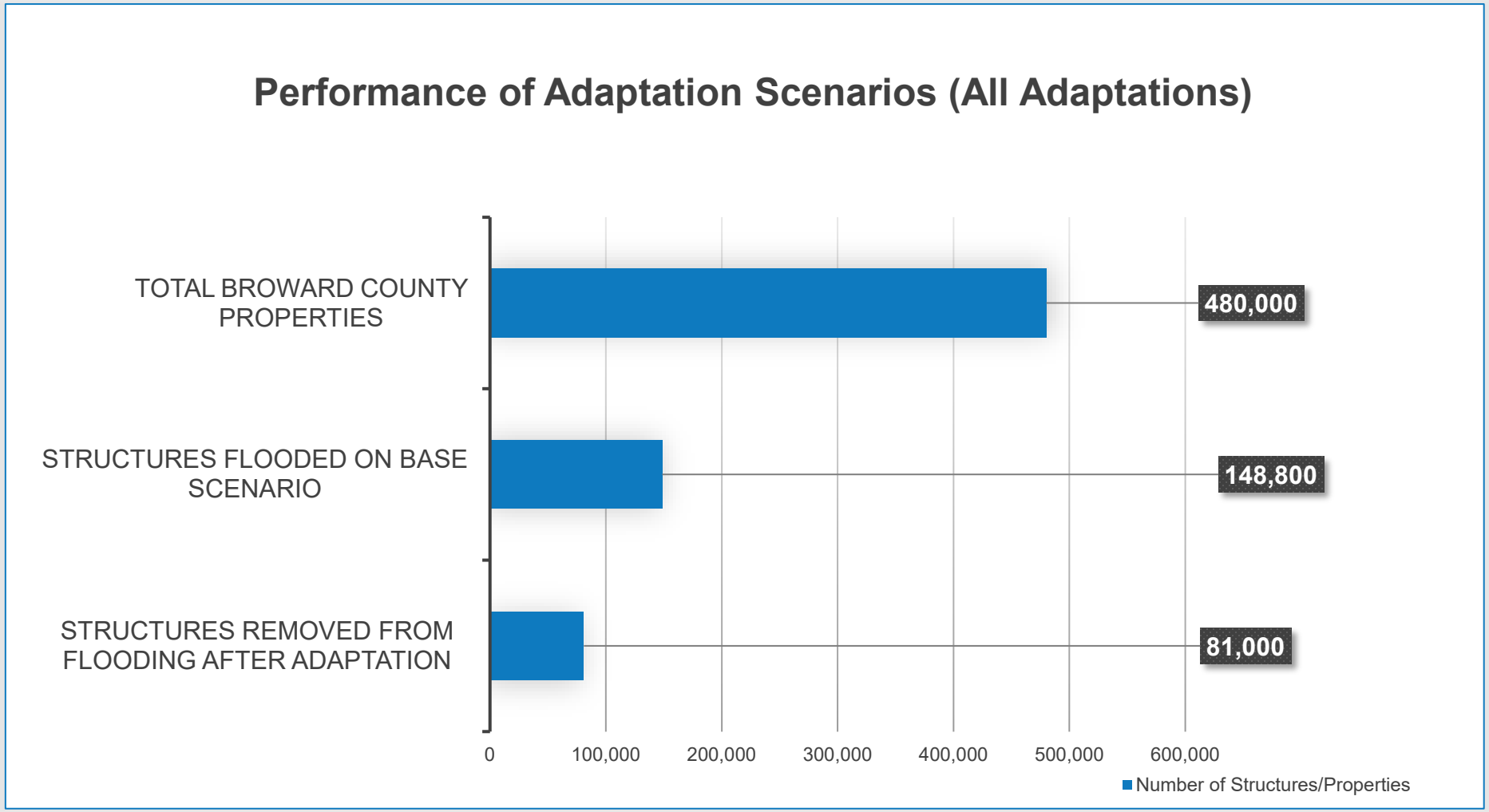


Calculations are based on estimated Finish Floor Elevations (FFEs). Only the structures with estimated FFEs below elevation 5 NAVD were included.

Increasing Groundwater storage (1ft)



All Adaptation Strategies Working in Combination

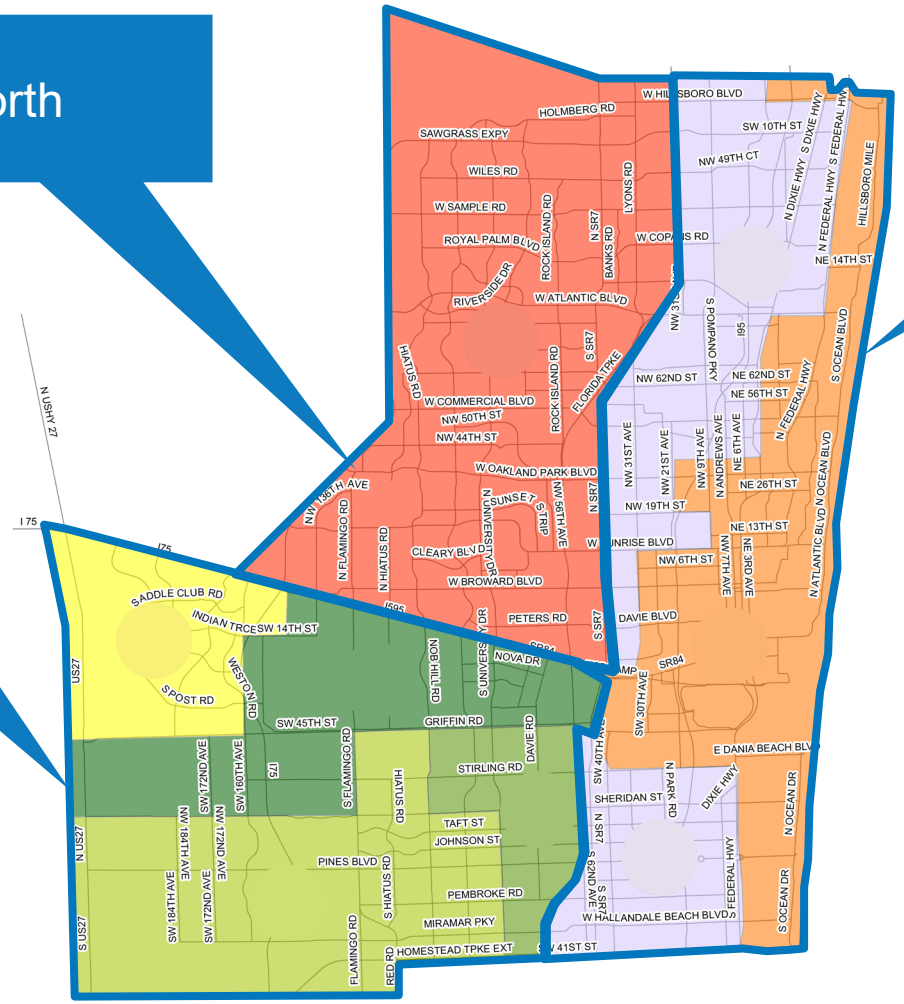


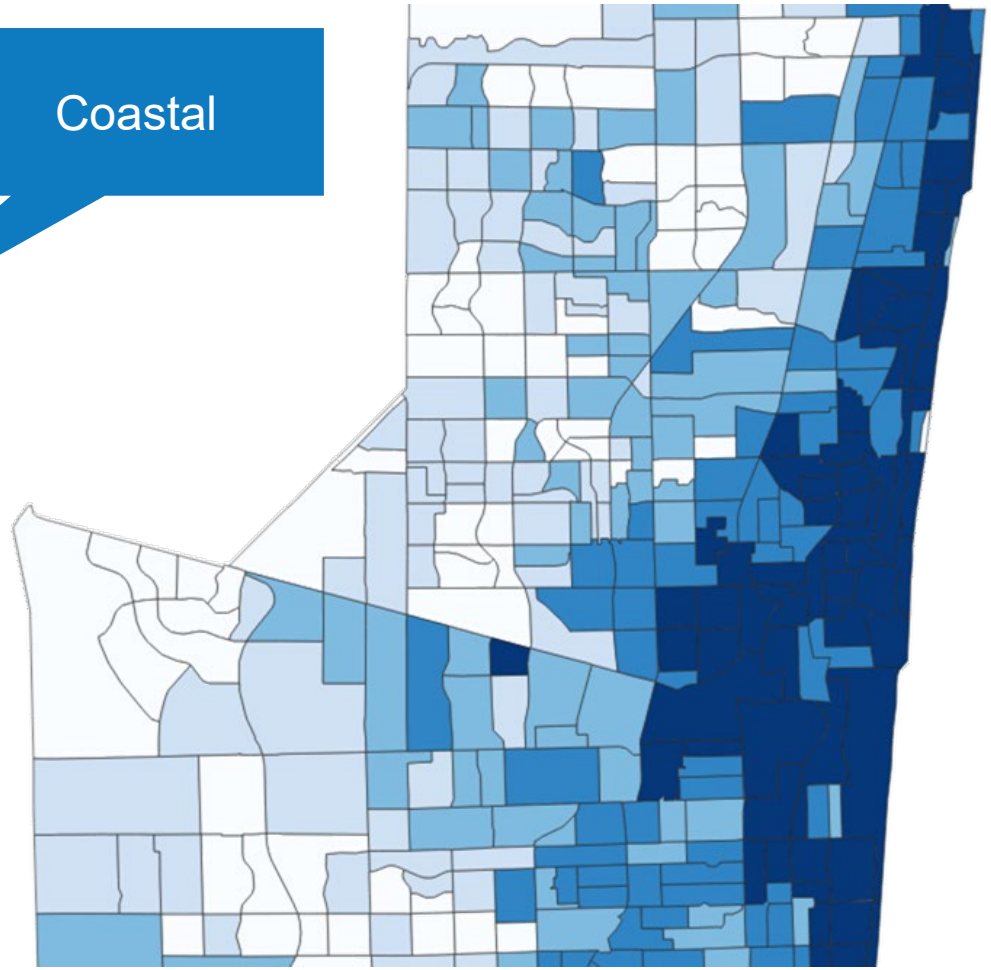
The results were presented to stakeholders in Three Subregional Meetings

North

South

Coastal

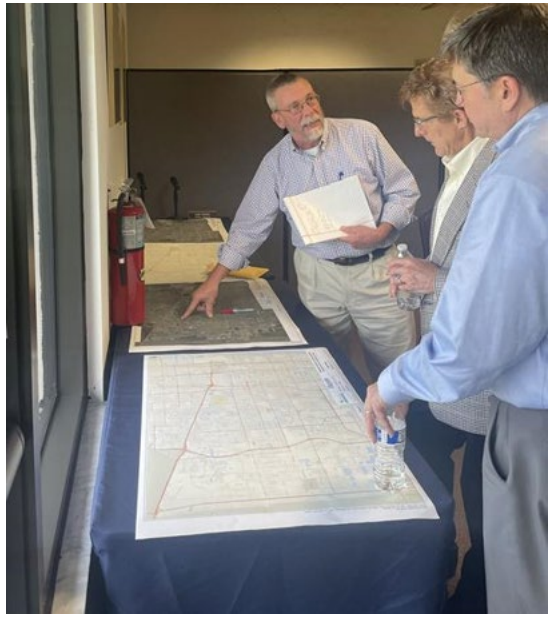




The South Meeting was held on March 14th at South Broward Drainage District

- **Attendees:**
  - City of Weston
  - City of Pembroke Pines
  - South Broward Drainage District

- **Additional Discussion:**
  - Verified that lowering the control structures does increase groundwater storage before storm events (Based on SBDD's experience)
  - Control elevations are maintained with telemetry; SBDD has recent pricing for telemetry



The Coastal Meeting was held on March 19th at Governmental Center

- **Attendees:**
  - Dania Beach, Fort Lauderdale, Hollywood, Oakland Park, Wilton Manors
  - Broward Public Schools
  - Broward Water Management District and Environmental Permitting Division

- **Additional Discussion:**
  - Ongoing growth includes addition of parking garages and more impervious area; get policies in place sooner rather than later
  - Energy-based solutions (pumps) will be required in the East while storage concepts will be more functional in the West
  - Future Groundwater levels and difficultly controlling is a significant concern

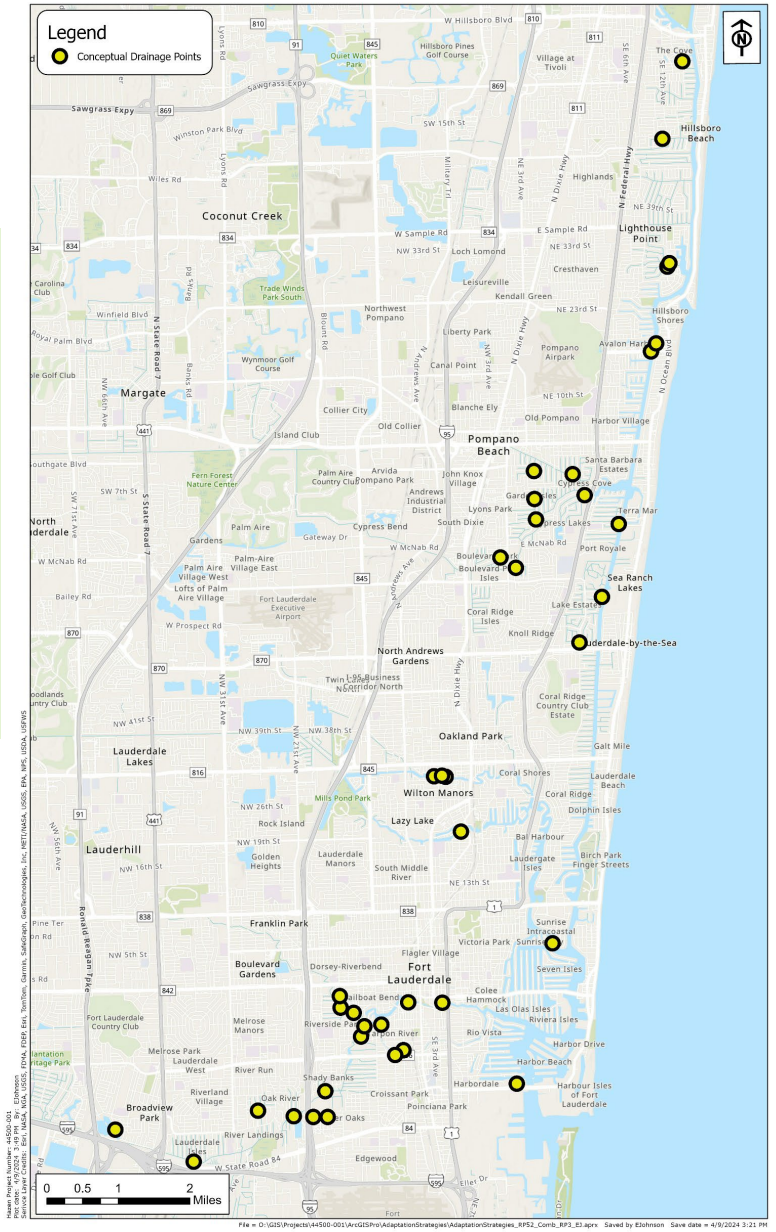
The North Meeting was held on March 25th at Wellebey Park in Sunrise

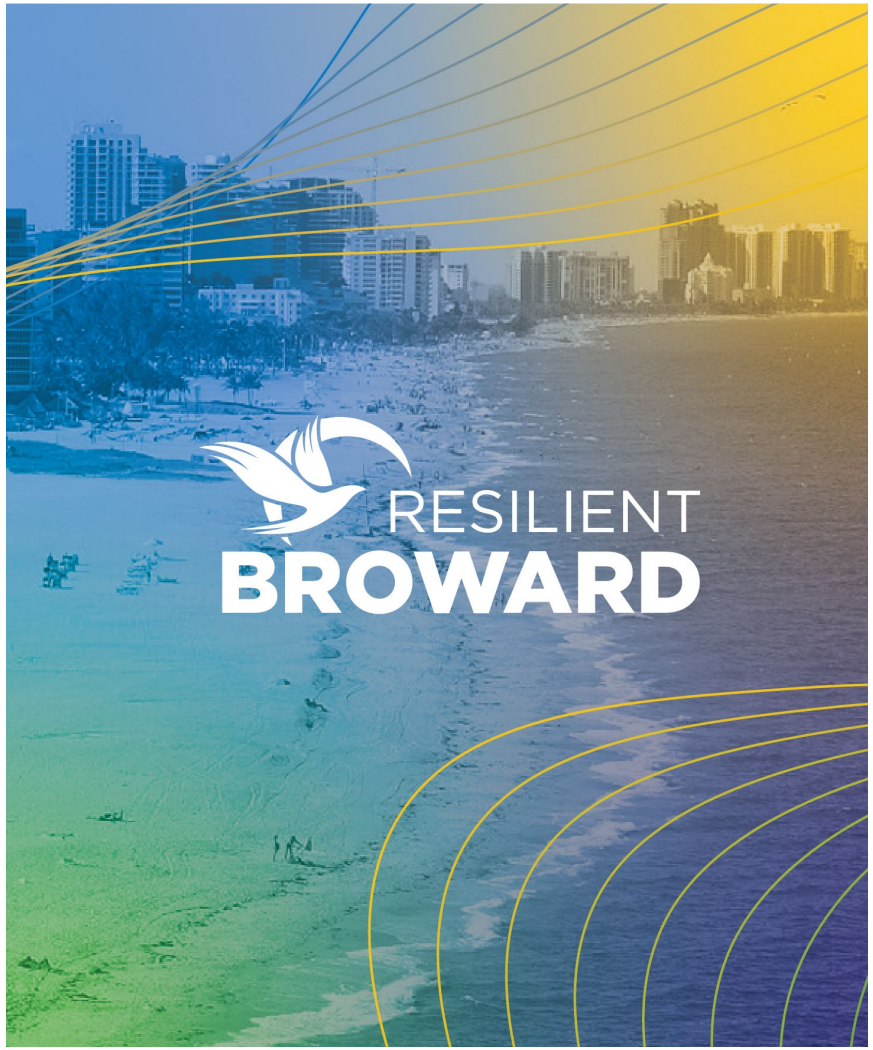
- Attendees:
  - Coconut Creek, Lauderhill, Parkland, Pembroke Pines, Plantation, Sunrise, Tamarac
  - Old Plantation Water Control District
  - Plantation Acres Improvement District
- Additional Discussion:
  - Reducing groundwater levels is most impactful
  - Additional storage will be needed – can be surface storage

After listening to the stakeholders, we are modeling additional adaptations

- Redevelopment
- Land Use Revisions
- Plan will also include recommendations for inspection and rehabilitation of drainage infrastructure (i.e. compacted swales, clogged exfiltration trenches, etc).

Map shows the location of stormwater collection systems that will be fitted with one-directional valves and potentially, pump stations





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Next Steps in Adaptation Modeling/Analyses

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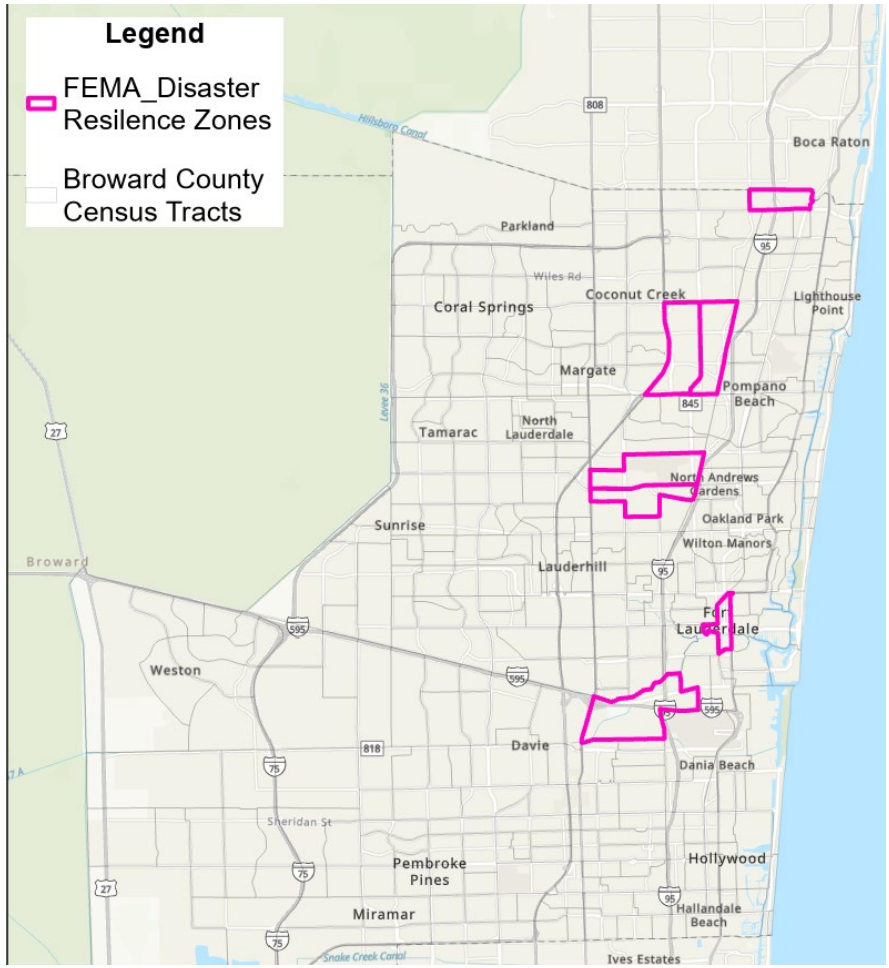
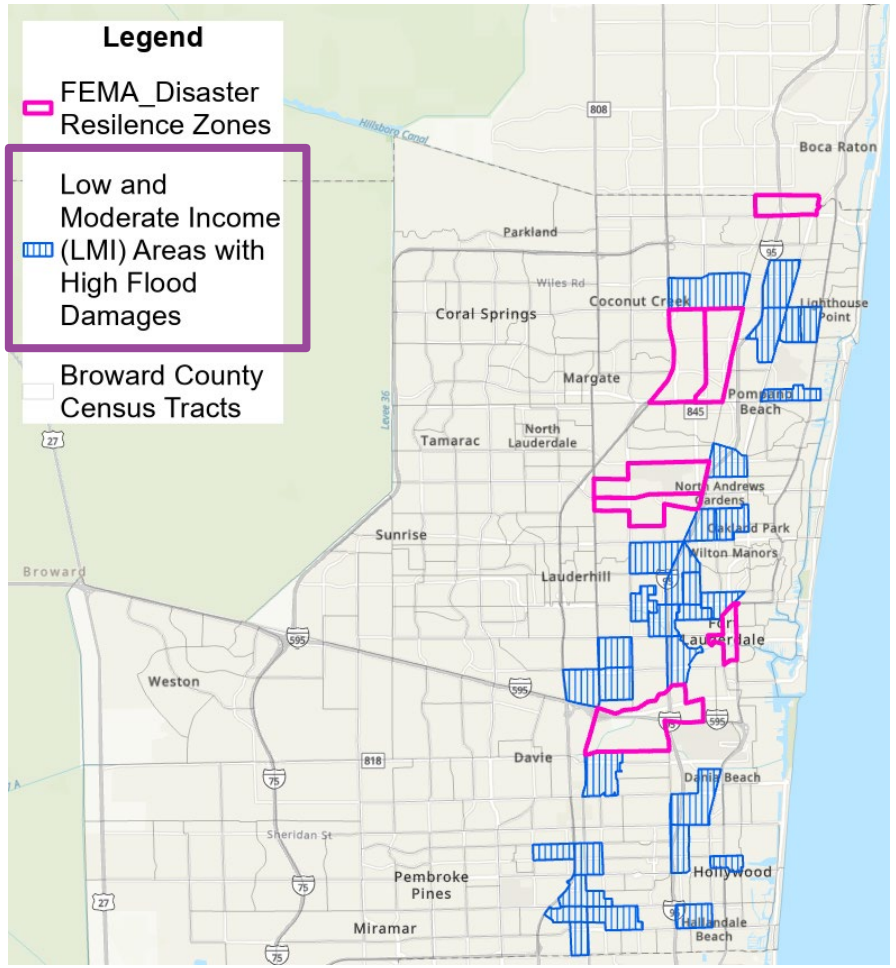
We are currently evaluating localized adaptation strategies in areas of FEMA Disaster Resilience zones and Low and Moderate Income (LMI) and

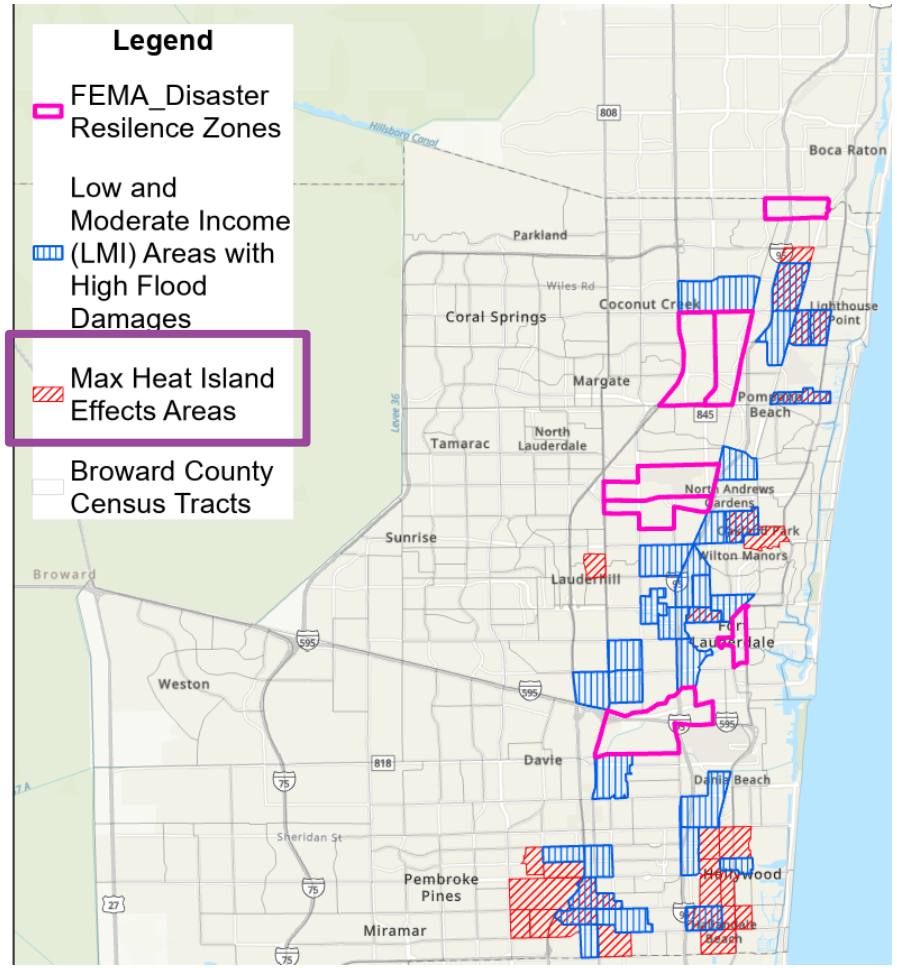


Zooming in FEMA Disaster Resilience areas …

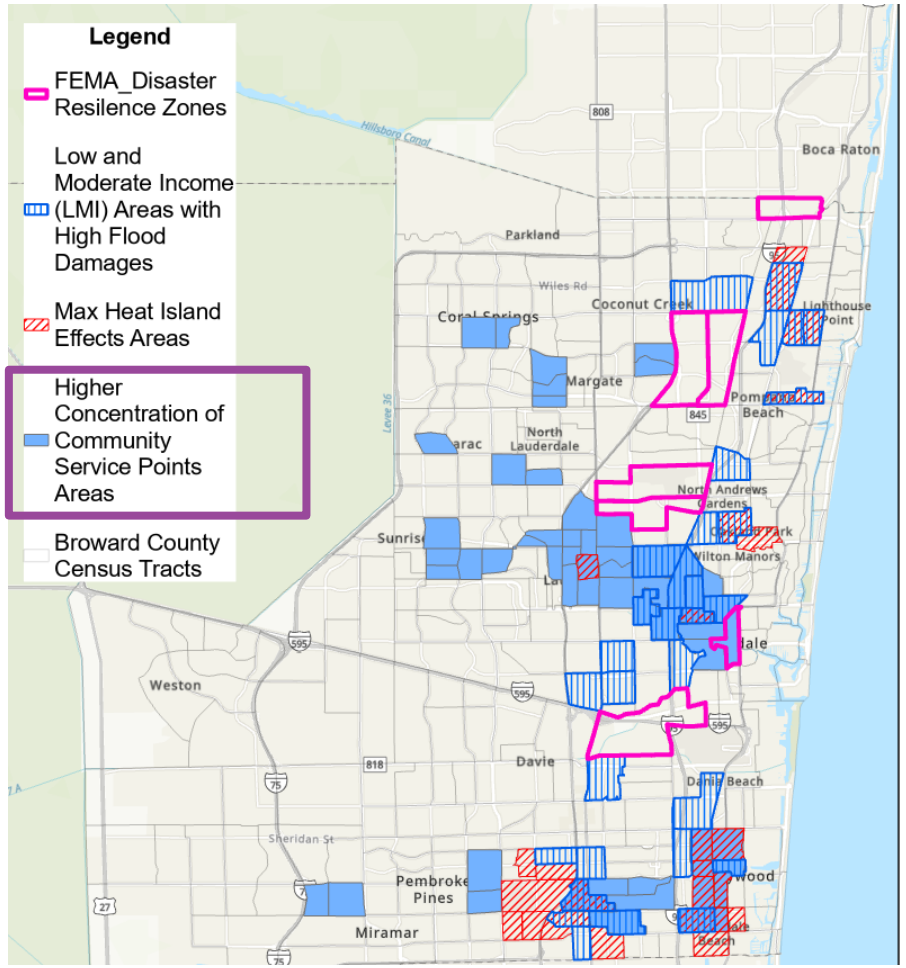


… and low- and moderate-income areas that showed elevated damages

These areas were complemented with areas affected by High Temperatures and areas where Emergency Community Services are located

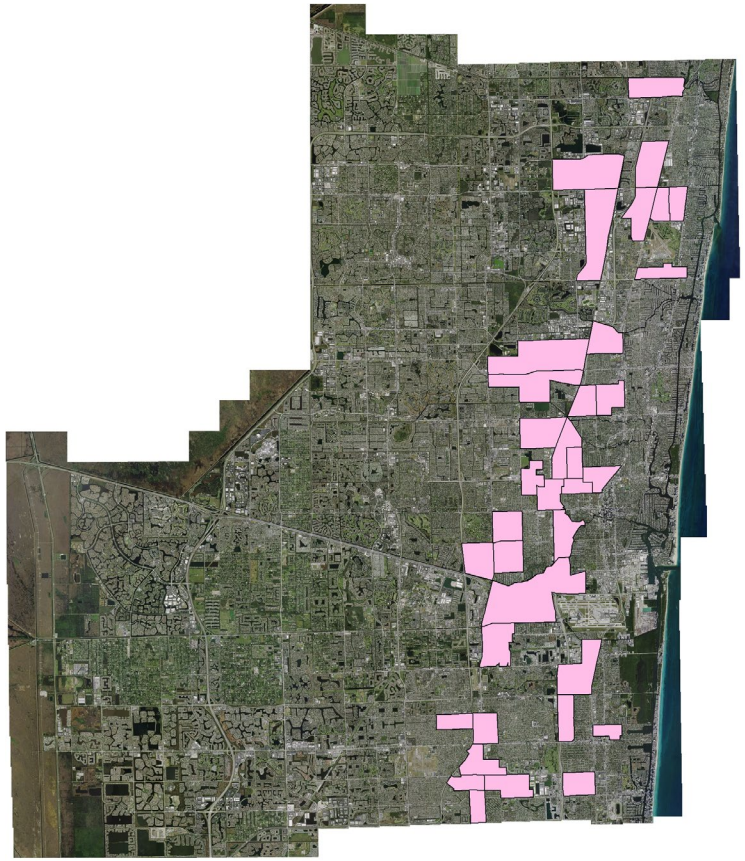


Some of this areas overlap with high heat impact areas identified earlier in the plan …

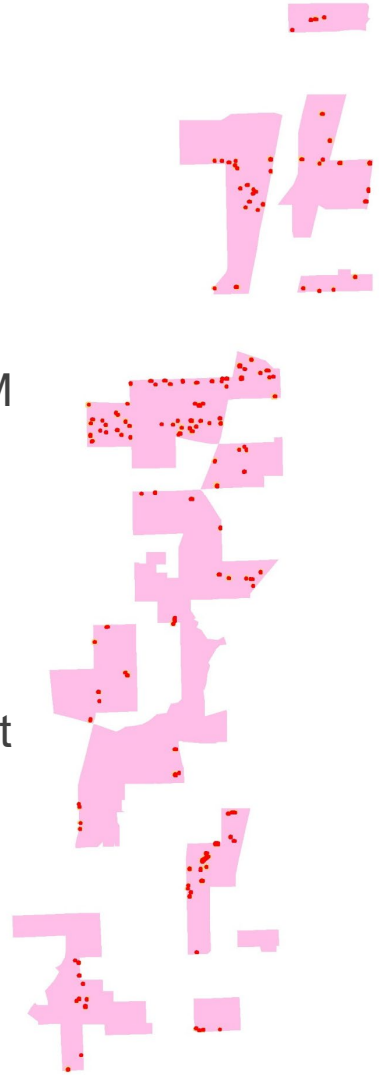


… and with areas with higher density of Emergency Community Services

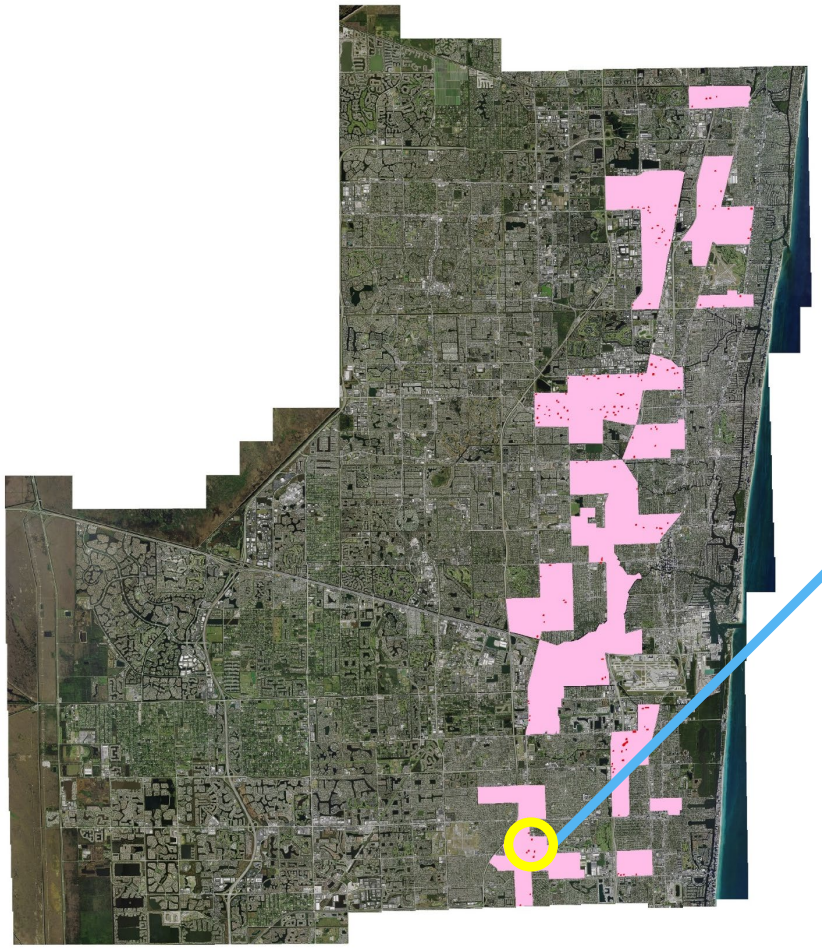
Identifying Storage Opportunities in Priority Areas

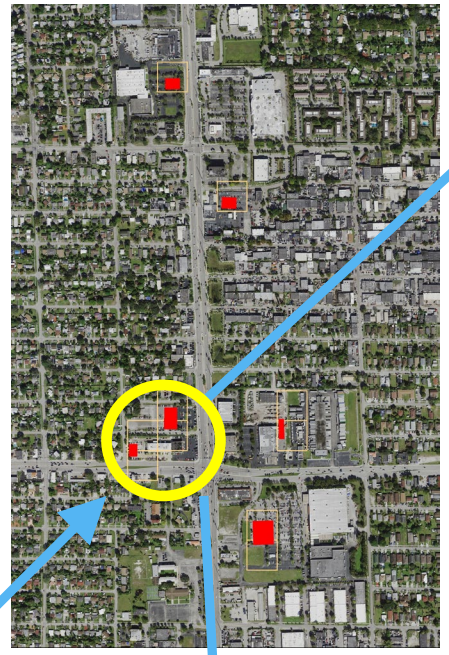


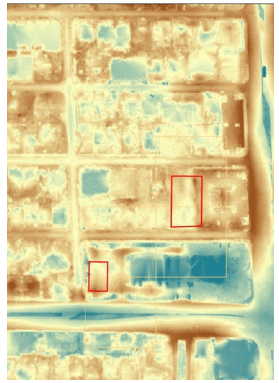
- Large expanses of impervious surfaces were identified using Deep Learning algorithm.
- Polygons obtained with this algorithm were aggregated when located with 10 feet of each other
- The lowest point within each area was identified using the DEM raster.
- Storage Areas were added around each lowest point, with a size of **10%** of the impervious area or **5,000 sq.ft.**
- This procedure identified **154 storage areas** with a total of 48 acres located within larger areas of impervious surfaces that could potentially be converted to storage.
- Next steps include performing the same analysis for the rest of the County.

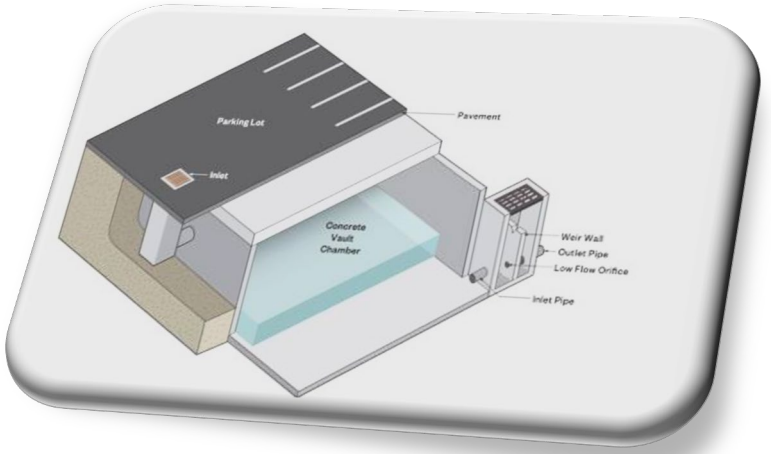


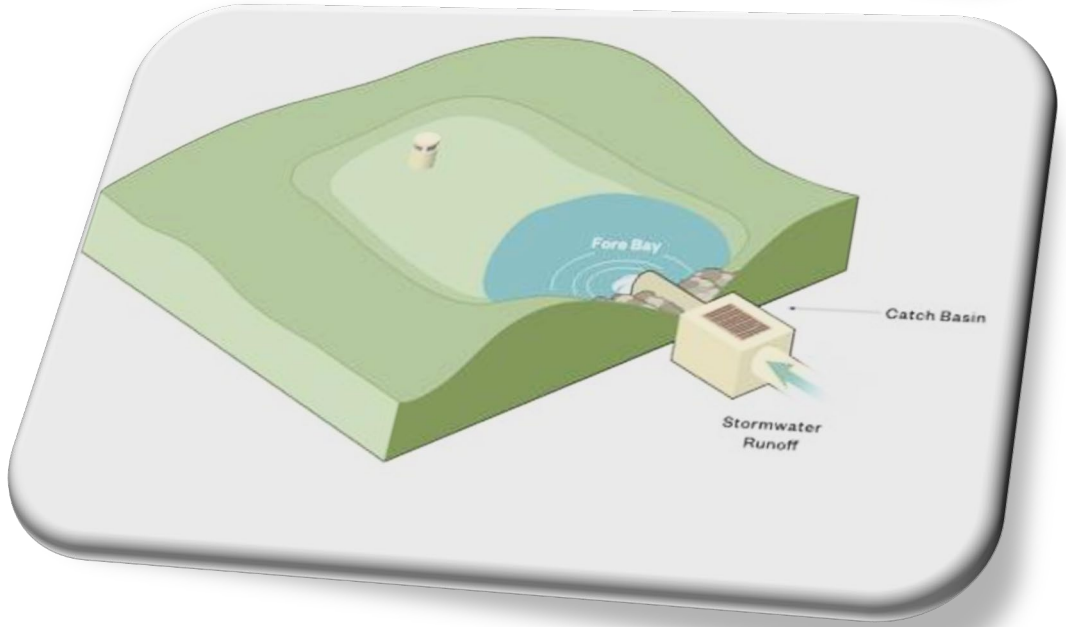
Identifying Storage Opportunities in Priority Areas







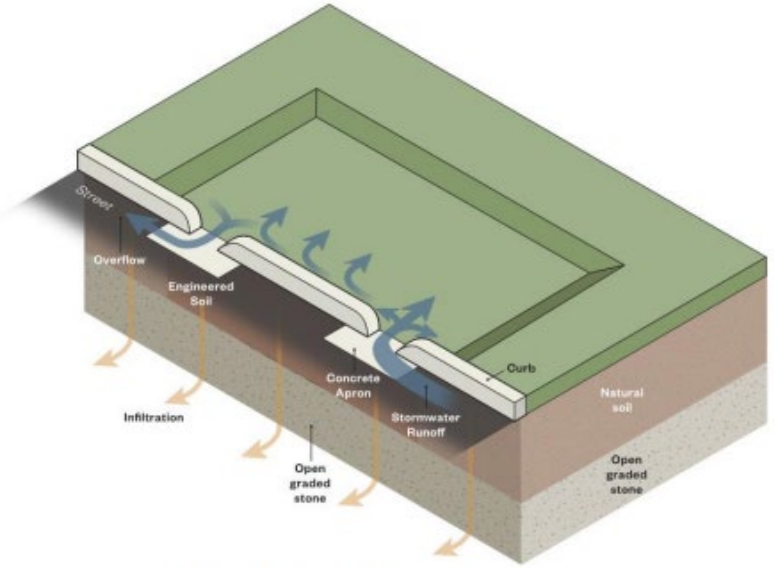




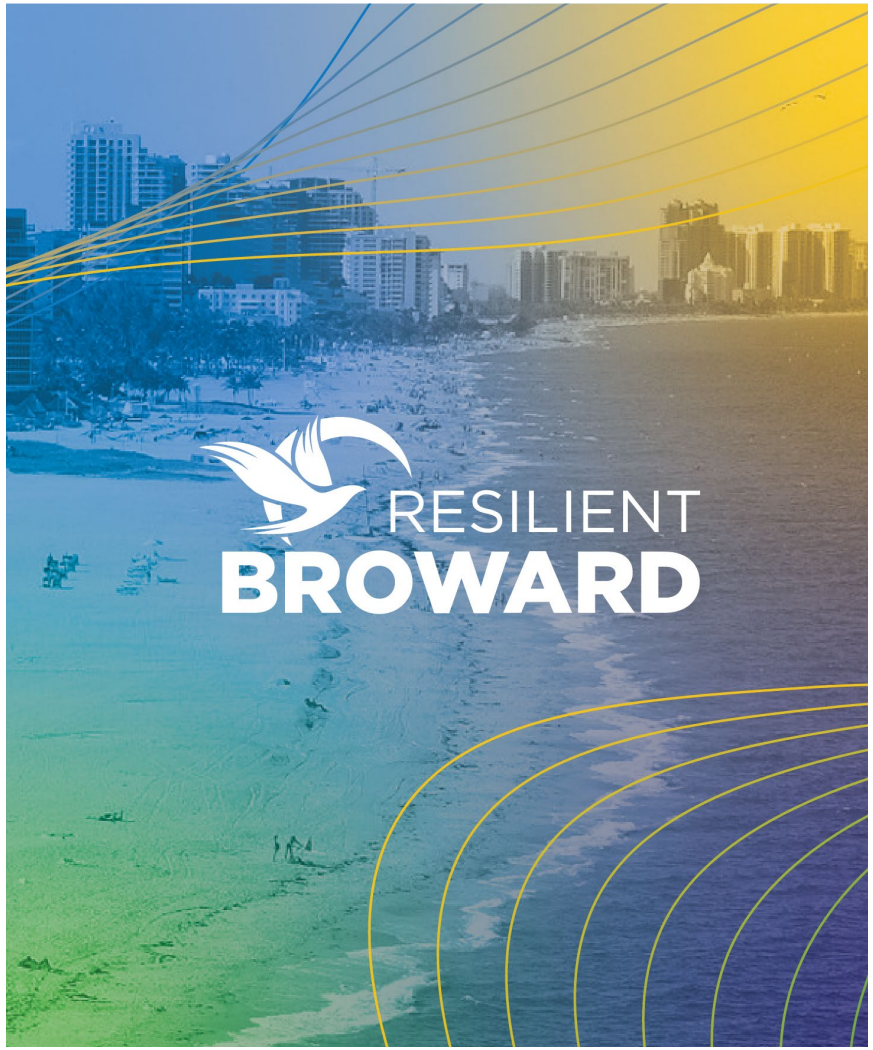
Planning for storage in future projects will be necessary

- Provide dry retention area instead of paved parking lot
- Improve parking areas by adding green infrastructure
- Incorporate storage into bottom level of parking garages, under parking lots, and/or under buildings

Stormwater storage/pumping in the “basement” level of large impervious structures could be encouraged/ incentivized



Right-of-Way Iceberg Bioretention



5

Second Generation Viewer Demonstration

Hazen

The Viewer Will Reside on the Platform, for all to Access

Climate Change and Flood Risk in Broward County: See How we are Preparing

The Viewer Will Reside on the Platform, for all to Access

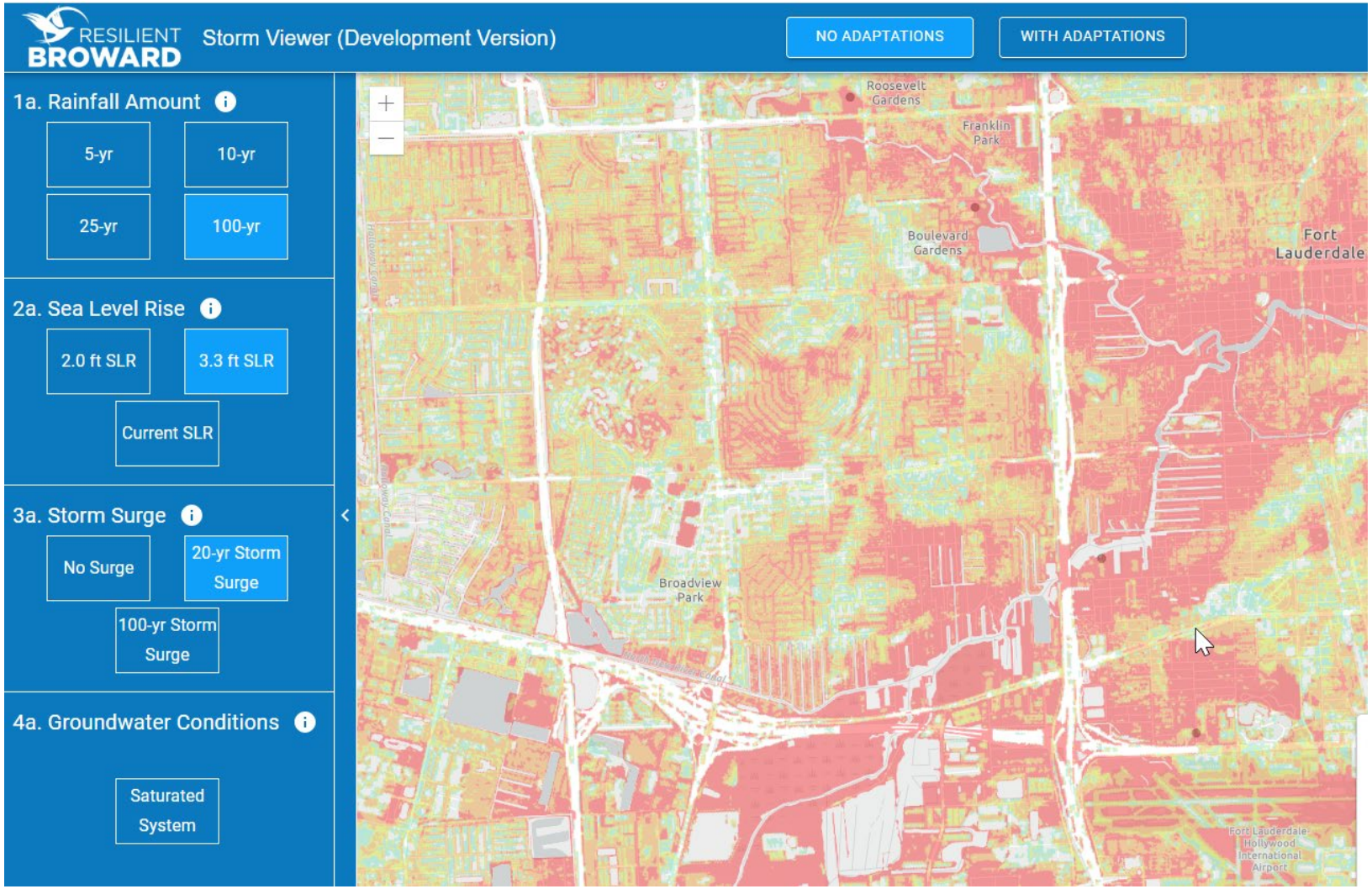
Why Do We Need a Resilience Plan?

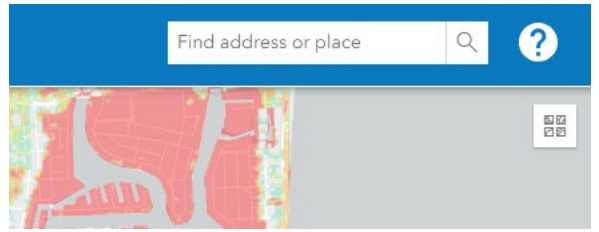
Our County cannot afford to wait. The sea level is rising and the rainfall is intensifying. With such low-lying and highly developed land, our County must prepare now.

Summary of Updates to the Second Generation Viewer

- User selects the scenario
  - Sea Level Rise
  - Precipitation
  - Surge
- Can view adaptation scenario vs non-adaptation scenario side-by-side
- More refined – hexagons show the flooding limits more distinctively; softer interface
- Can view predicted heights of flooding
- Can view aerial imagery and other basemaps behind the flooding
- Can view 360 photographs with flooding rendered

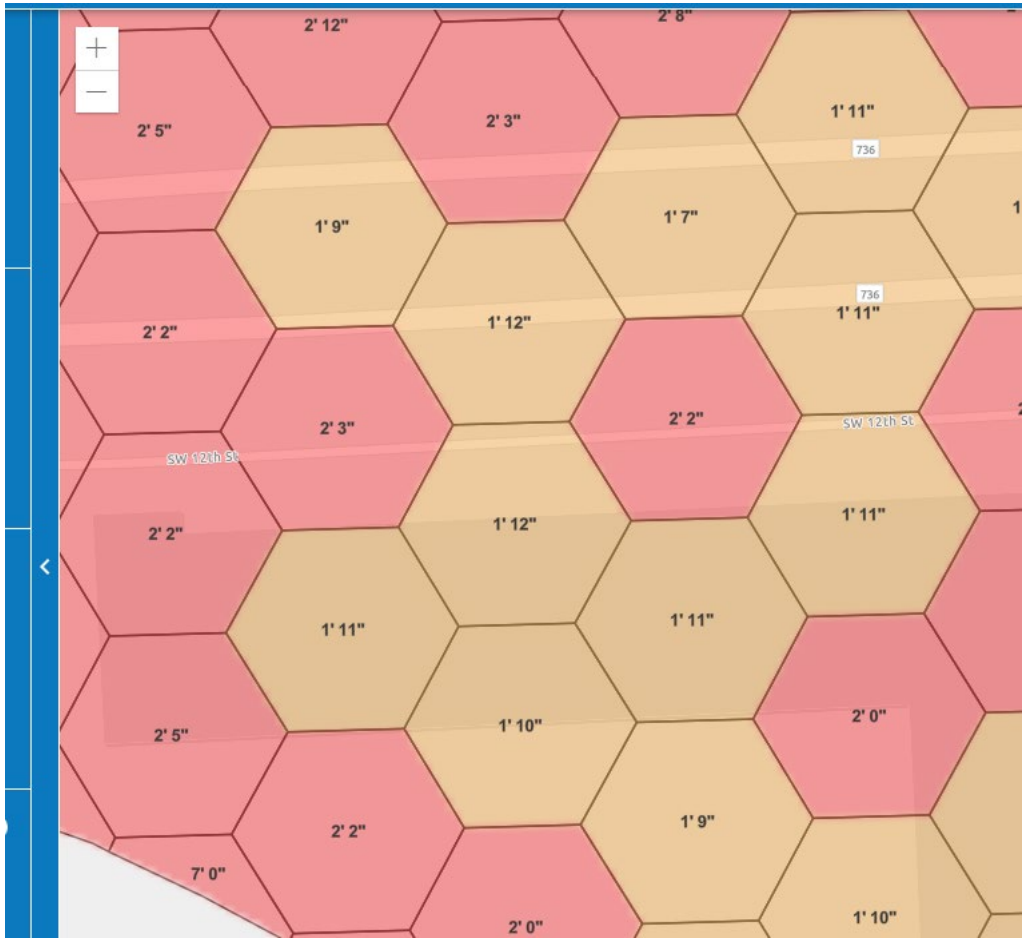
The User will select Rainfall, SLR, and Surge Event. Groundwater Condition will populate based on the selections.



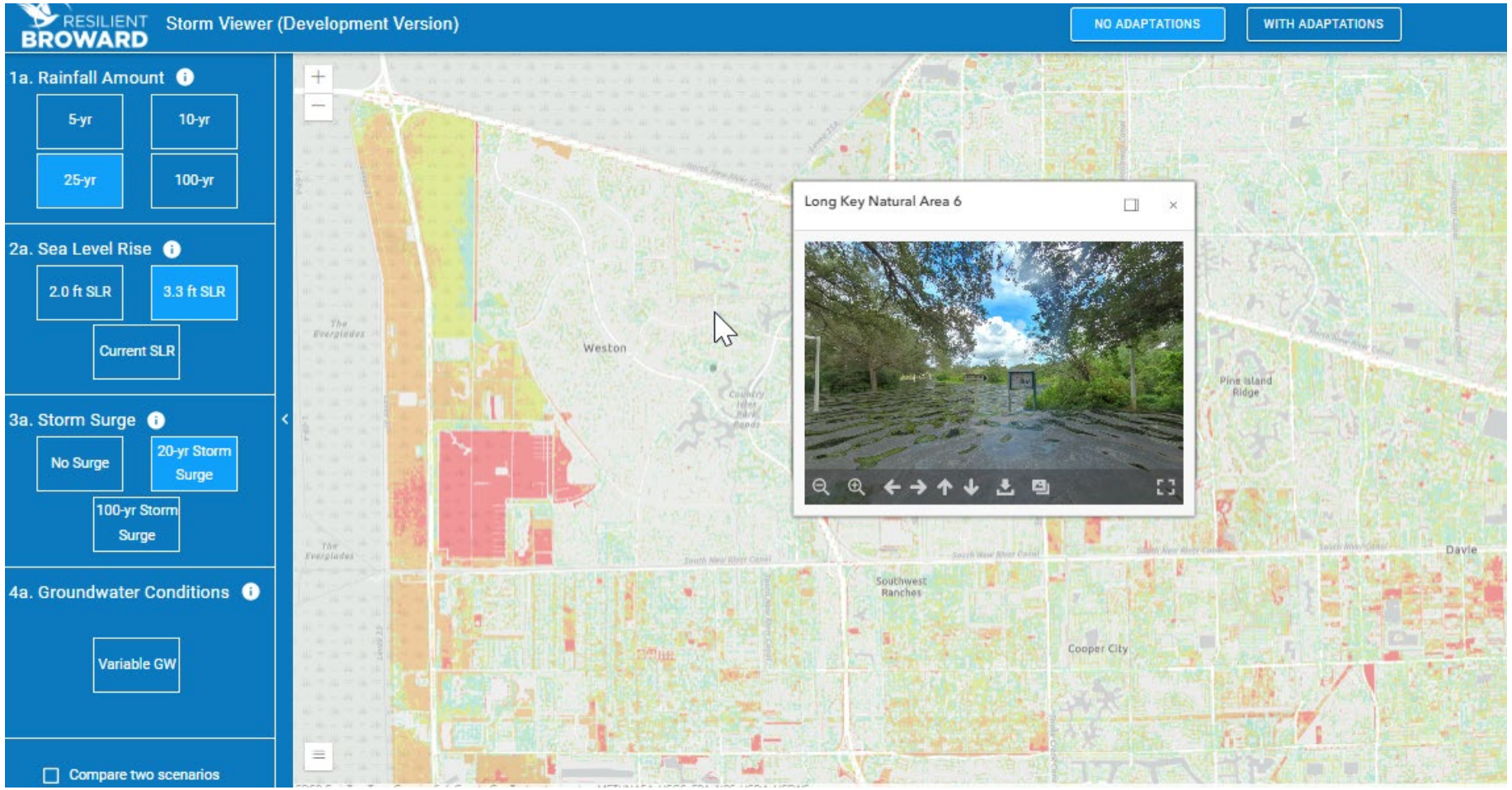


User may enter an address or zoom in directly

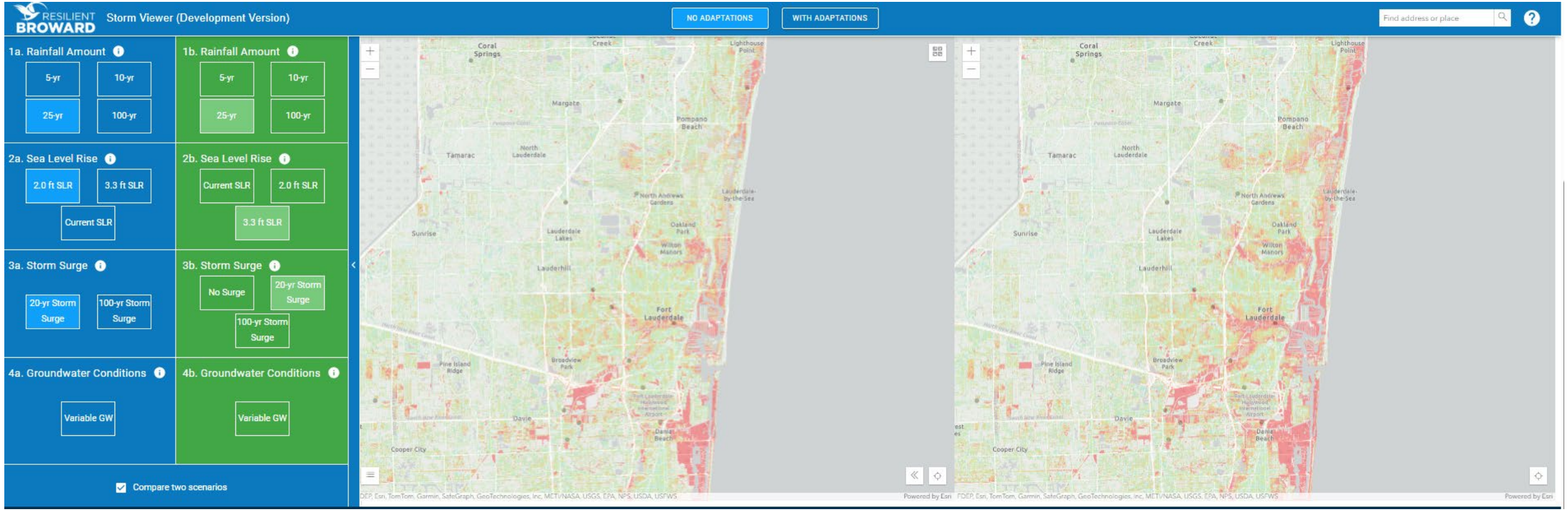
The User can continue to zoom in to determine predicted height of flooding

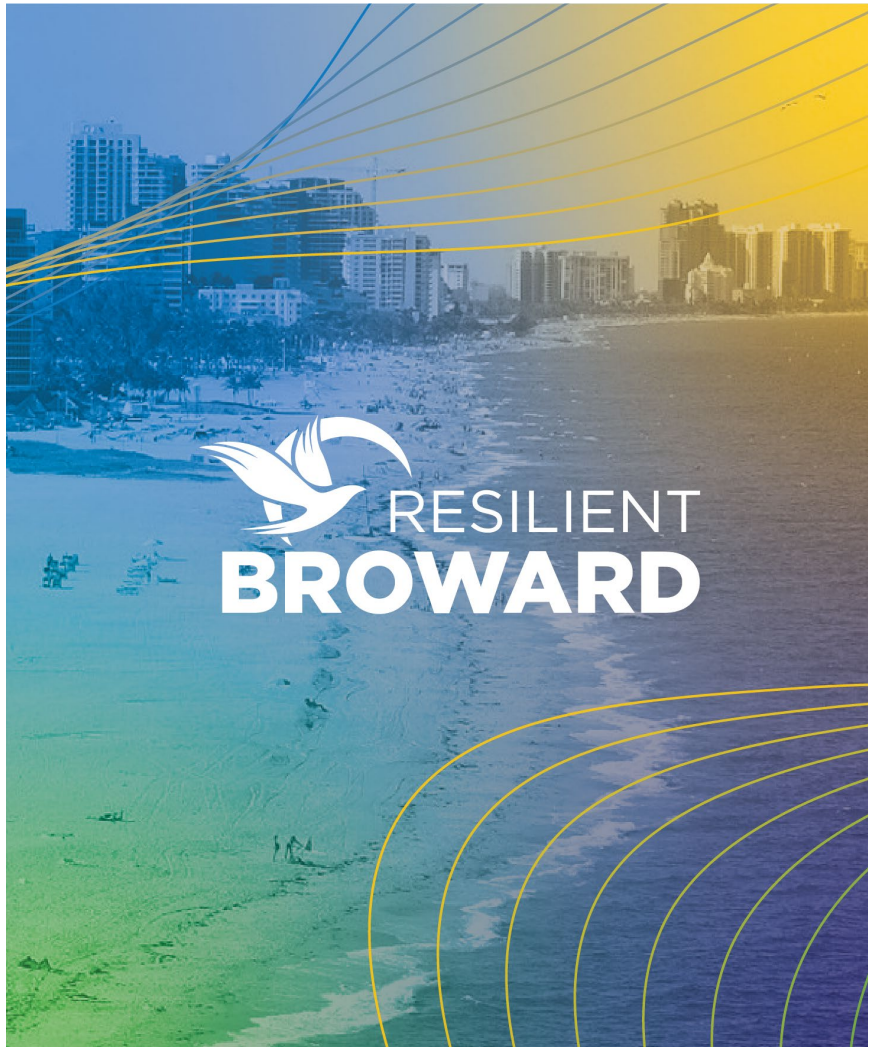


In 30 locations, the User can select a 360 photo and view the modeled height of flooding



The User can compare two scenarios side-by-side





6

Upcoming Schedule

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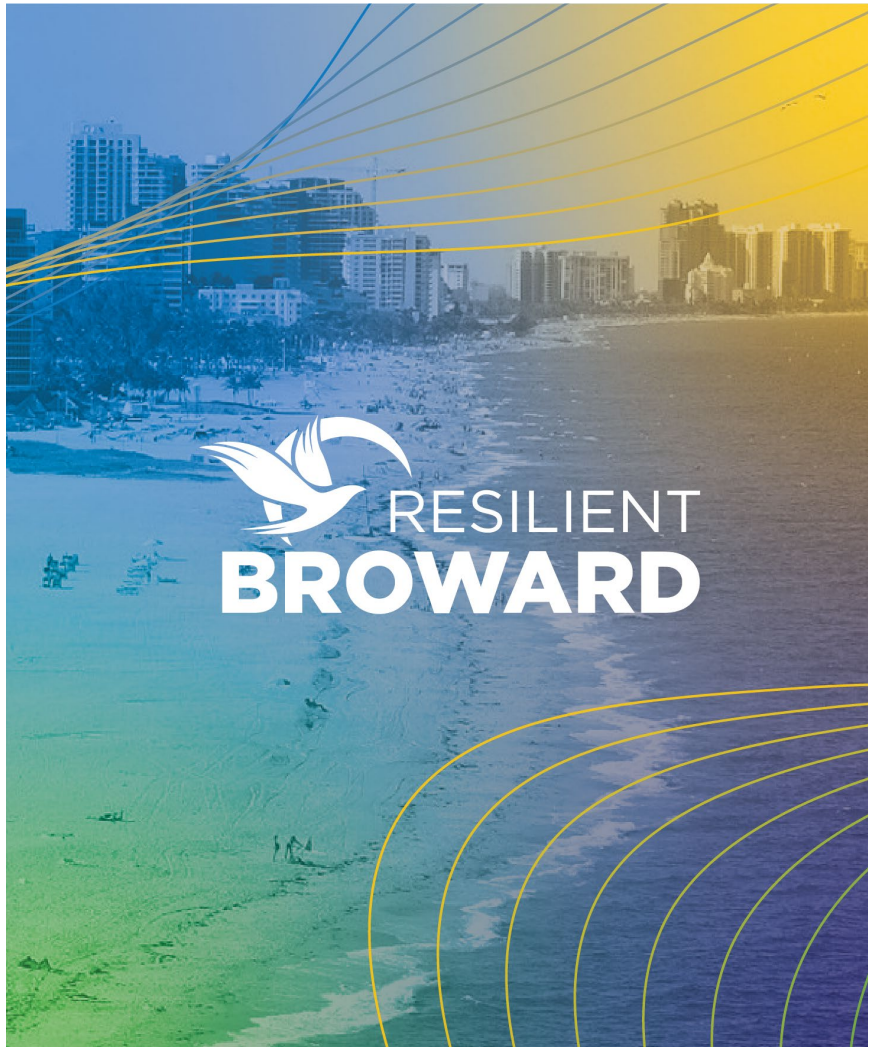
Next Steps and Estimated Completion Time

- Complete the Six Conceptual Asset Adaptation Representations (end of May/early June)
- Evaluate Six Suites of Adaptation Strategies (end of April/early May)
- Complete the Economic Analysis (end of May/early June)
- Complete Platform, including Second Generation Viewer (end of May/early June)
- Complete Property Scale Proposals (including costs) for Ten Sub-basins (August)
- Finalize the Plan/Turnover the Platform (end of July/beginning of August)
- Present to RSC at the August Meeting
- Present update to TAC at the August Meeting
- Present to WAB at the September Meeting



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Adjournment

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