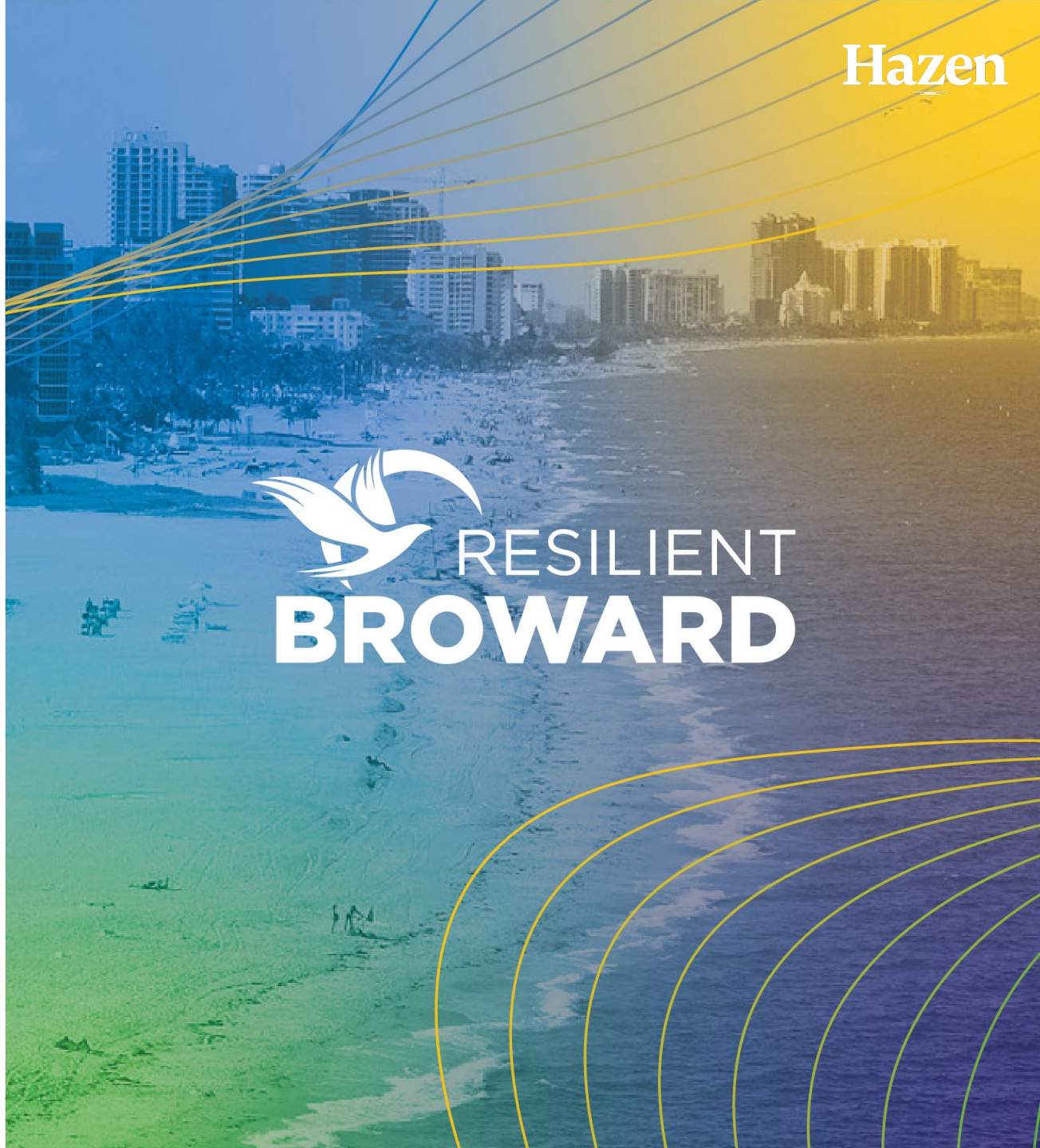
COUNTYWIDE RISK ASSESSMENT AND RESILIENCE PLAN

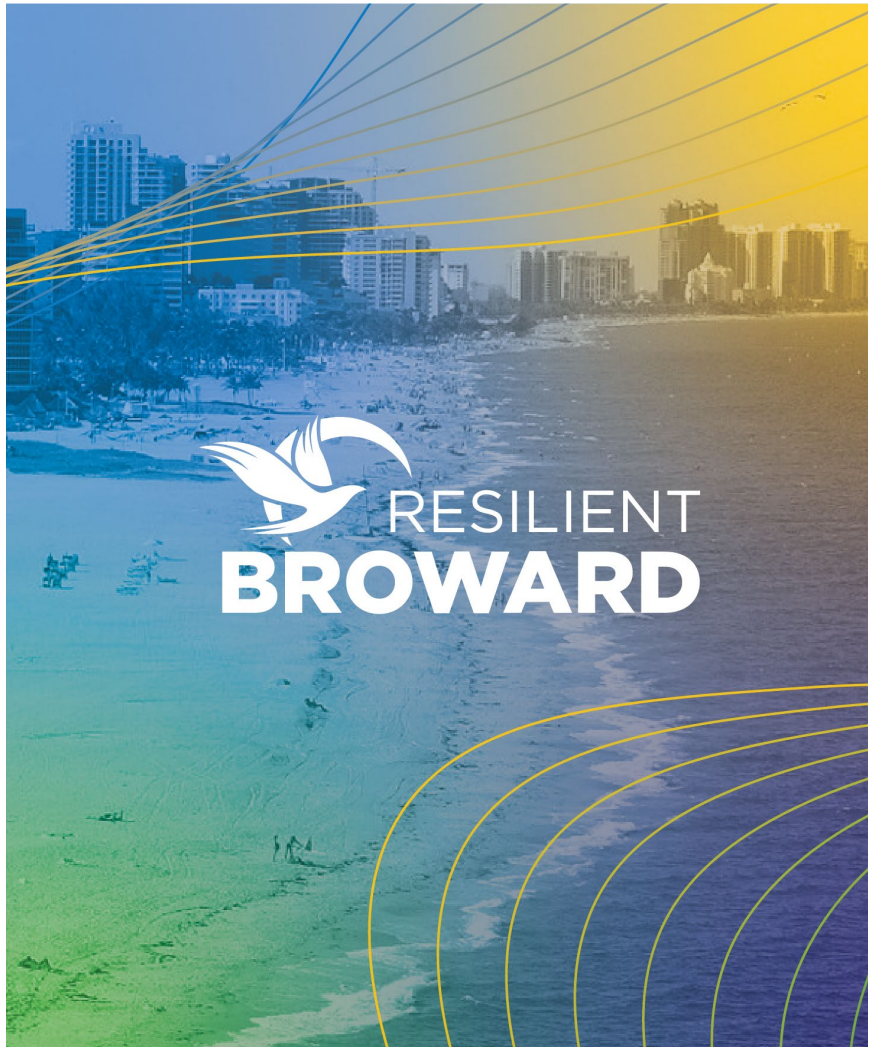
Resilience Plan Steering Committee

August 23, 2023



Outline

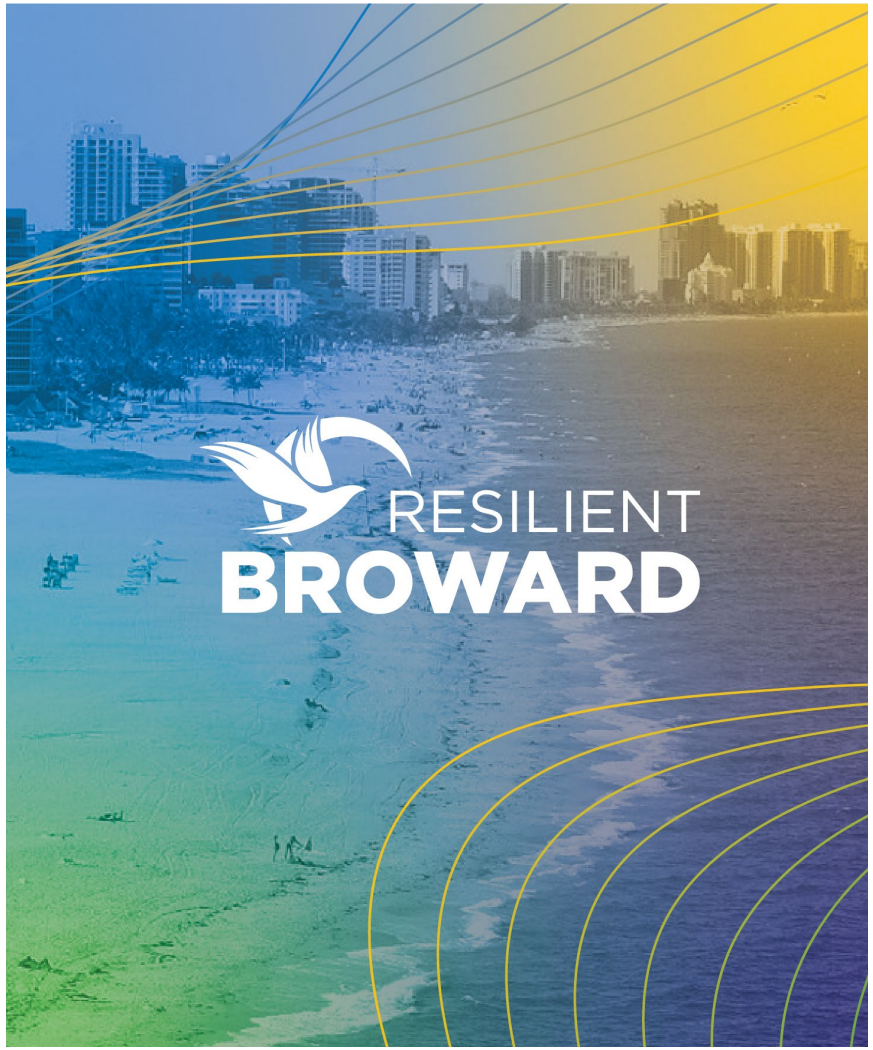
1. Welcome
2. Roll Call
3. Heat Data Analysis
4. Outreach Plan Overview
5. Stakeholder Input from H&H Review
6. Adaptation Strategy Kickoff
7. Asset Analysis: Risk Analysis Performed for Sample Set of Critical Assets, Roadway Risk Methodology
8. Economics Modeling Update
9. Adjournment



1

Welcome

Hazen



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Roll Call

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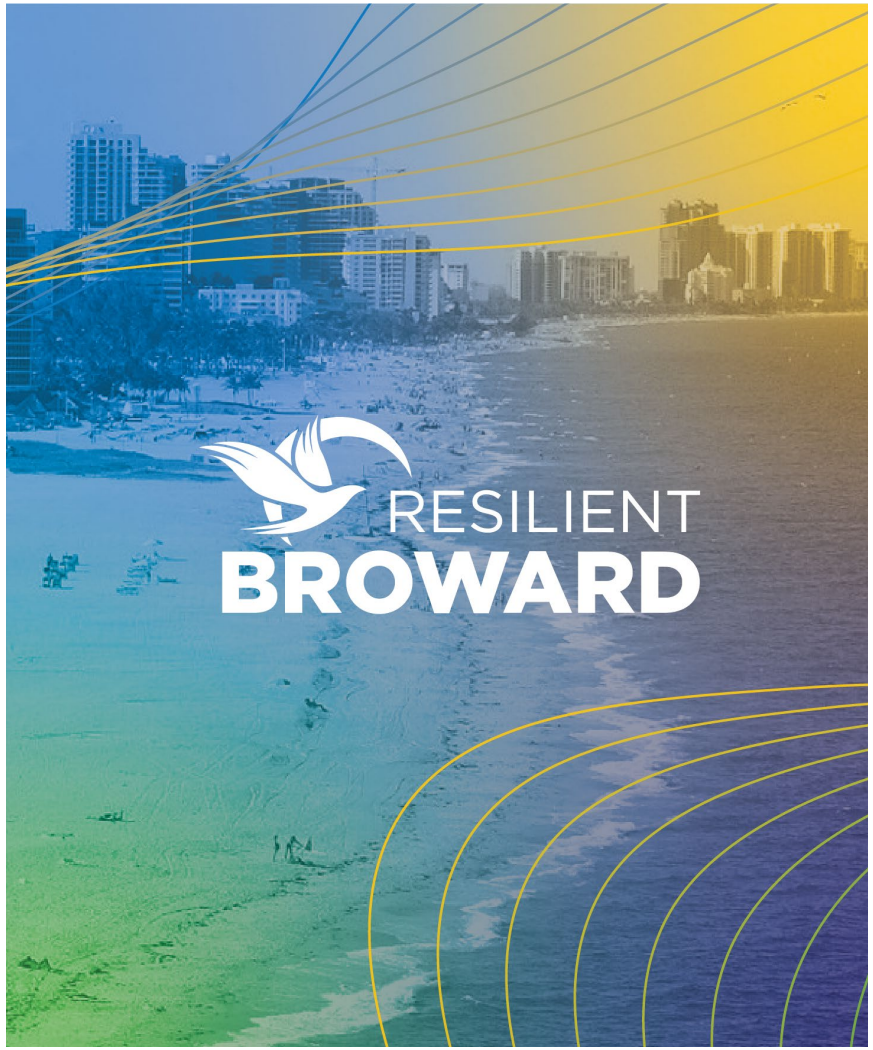

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Heat Analysis Overview

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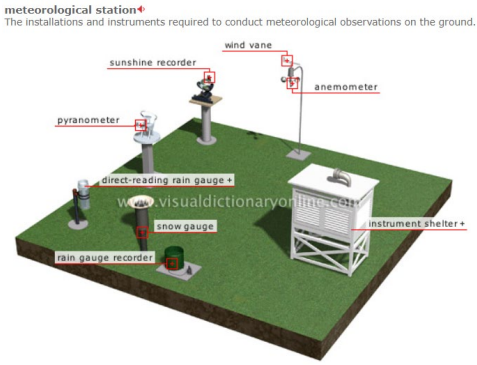
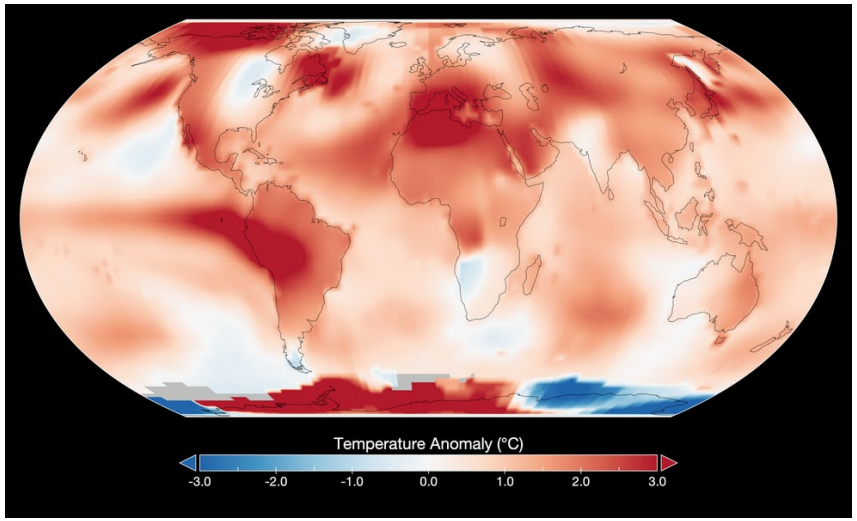
Record Breaking Temperatures



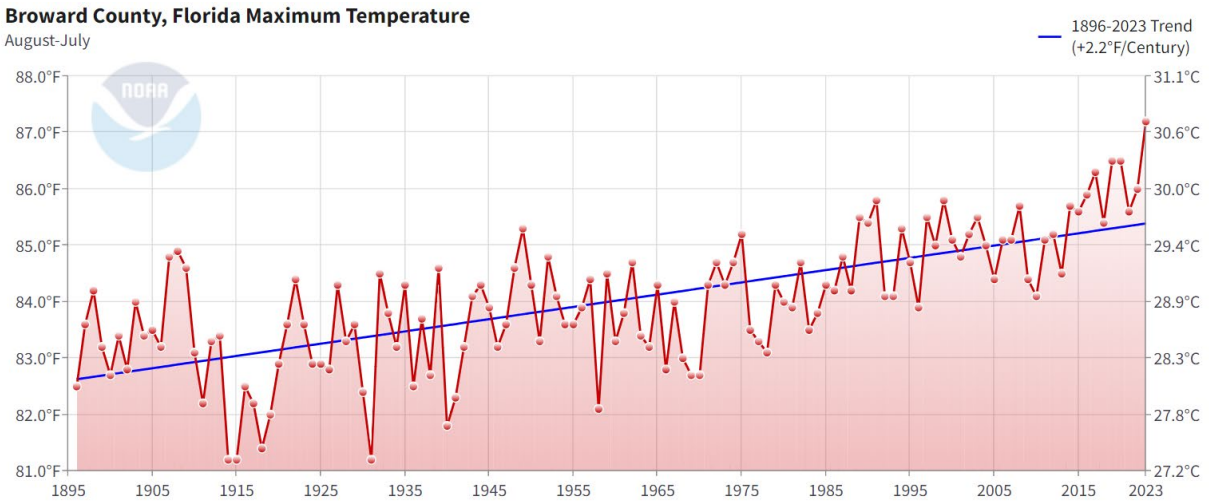
Global

- Average global surface (land and ocean) temperature in June 2023 was 1.89-degree F above average
- NASA records July 2023 as hottest month on record since 1880

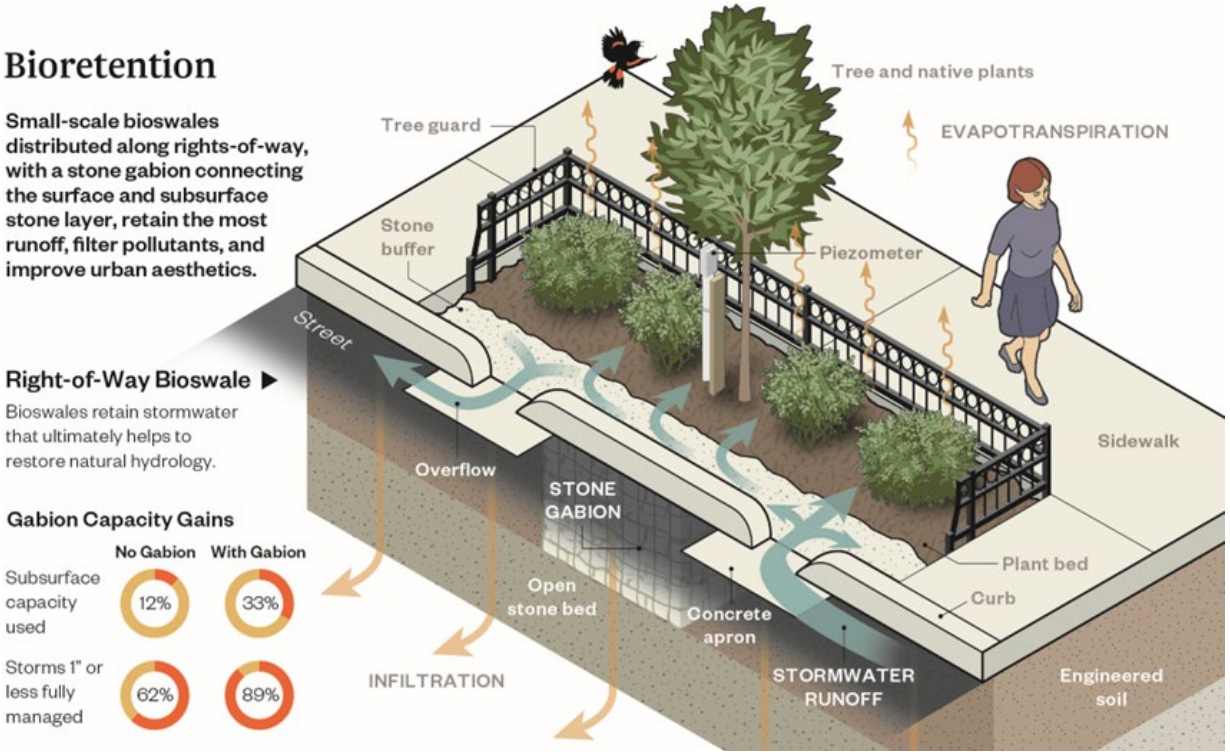


Local

- Number of days heat index surpassed new heat advisory and warning thresholds (105° F and 110 ° F respectively) in June & July
- Historical Trend : 2.2º F(1ºC) /100 year



Overview and Goals of Analysis



- Investigate impact on vulnerable populations
- Identify heat islands or “hot spots”
- Evaluate impact on localized activities
- Identify opportunities for cost-sharing and funding mechanisms

Results will be used to inform adaptation strategies and evaluate co-benefits of green infrastructure

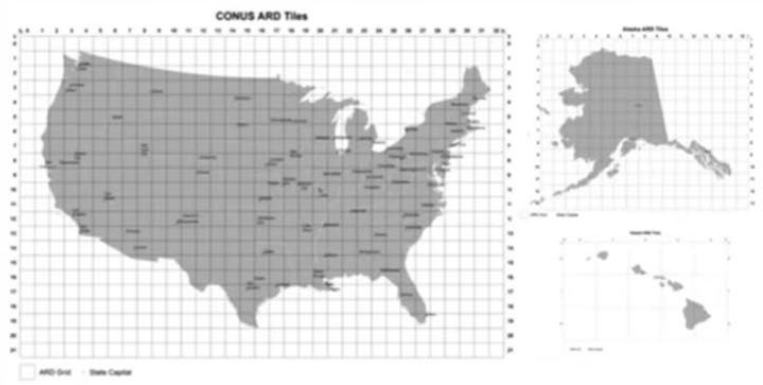
Land Surface Temperature (LST) Data

- LANDSAT 7/8 Imagery
- Google Earth Engine
- NASA

Landsat LST Data

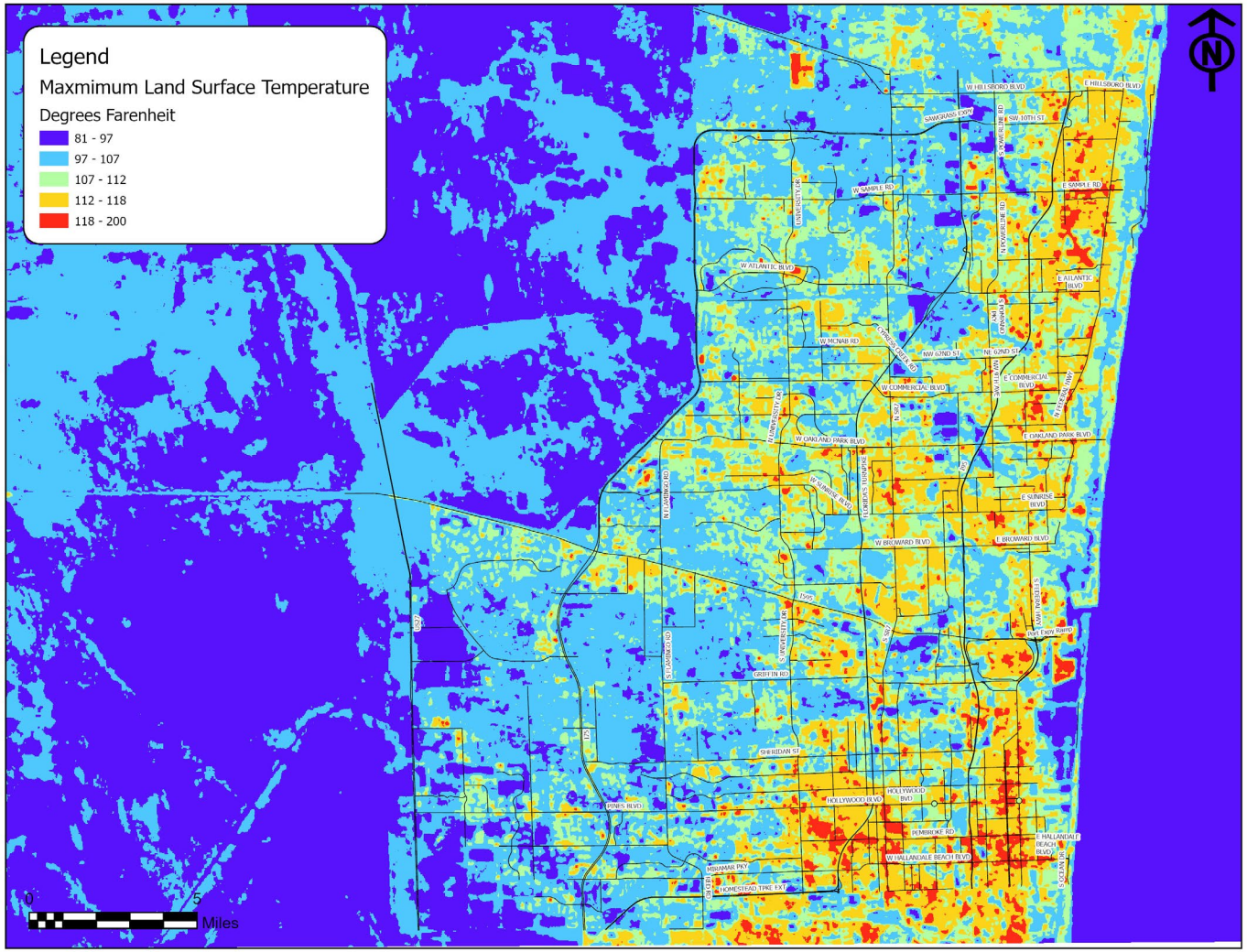
- https://www.usgs.gov/media/files/landsat-provisional-surface-temperature-product-guide
- Provisional Land Surface Temperature based on Landsat 4-8 missions' TIR
- Part of U.S. Landsat Analysis Ready Data (ARD) products (1982 to present)
- ASTER Global Emissivity Database (GED) and NDVI data are used
- Atmospheric profiles of geopotential height, specific humidity, and air temperature extracted from reanalysis data
- Data available **for the U.S.** at 30 m resolution

VIDEOS



Maximum recorded land surface temperature for 2022 was utilized for analysis with approximately 90-foot by 90-foot cell size

Influences on Heat



Maximum LST

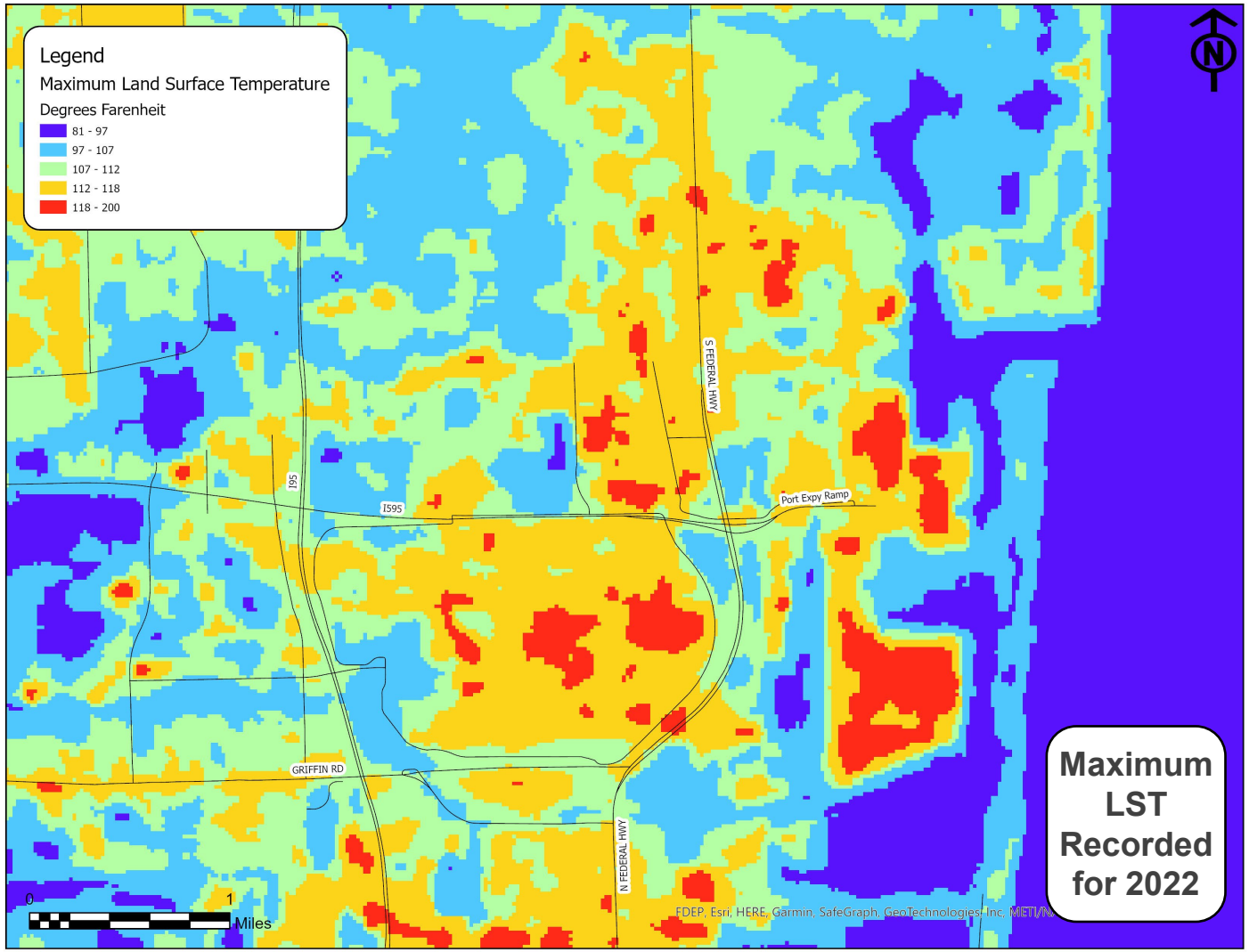
Environmental Impacts

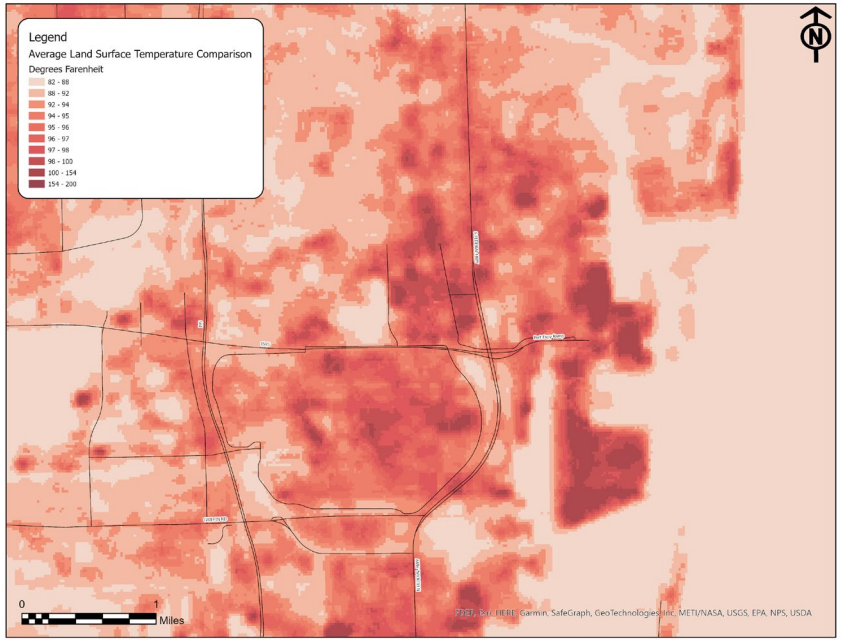
- Coastal and tidal influences
- Everglades Marshland

Identified Hotspots

- Visible hot spots consistent within summer and winter months
- The majority of Broward County is considered a metropolitan area, however, there are still “ultra-urban” areas where hot spots are visible

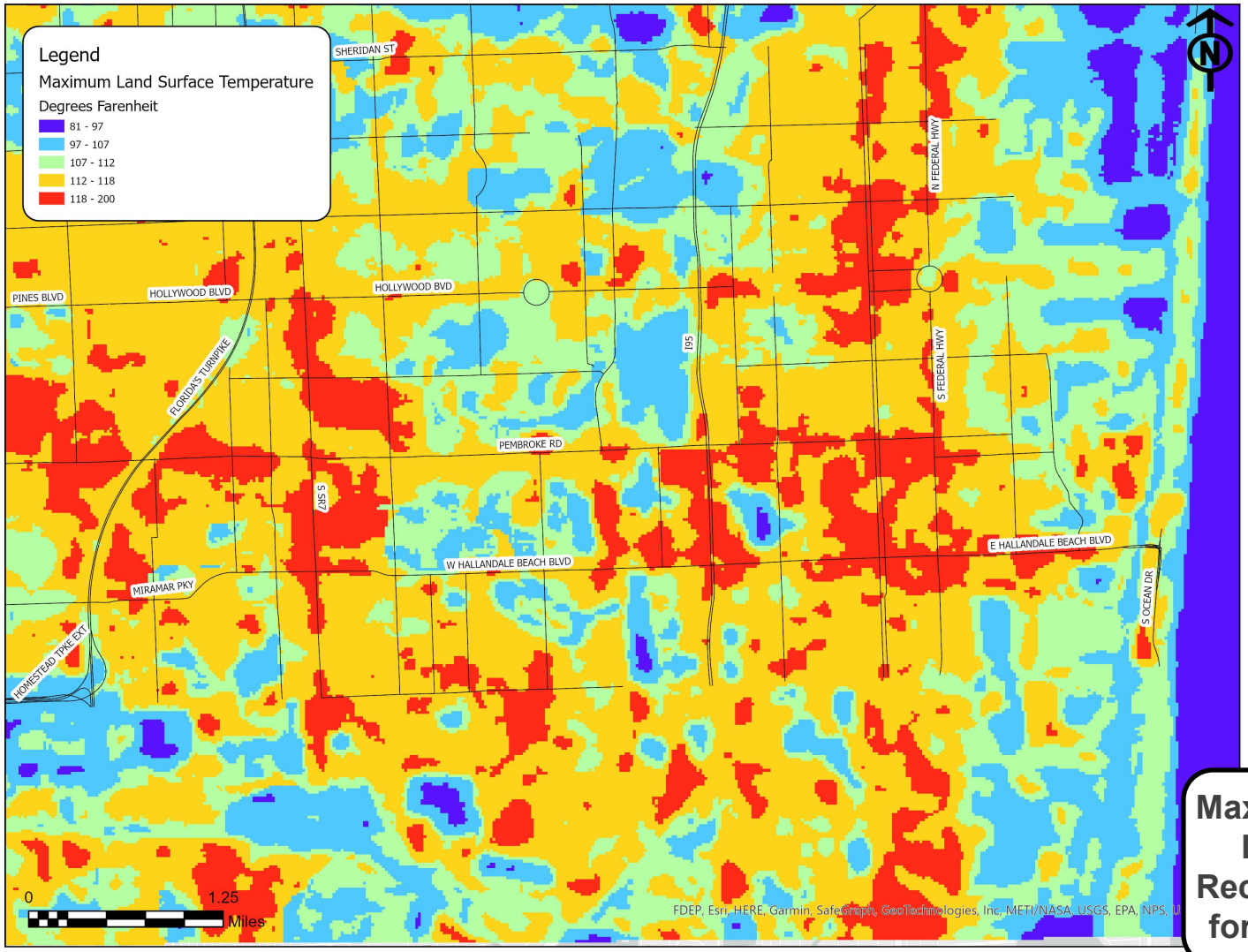
Hotspots – Port Everglades



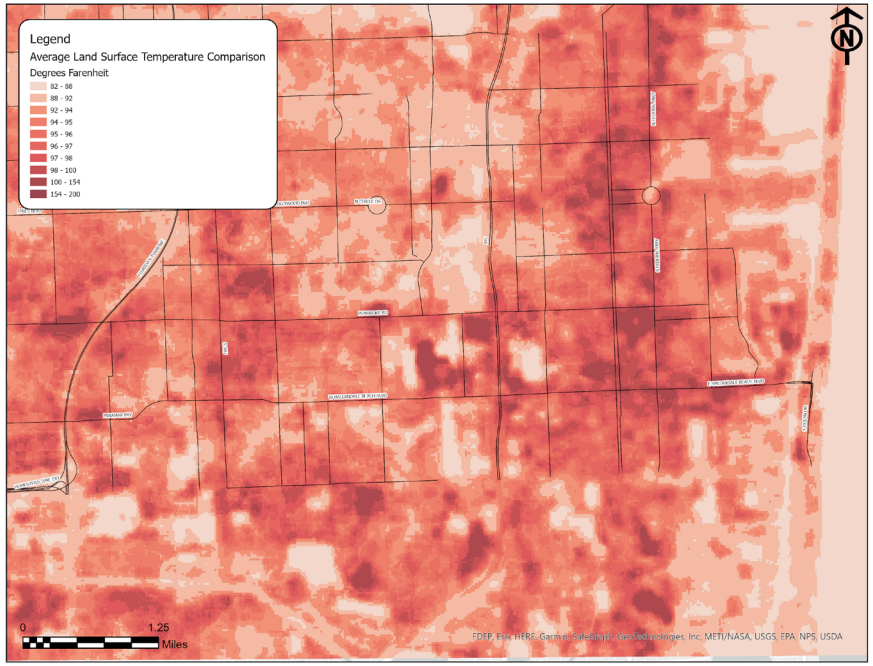


Average LST Recorded for 2022

Hotspots – Hallandale Beach – Densely Populated Areas

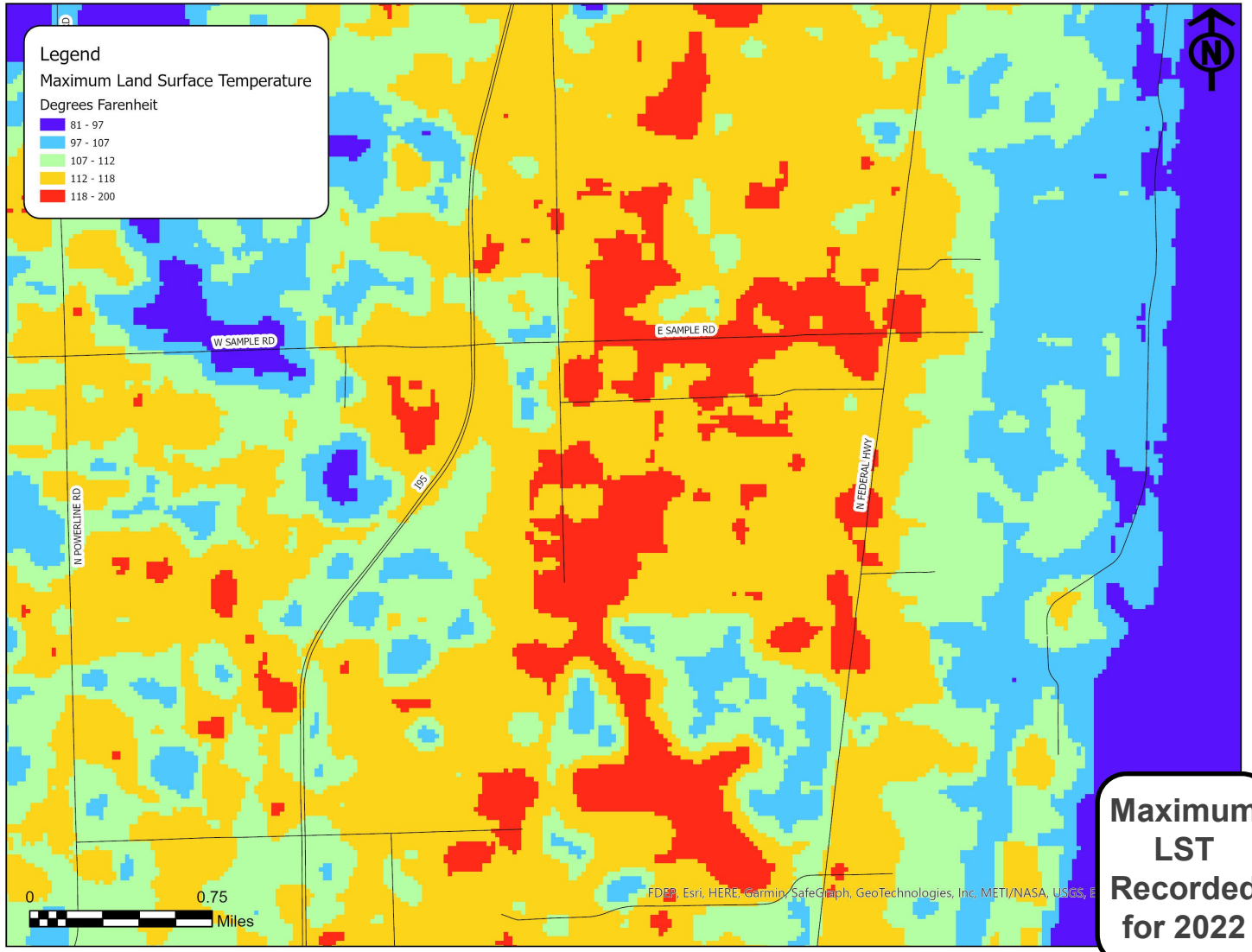


Maximum LST Recorded for 2022

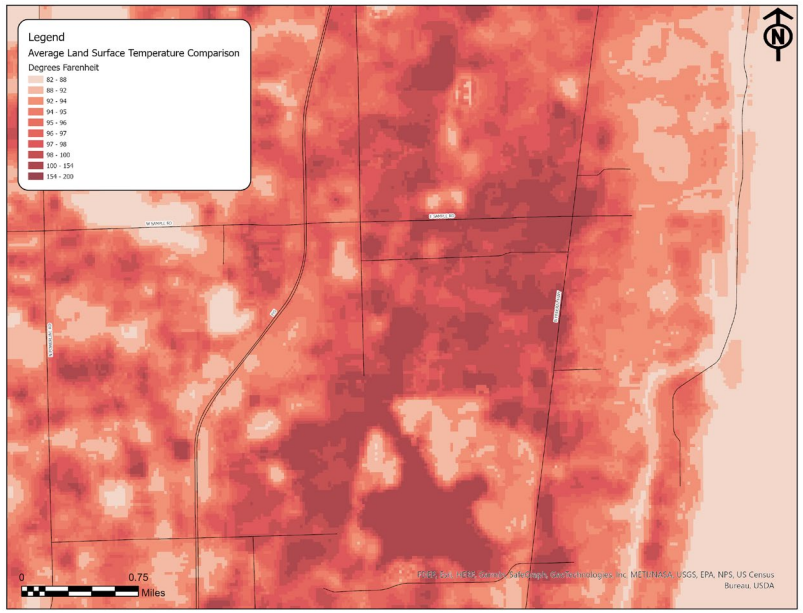


Average LST Recorded for 2022

Hotspots - Industrial

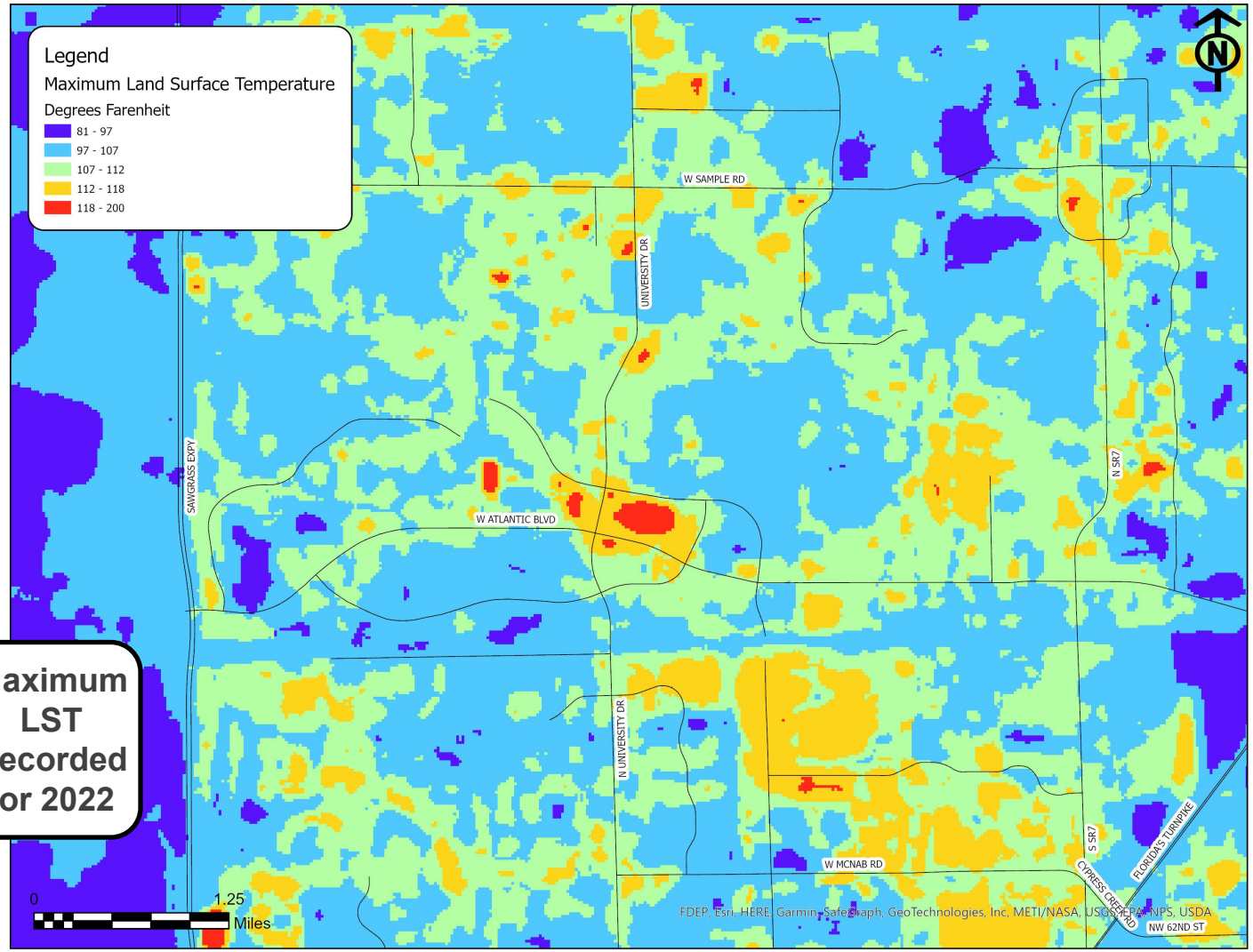


Maximum LST Recorded for 2022

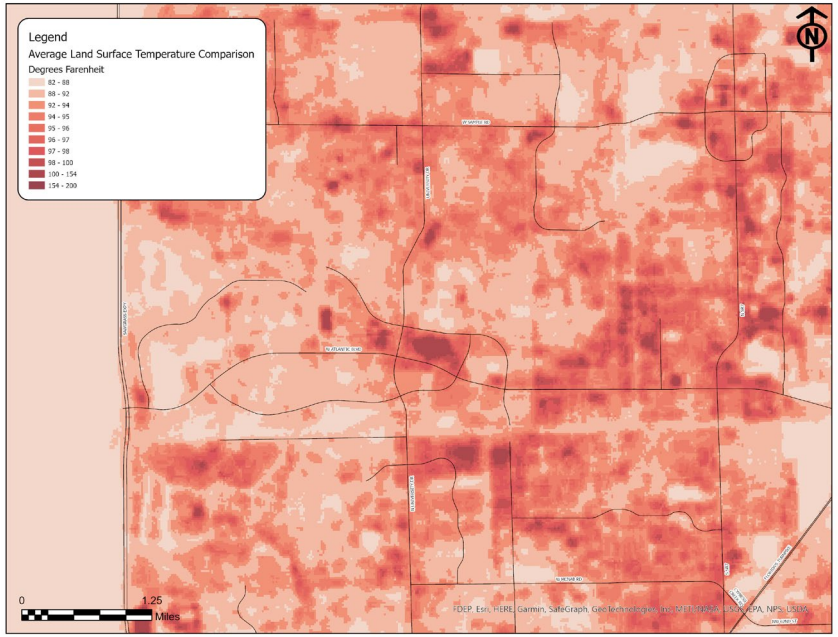


Average LST Recorded for 2022

Hotspots – Shopping Centers



Maximum LST Recorded for 2022

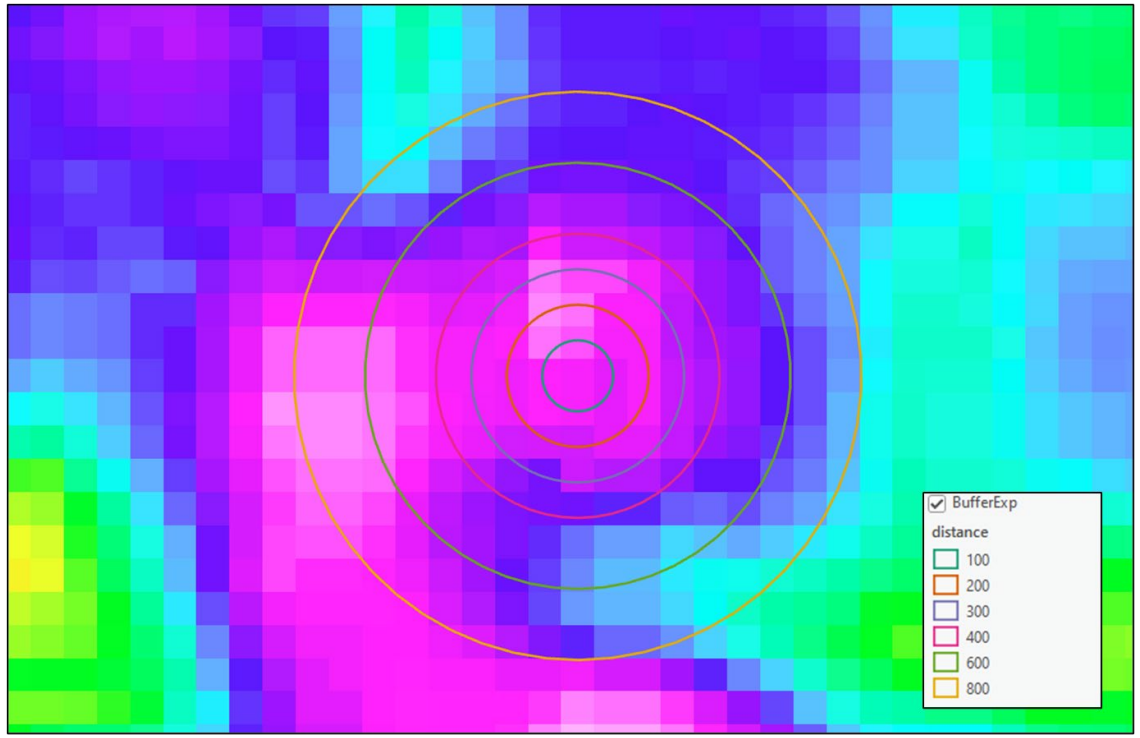


Average LST Recorded for 2022

Analysis - Correlation between Pervious Areas and LST

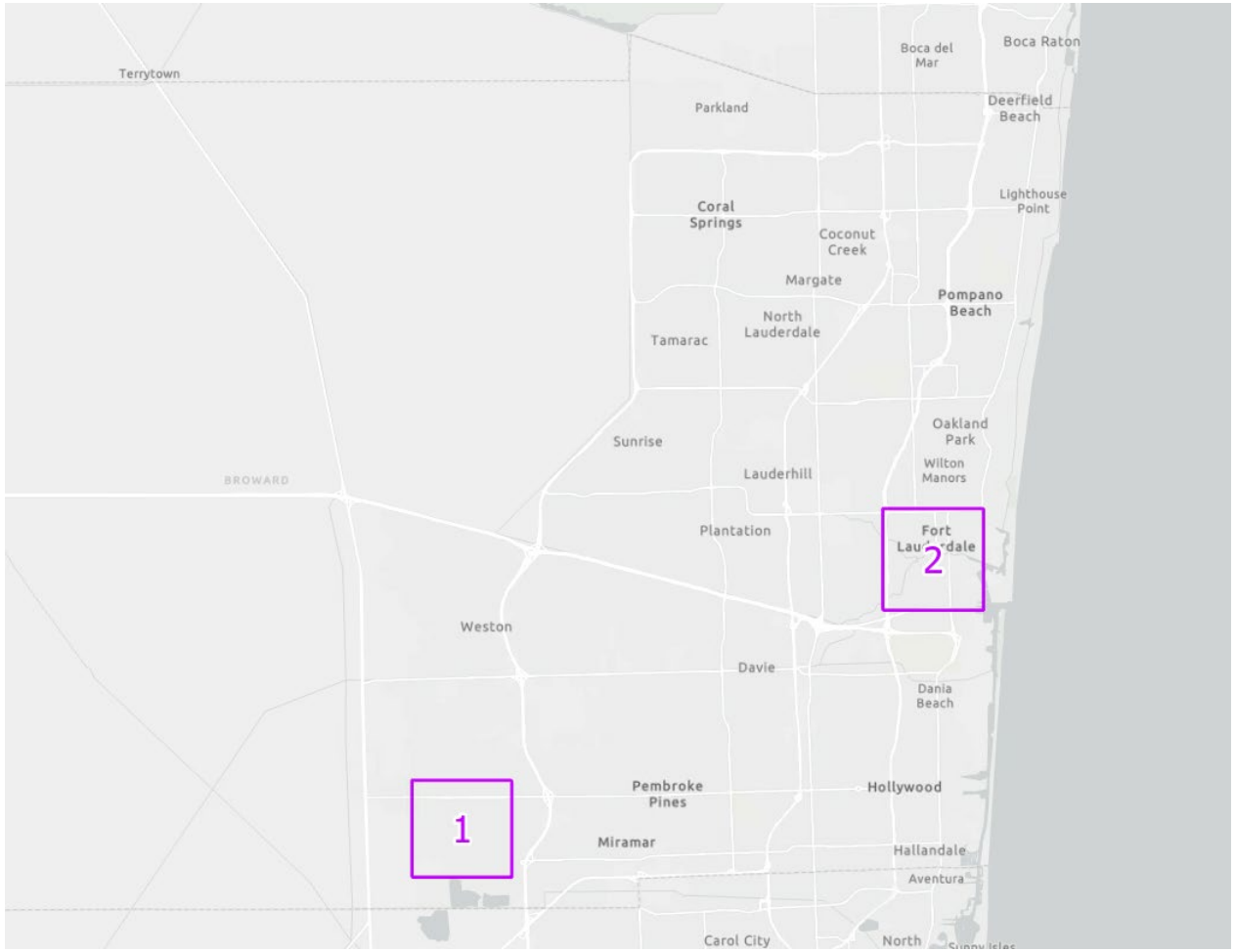
Methodology

- Create a fishnet of all of Broward County
- Extract the local temperature values into the fishnet layers
- Calculate the impervious percentage of the fishnet cubes
- Create buffer from fishnet center points
- Calculate average temperature within the buffers
- Compare the impervious percentage to the average temperature within the buffer to evaluate the correlation between how impervious an area is to the surrounding temperature



Correlation between Pervious Areas and LST

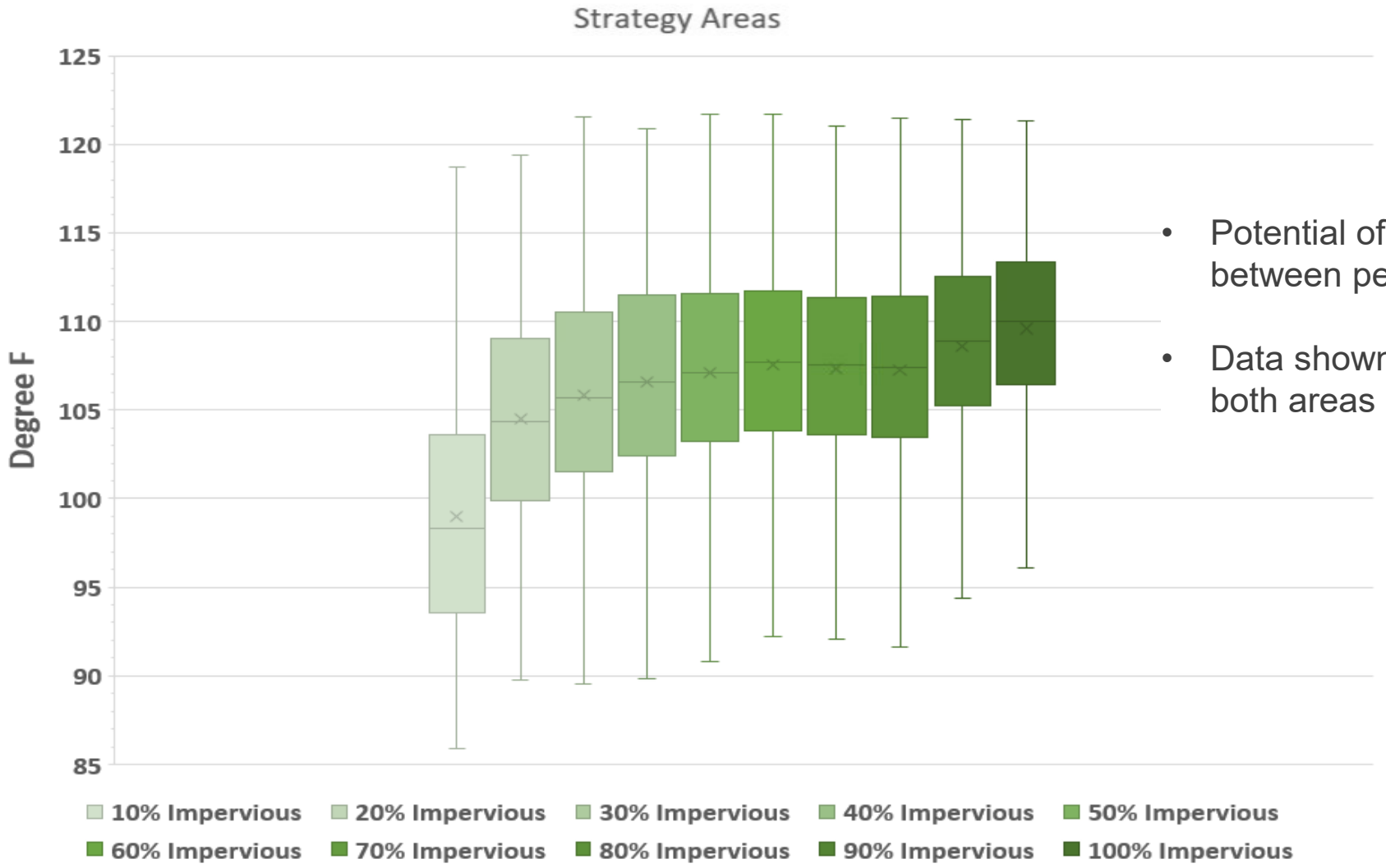
Strategy Areas



- Areas within the County were selected to perform a spatial analysis.
- Selection of the areas was based on the percent impervious with the intention to cover a wider range.

Correlation between Pervious Areas and LST

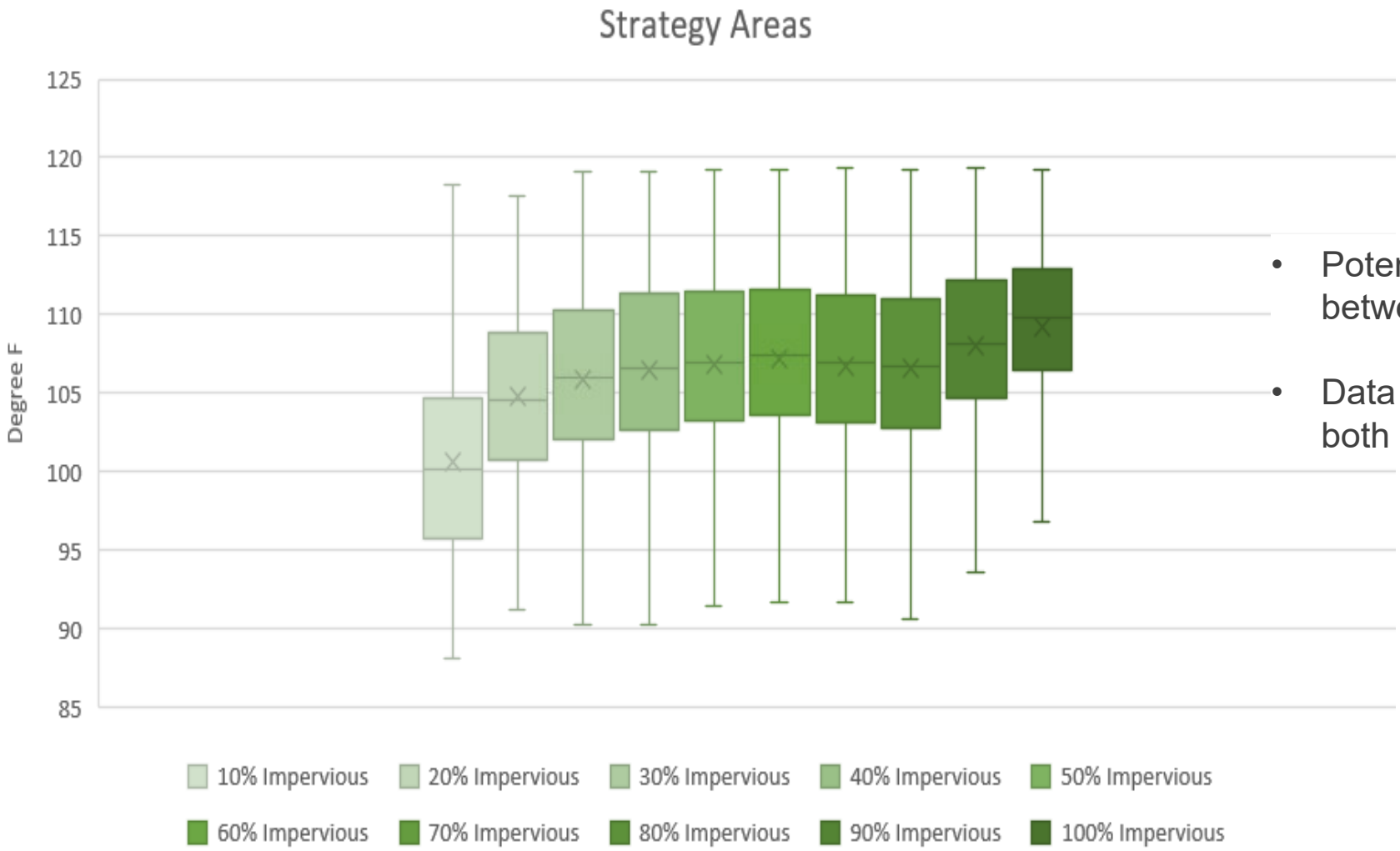
Confirming the 300-foot buffer region



- Potential of a delta of 13 degrees in LST between pervious and impervious
- Data shown compile results obtained in both areas analyzed

Correlation between Pervious Areas and LST

Confirming the 1,000-foot buffer region



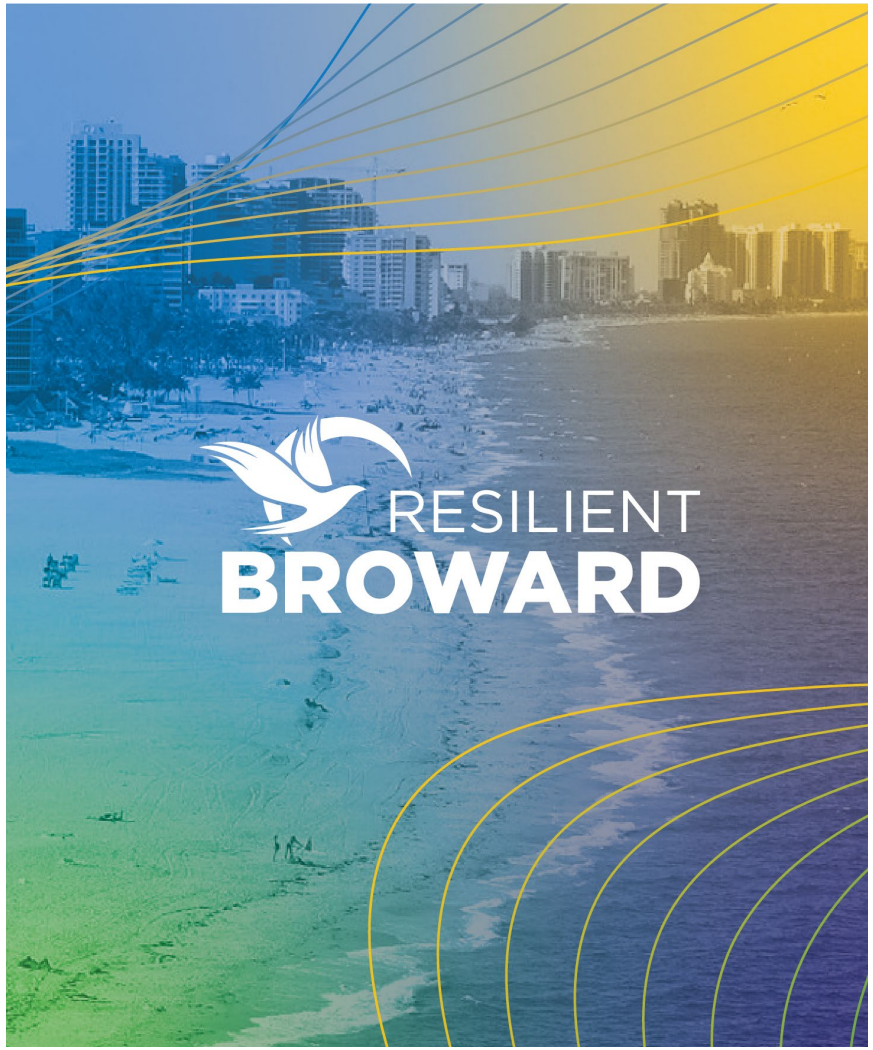
- Potential of a delta of 10 degrees in LST between pervious and impervious
- Data shown compile results obtained in both areas analyzed

Summary

The analysis confirmed a correlation between the percent pervious/imperviousness of a cell and the LST in areas beyond that cell

The analysis has been performed within two test areas in the County

Based on these analyses, a buffer of 1,000 feet will be used to estimate the radius of influence of a Green Infrastructure (GI) BMP that includes changes in pervious areas. These radii of influence will be used to delineate the areas that will also be benefited from the GI.



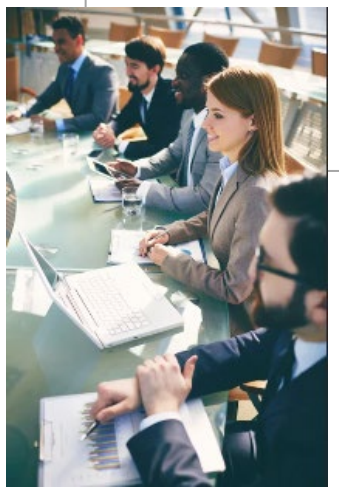
4

Outreach Plan Overview

Hazen

Primary Stakeholder Engagement is ongoing

- The initial set of Primary Stakeholders refers to municipal Public Works/Utilities and Planning Directors, as well as Water Control District Officials
- The first workshop was to describe project and initiate data collection
- The second workshop (5 subregional meetings) focused on corroboration of problem flooding areas and other local nuances, as well as identify what adaptation approaches might be successful



The Stakeholder Engagement Approach is documented in the Outreach Plan

Draft

Deliverable 1.4.6

Outreach Plan

for

Broward County Countywide

Risk Assessment and Resilience Plan

July 13, 2023
Version 1.6

This Outreach Plan was prepared by Brizaga, Inc (subconsultant to Hazen and Sawyer) as Draft Deliverable 1.4.6, authorized under the Broward County Countywide Risk Assessment and Resilience Plan Agreement between Broward County and Hazen and Sawyer.

The Outreach Plan will be modified throughout the project with final outreach deliverables provided under Task 5.

The Outreach Plan defines who is engaged for each task of the project

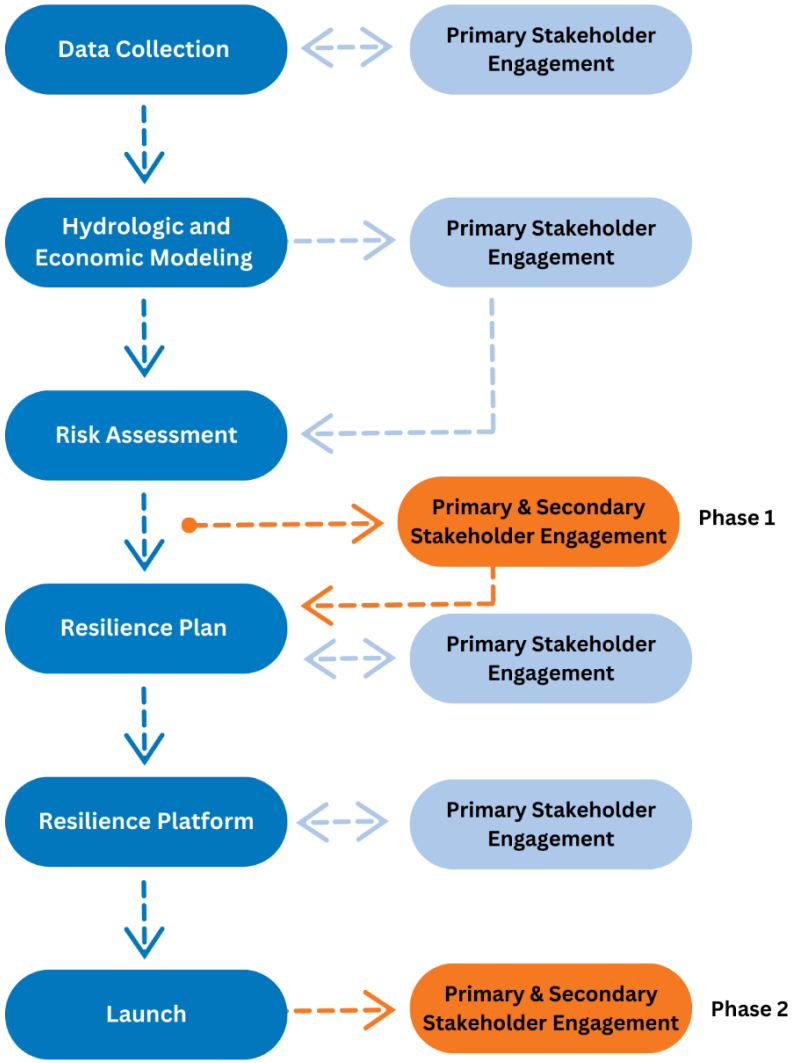
Primary Stakeholders

Elected Officials
County, Municipal, WMD Staff
Technical Experts

Secondary Stakeholders

Business Community
Community-Based Organizations
General Public
Visitors
Prospective Investors/Financial Entities
Institutions

Stakeholder Engagement Diagram



This Resilience Plan

The Initial Goals are Defined in the Draft Outreach Plan

01

Goal 1: Educate the community on climate risk, adaptation, and water management.

02

Goal 2: Gather feedback on the Countywide Risk Assessment and Resilience Plan and build public support for implementing specific adaptation measures.

03

Goal 3: Advance the Broward County community toward significant action on climate adaptation and community-wide resilience.

Examples of Tactics to be Employed by Stakeholder Groups for the Resilience Plan

Subject Matter and Technical Experts

Dedicated Website; **Educational Materials and Videos;** Case Studies; **Educational Programs**

Elected Officials

Dedicated Website; Social Media; Educational Materials and Videos; Newsletters; Educational Workshops; Case Studies; **Emails**; Private Property Adaptation Program; Community Events

The Business Community

Dedicated Website; Social Media; Educational Materials and Videos; Newsletters; Brand and Marketing Materials; Resilience Ambassadors; Educational Workshops; Case Studies; Surveys; Partnerships; Business Signs; Project Planning; **Individual Meetings; Innovative Digital Tools;** Interviews; **Forums and Meetings**

Partners and Community-Based Organization

Dedicated Website; Social Media; Educational Materials and Videos; Newsletters; Brand and Marketing Materials; Resilience Ambassadors; Surveys; **Website;** Signs; **Digital Tools**

Visitors

Dedicated Website; Educational Materials and Videos; Newsletters; Tourist Surveys; Project Signage

General Public Engagement

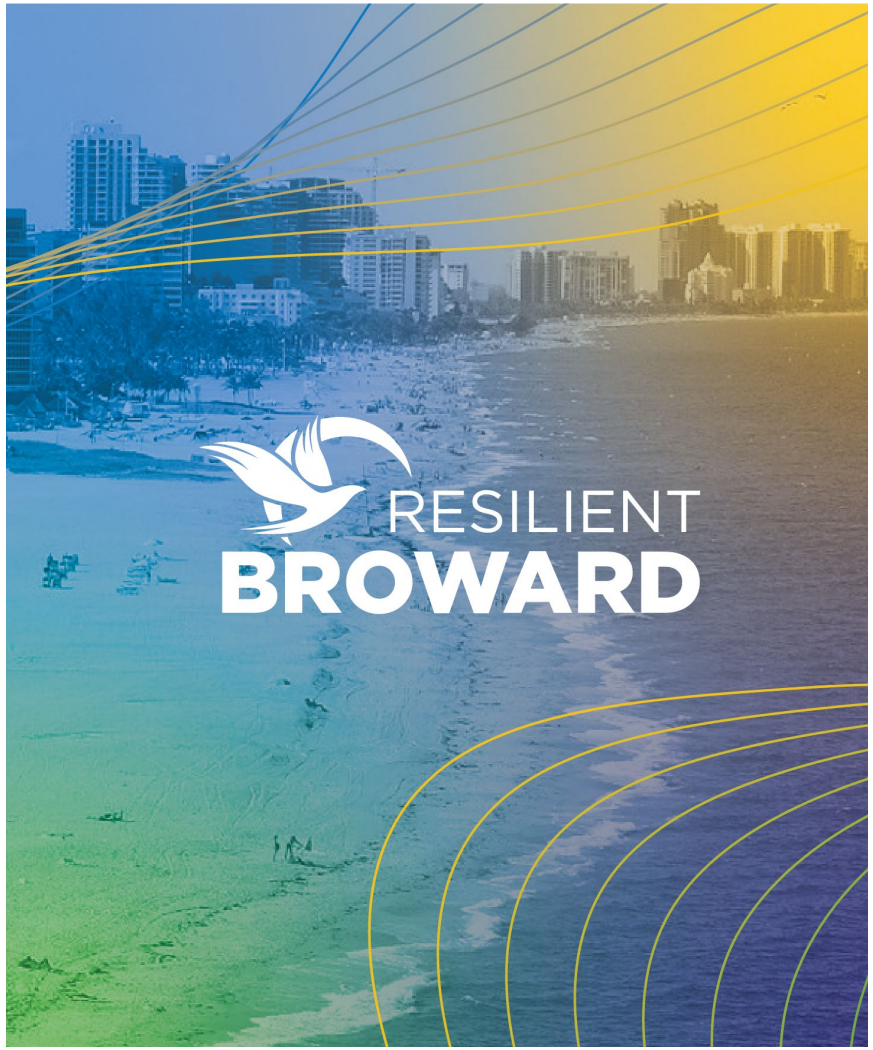
Dedicated Website; Social Media; Brand and Marketing Materials; Resilience Ambassadors; Forums

Prospective Investors & Financial Institutions

Dedicated Website; Social Media; Educational Materials and Videos; Newsletters; Resilience Ambassadors; Educational Workshops; Partnerships

County & Municipal Staff

Educational Materials and Videos; Newsletters; Brand and Marketing Materials; Promotional Materials; Staff Meetings; Staff Workshops; County Point Person



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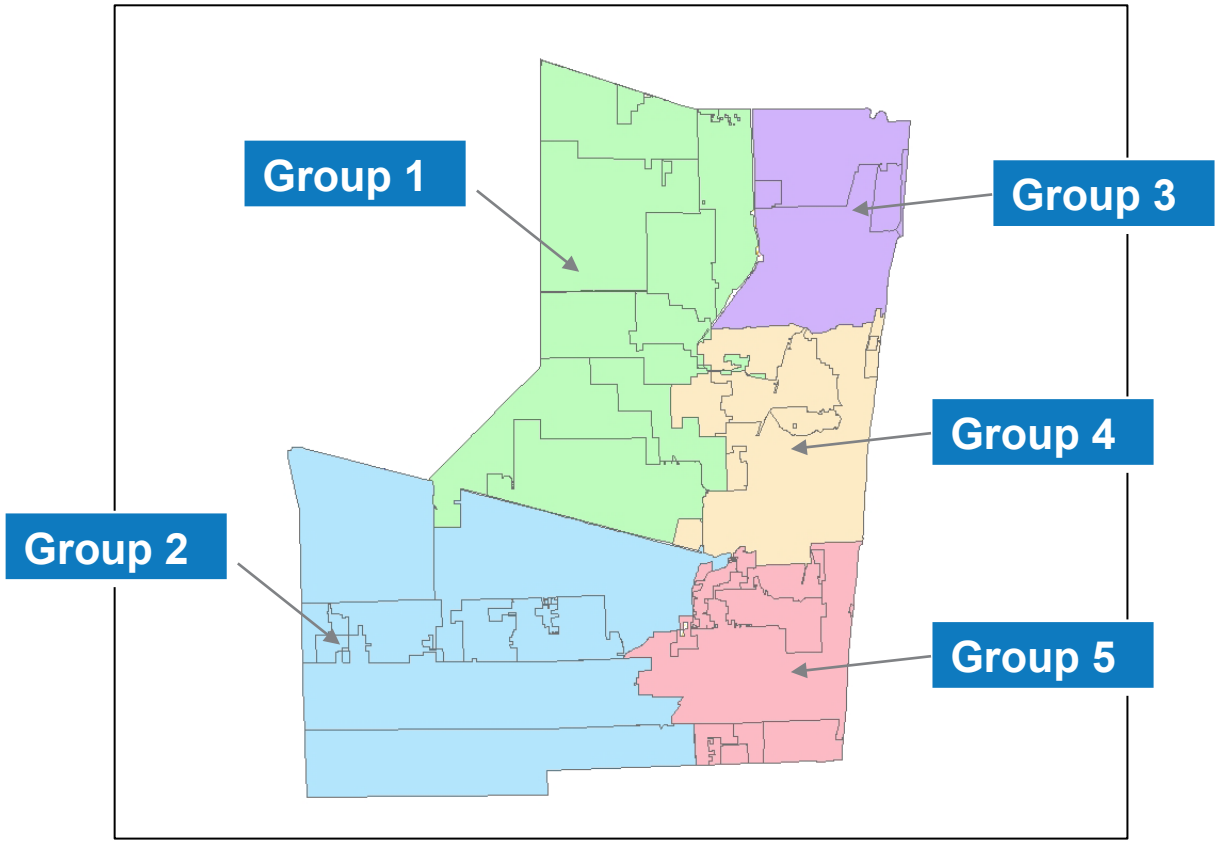
Stakeholder Input from Initial Hydraulic and Hydrologic Results Review

Hazen

Sub-regional Stakeholder Review Workshops helped fine tune the model and informed adaptation strategy



Five meetings were held in **May/June**

The grouping of Stakeholder entities is noted below

GROUP 1

North Lauderdale
Coral Springs
Coconut Creek
Tamarac
Parkland
Plantation
Lauderhill
Margate
Sunrise
Seminole Tribe of Florida
NSID WCD
Old Plantation WCD
Plantation Acres WCD
Pine Tree WCD
Cocomar WCD
Turtle Run WCD
Sunshine WCD
Coral Springs WCD
Coral Bay WCD
Cypress Cove WCD
North Lauderdale WCD

GROUP 2

Davie
Southwest Ranches
Weston
Pembroke Pines
Miramar
Cooper City
South Broward WCD
Indian Trace WCD
Bonaventure WCD
Central Broward WCD
Tindall Hammock WCD

GROUP 3

Pompano Beach
Deerfield Beach
Hillsboro Beach
Lighthouse Point
Broward WCD

GROUP 4

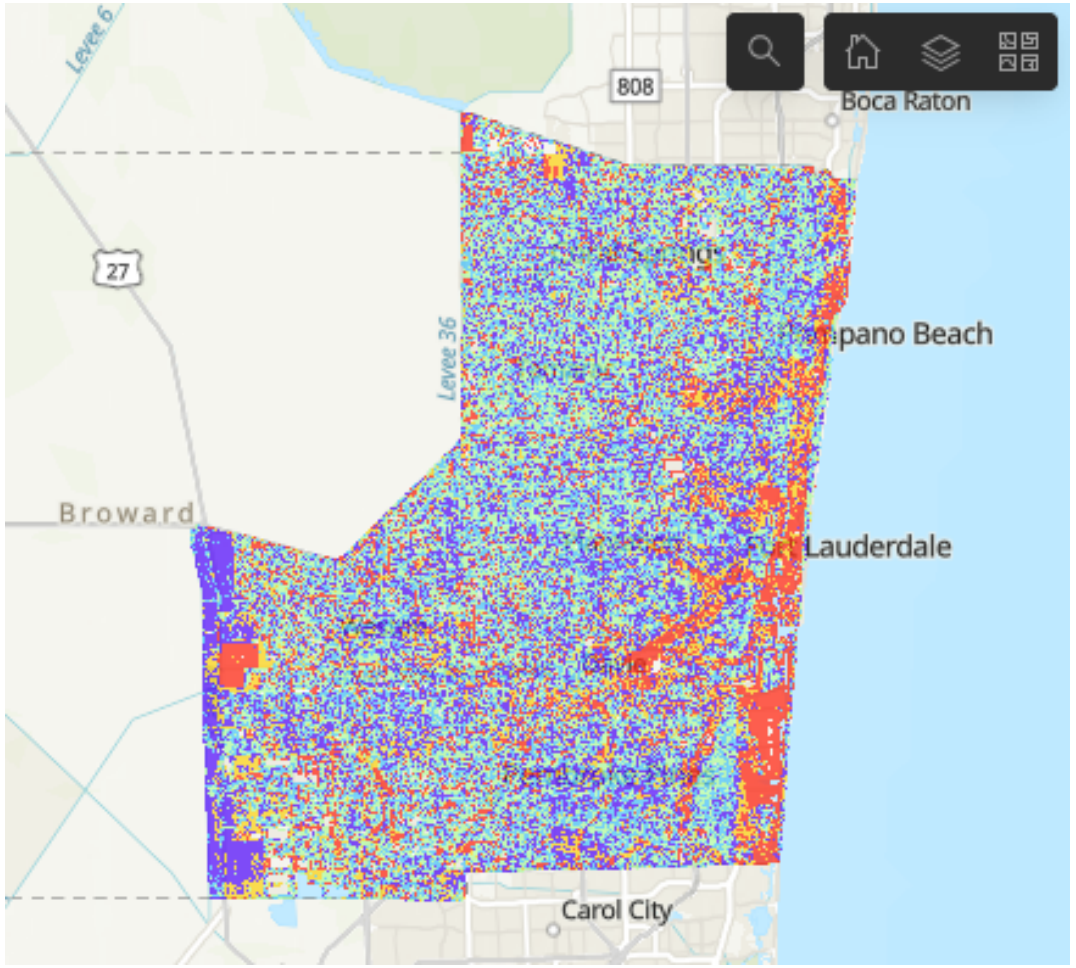
Fort Lauderdale
Lauderdale Lakes
Wilton Manors
Lauderdale-By-The Sea
Sea Ranch Lakes
Lazy Lake
Oakland Park
Lauderdale Isles WCD

GROUP 5

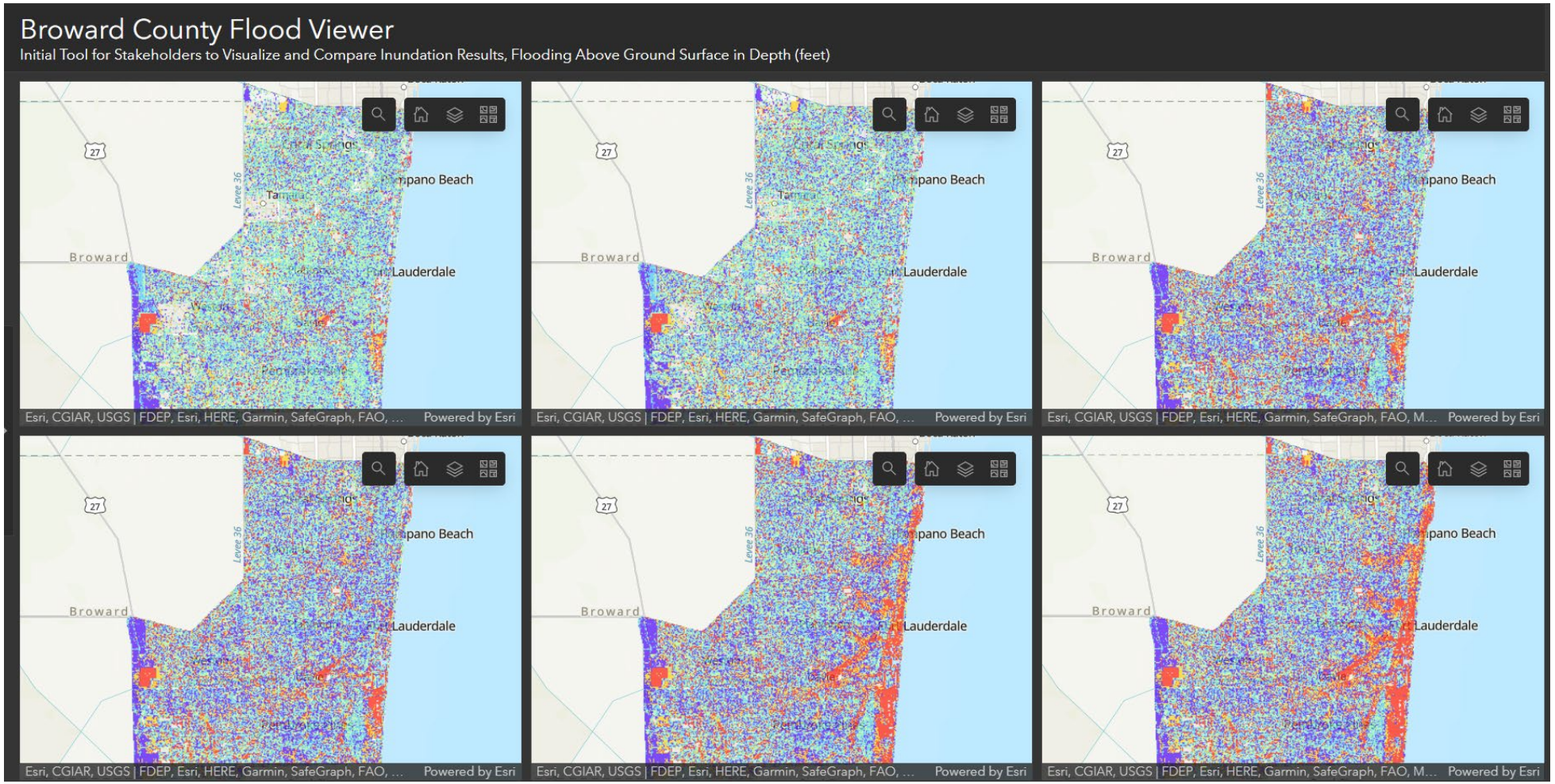
Dania Beach
Hollywood
Hallandale Beach
West Park
Pembroke Park
Seminole Tribe of Florida
Oakridge WCD
Twin Lakes WCD

Prior to the meetings, we posed three questions to Stakeholders:

- Are the model results generally provided consistent with your experience from extreme storm events and/or other flood vulnerability analyses of your community?
- Are there areas of your community identified as focal points for attention regarding the economic impact?
- Are there mitigation strategies that your community has found particularly helpful (or not) based on the general conditions in your jurisdiction?



We used the Review Tool to address specific questions/comments



Model results' prediction of heavily impacted areas were confirmed

BROWARD COUNTY FLORIDA

COUNTYWIDE RISK ASSESSMENT AND RESILIENCE PLAN

Resilience Plan Steering Committee

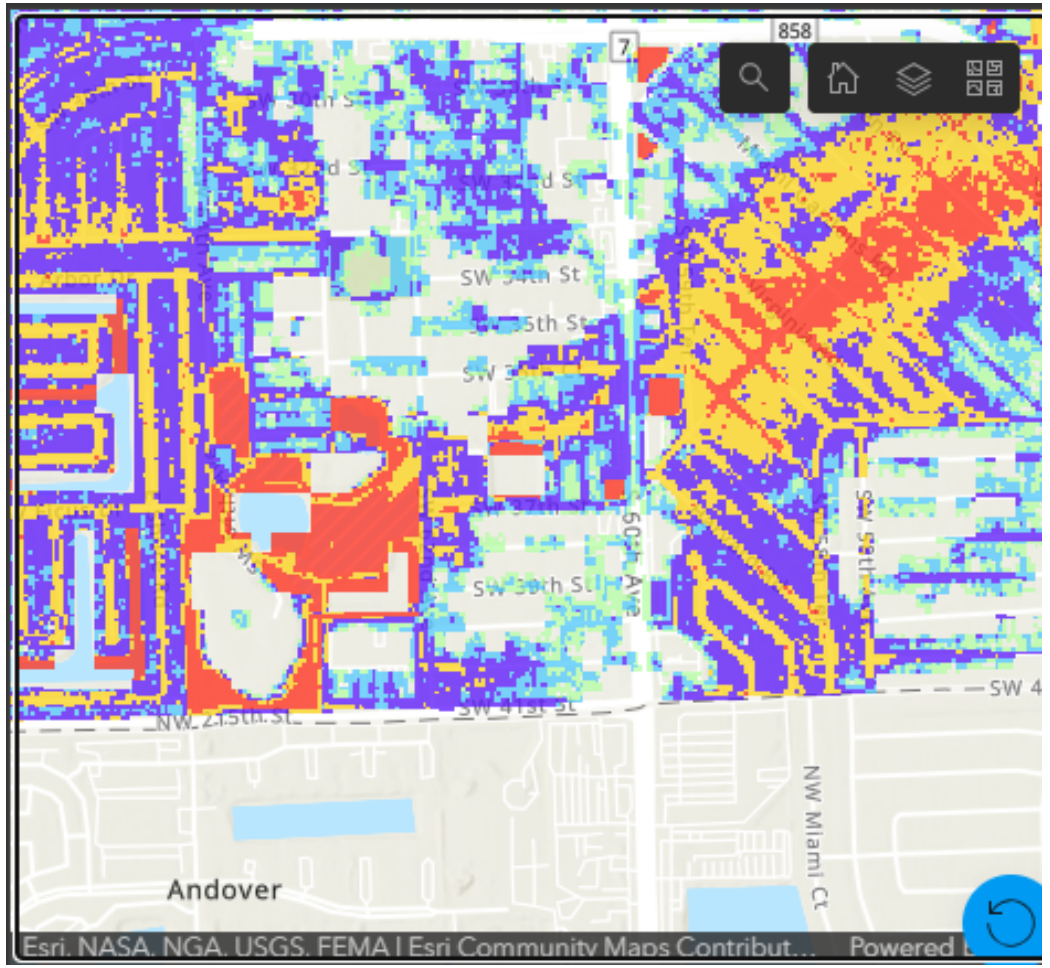
April 12, 2023

There was strong participation in each of the five sessions, and feedback from the stakeholders was encouraged and received.

	Meeting Number, Date and Time				
	1	2	3	4	5
	05/22 11:00 am	05/22 3:30 pm	05/30 1:00 pm	06/30 11:00 am	06/05 3:00 pm
Number of Attendees		26	22	21	
Number of Organizations Represented					

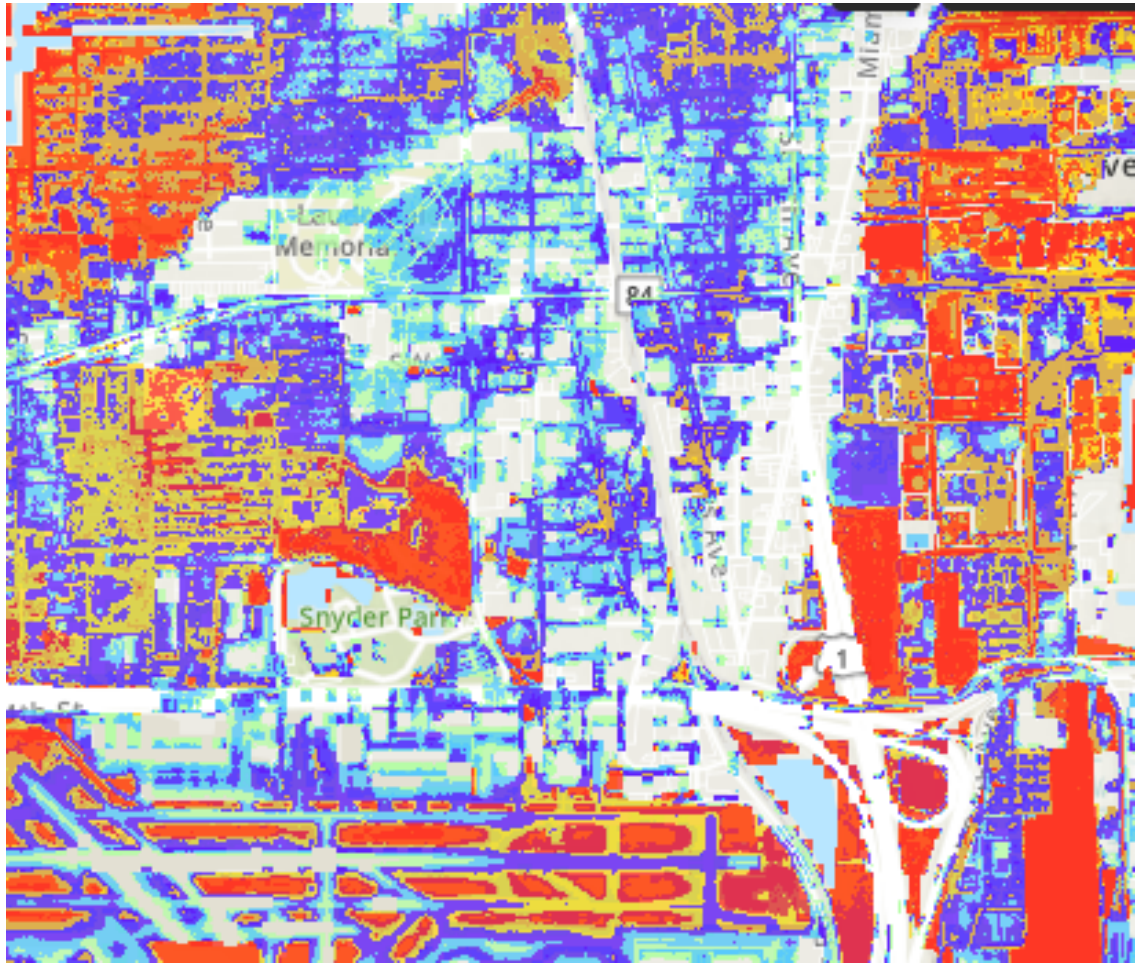
Some of the specific observations (by stakeholders) are as follows:

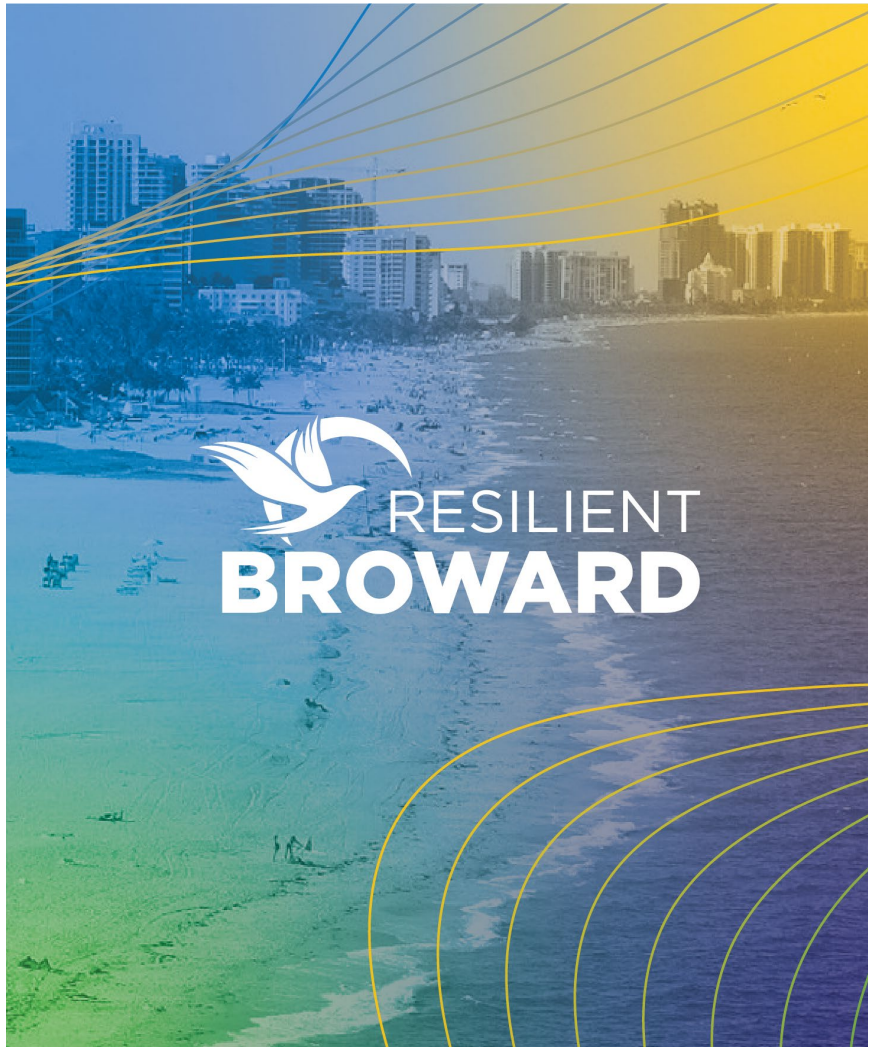
- All communities providing input indicated their observations corroborated model results. Those included: Tamarac, North Lauderdale, Plantation, Weston, Pompano Beach, Oakland Park, Hollywood, Deerfield Beach, Lighthouse Point, Oakland Park, West Park (Miami Gardens neighborhood)
- Some stakeholders noted confirmation of need for planned CIP's (Deerfield Beach, Plantation)
- SBDD – noted issues with DEM around areas of new construction; suggested layer with groundwater elevation
- Broward – noted issues around Prospect Wellfield and some issues around interface with water bodies
- Fort Lauderdale asked whether City infrastructure was integrated and if flows from the west were included. "Yes" to both.



Key overall takeaways included:

- Model results appear to confirm observations from recent extreme events (TS Eta, April 12/13 storm)
- Strong degree of consistency between model predictions and stakeholder observations
- Noted areas of adjustments (and updated model accordingly)
  - Around wellfield drawdown
  - DEM in areas of recent land development
- Yielded necessary confidence to accept baseline model and move forward





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Adaptation Strategy Kickoff

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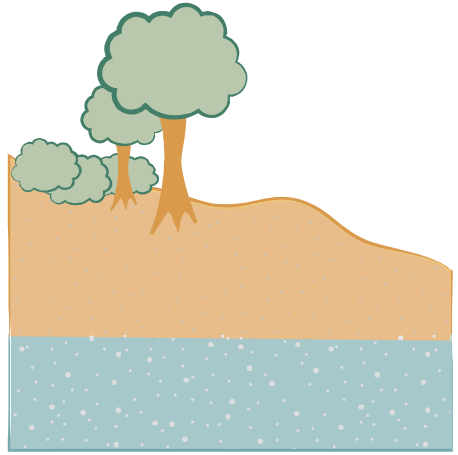
Adaptation strategies must consider a number of factors; sometimes in compounding fashion

Extreme Rainfall Event

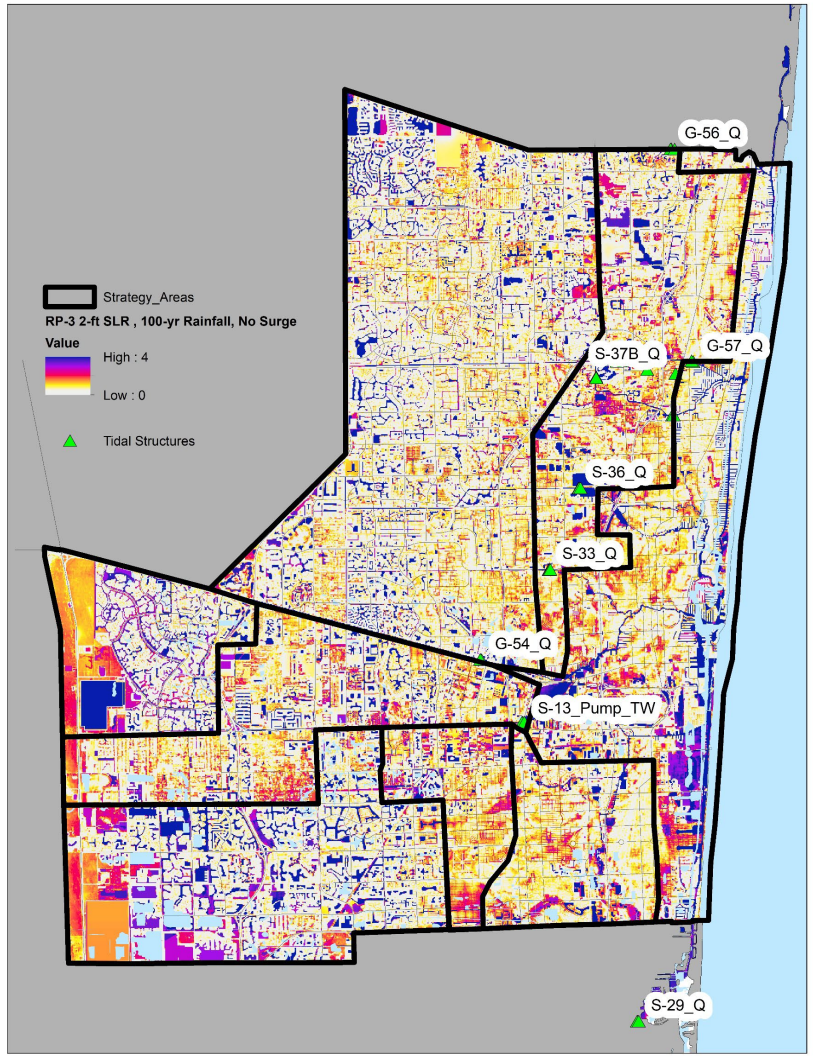
Storm Surge

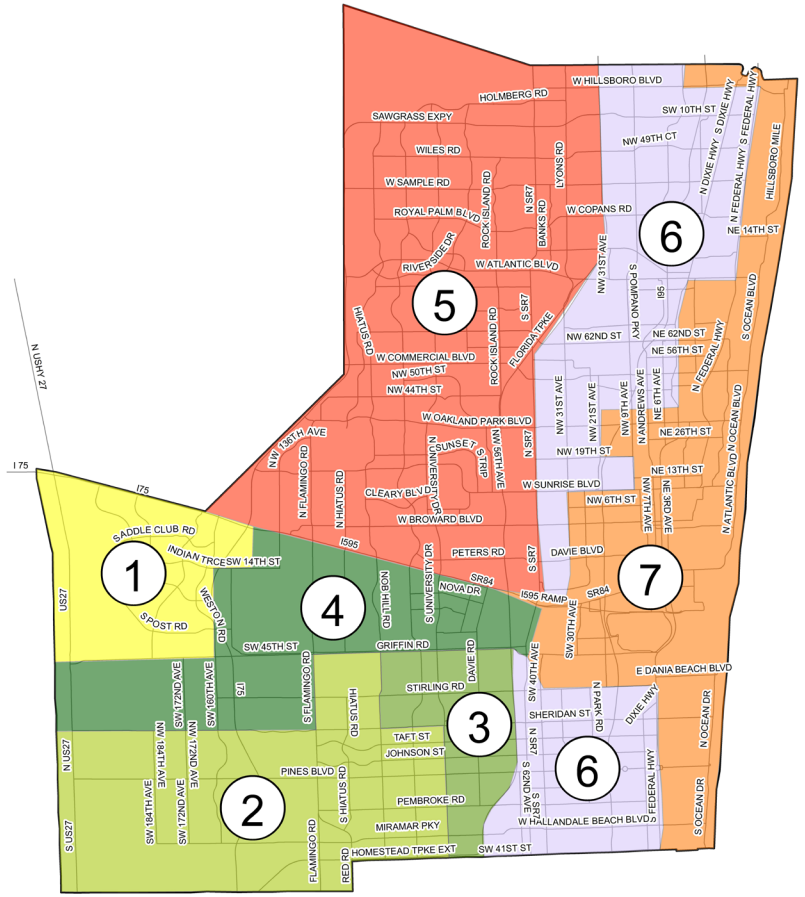
Extreme Tides/SLR



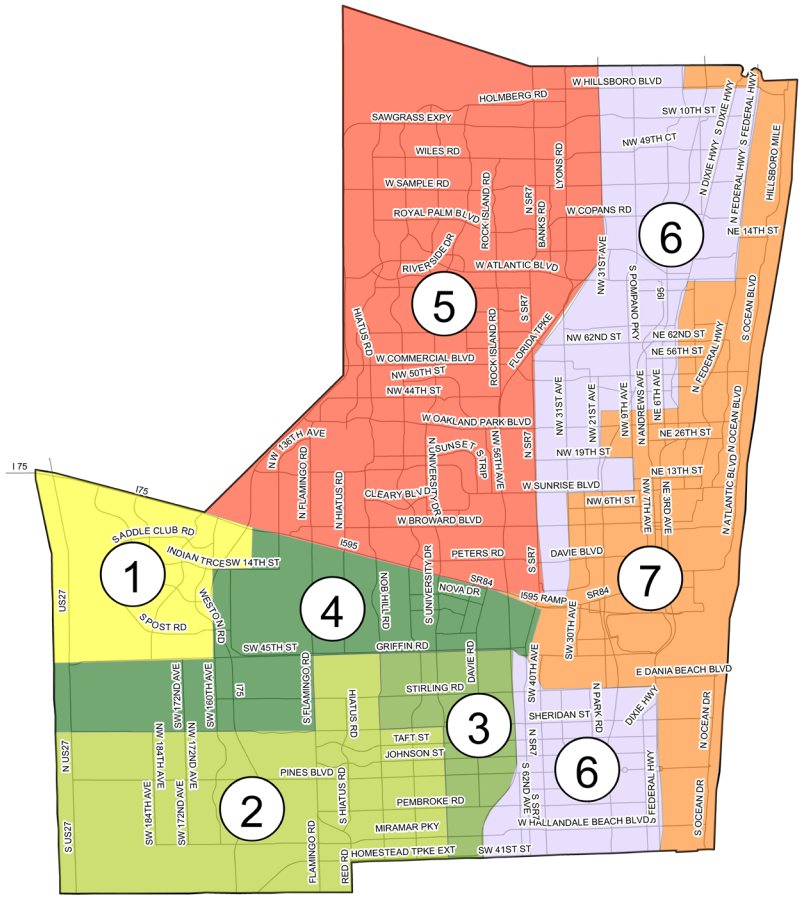
Antecedent Conditions

The hydrologic and hydraulic model results we just discussed are driving the adaptation strategy selection and distribution





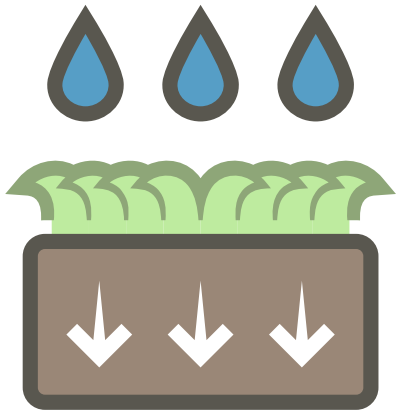
Evaluation of those baseline results provided some general direction relative to our adaptation strategies



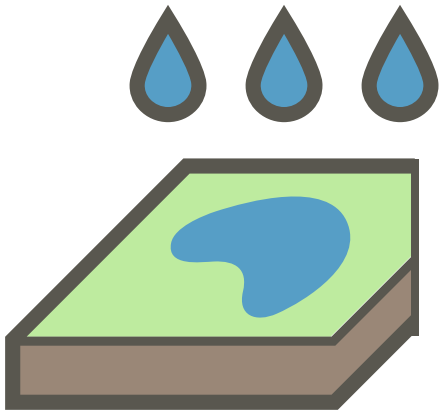
Zone	Preliminary Strategy
1	• Explore Pre-storm operations to gain storage ahead of the storm. • Manage discharges to allow other areas to drain.
2	• Explore Pre-storm operations to gain storage ahead of the storm. • Manage discharges to allow other areas to drain. • Maintain beneficial site storage.
3	• Add conveyance improvements, probably based on energy. • Identify storage opportunities.
4	• Maintain beneficial site storage. • Target flooding spots based on cost of damages. • Explore Pre-Storm Operations to gain storage.
5	• Identify storage to reduce runoff. • Manage storage ahead of the storm.
6	• Minor opportunities for storage. • Improve gravity-based conveyance. • Add energy.
7	• Manage and protect coast. • Add artificial and natural barriers. • Incorporate energy-based conveyance improvements.

Primary strategies are being developed around four major concepts (delivered in multiple ways)

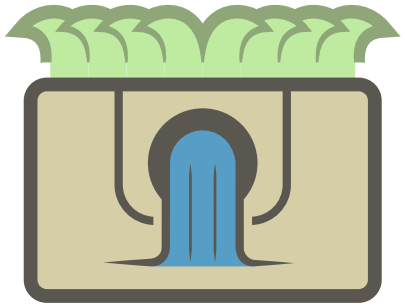
- Policy
- Infrastructure
- Procedures
- Regulation



Runoff Reduction



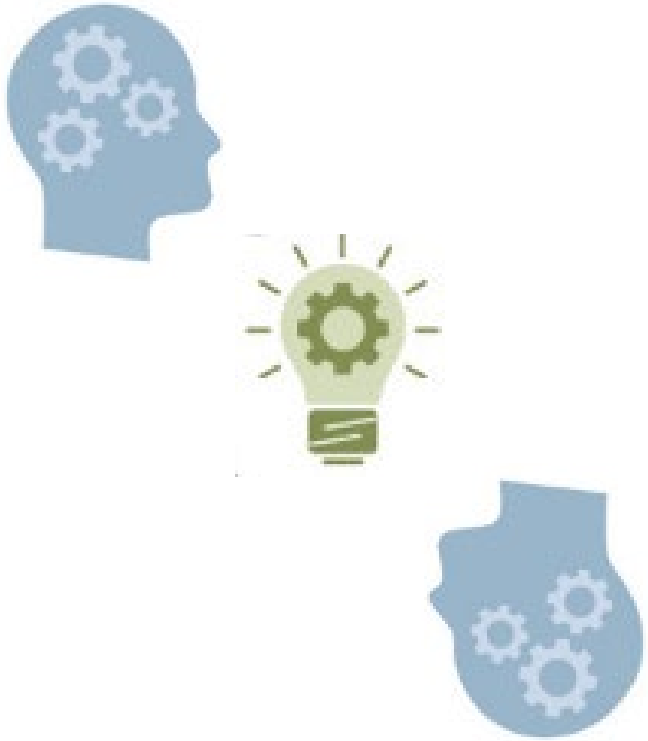
Runoff Storage



Strategic Conveyance/ Discharge

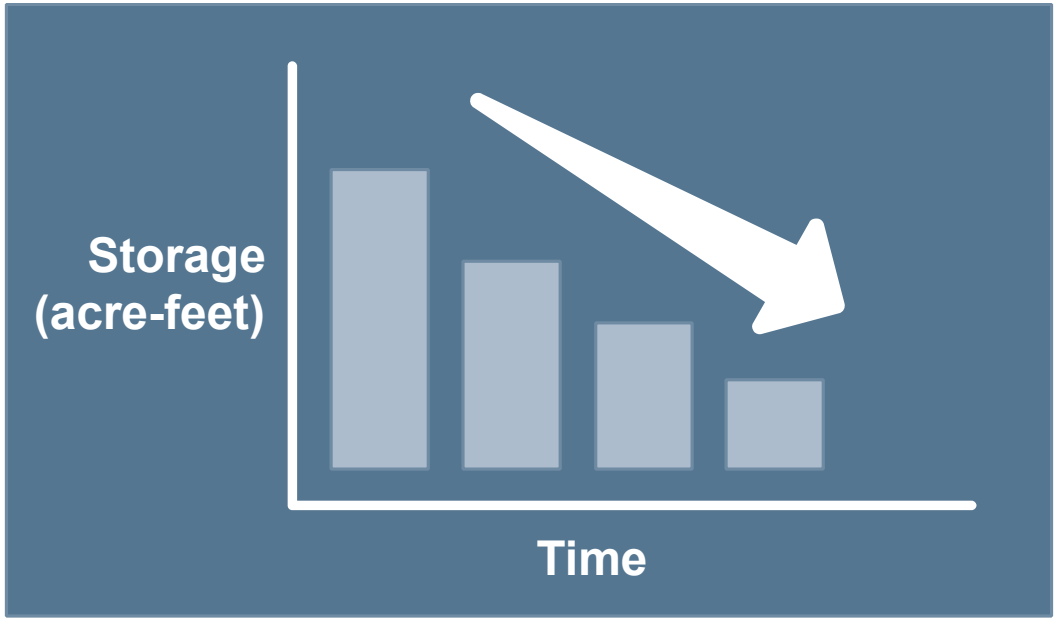
Adapting to Water

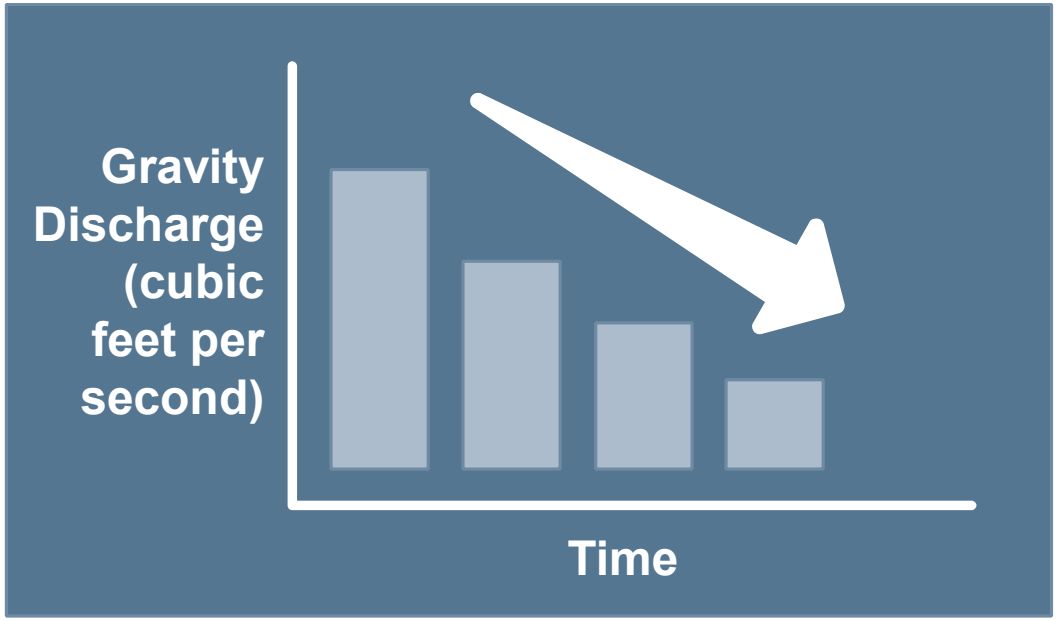
These adaptation strategies must also incorporate a necessary paradigm shift in how we think about flood control



- Historically passive, gravity-controlled systems (except at WMD/ WCD levels)
- Primary consideration was the immediate land use and onsite infrastructure (master of your own destiny)
- Growth, rising seas and groundwater, etc. have changed things
- Surrounding conditions (rising tides, regional systems, etc.
- Competition for discharge capacity
- Requires new approach – much more actively managed, coordinated timing of discharges, pre-storm operations
- Systematic reclamation of storage (soil and surface)

Future sea level rise and groundwater rise will inherently reduce our ability to store and drain runoff via gravity

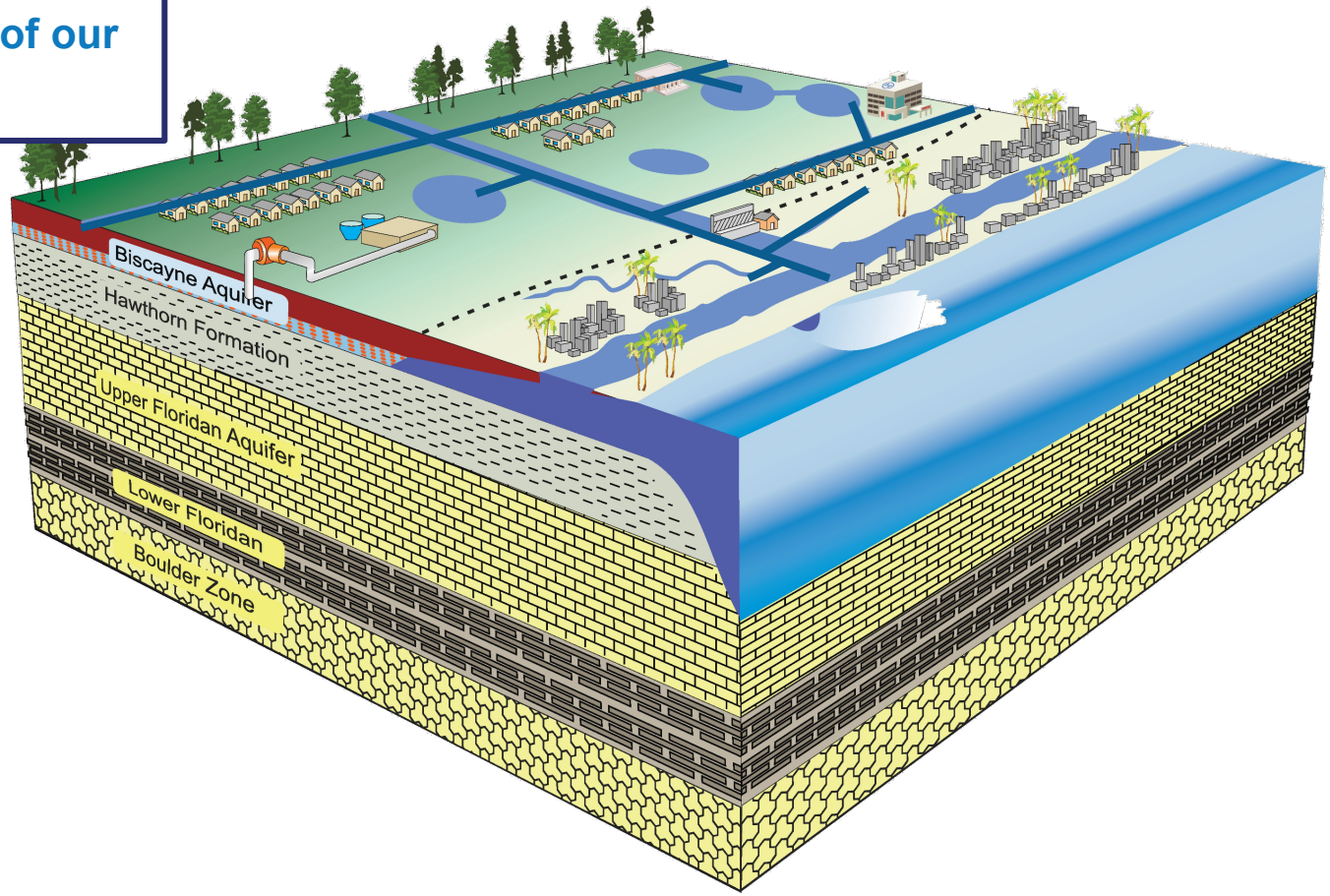




Purposeful development/redevelopment can help offset those impacts

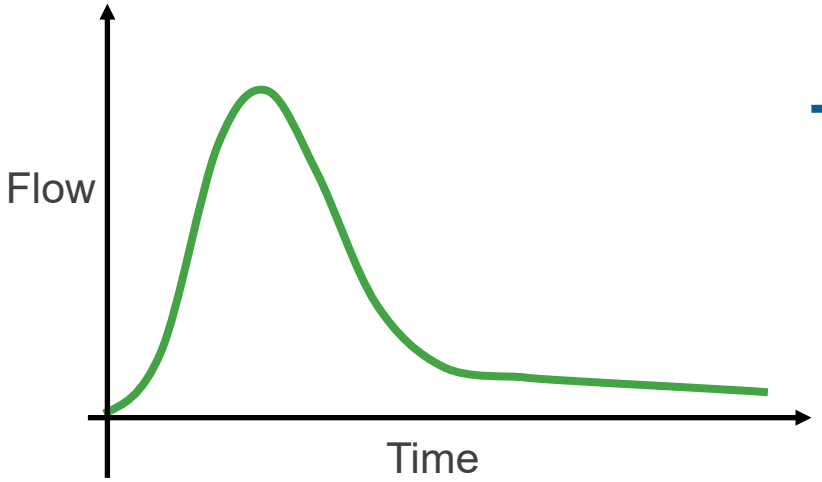
Strategically timing discharges in watersheds will be important…

To represent this, we will draw a schematic of our drainage system

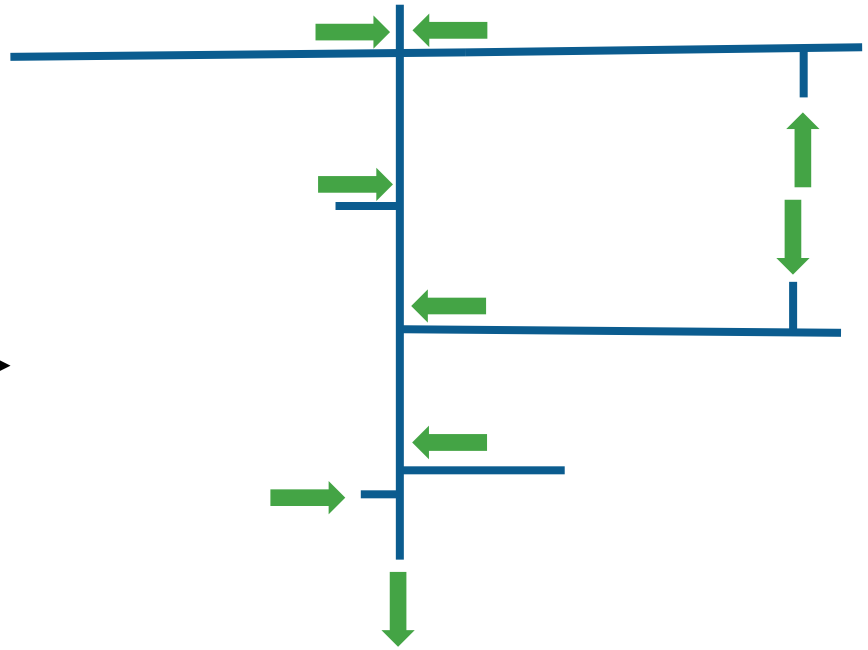


Strategically timing discharges in watersheds will be important…

Conventional wisdom is to attenuate the peaks…



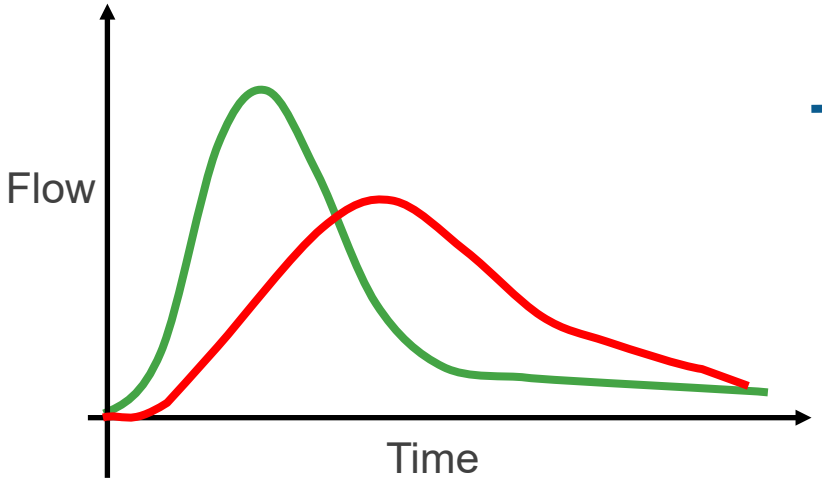
Uncontrolled discharges: higher peaks, shorter durations



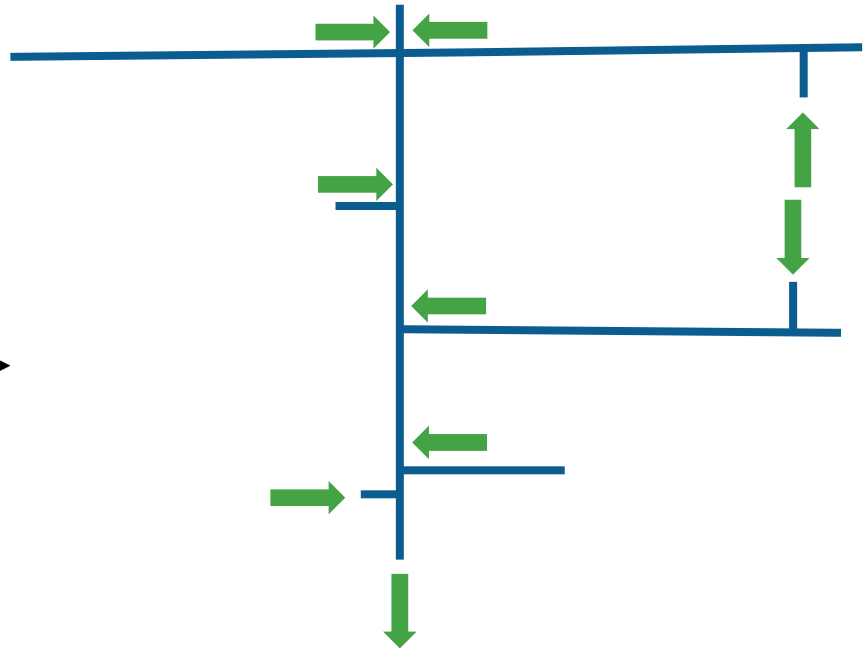
Green Arrows represent uncontrolled discharges

Strategically timing discharges in watersheds will be important…

Conventional wisdom is to attenuate the peaks…



Controlled discharges (current system): lower peaks, longer durations

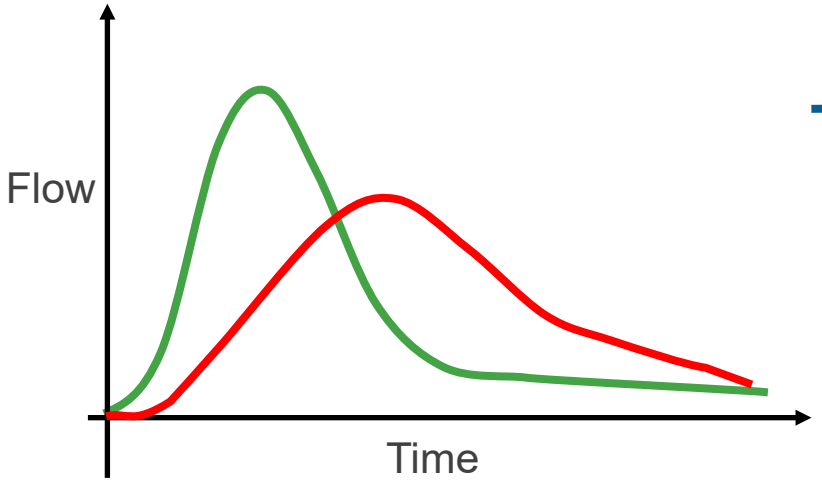


Green Arrows represent uncontrolled discharges

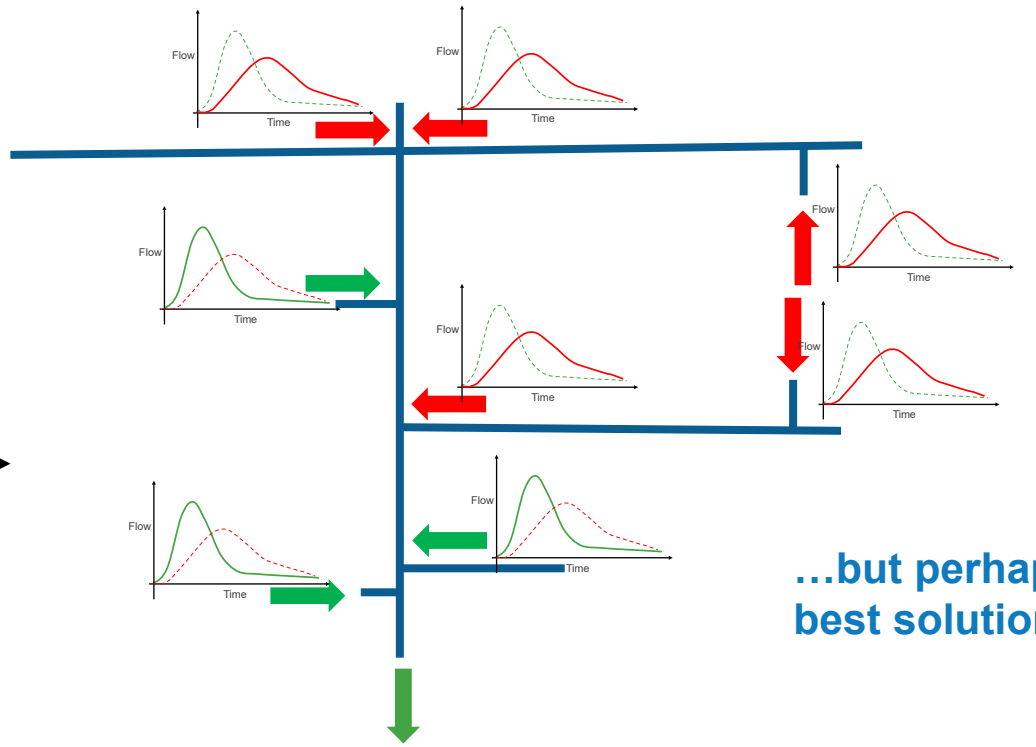
Red Arrows represent controlled discharges

Strategically timing discharges in watersheds will be important…

Conventional wisdom is to attenuate the peaks…



Optimize discharges to minimize impacts



Green Arrows represent uncontrolled discharges

Red Arrows represent controlled discharges

…but perhaps that is not the best solution in all basins.

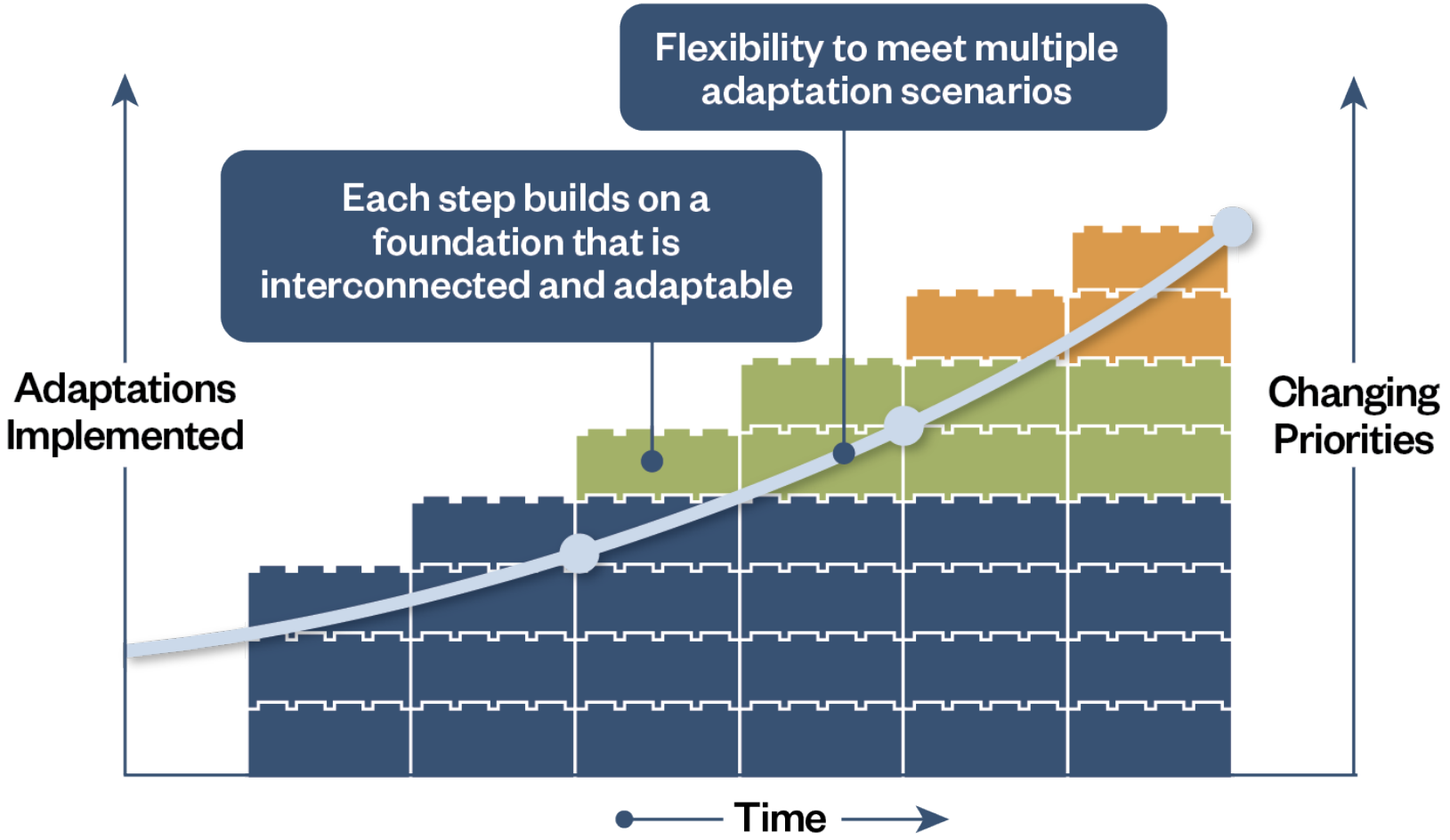
…and real time data can help optimize these “cascading discharges”

Adaptation strategies are now being built into our baseline model

- The team is currently working to translate concepts into real, testable suites of improvements
- Day long internal workshop August 28th
  - **Advancing spatial application of strategies**
  - **Working with modelers to incorporate into the baseline model**

  - **Add a photo – from some similar previous effort – with a half dozen people in conference room; maybe with white board or maps, and someone must have computer**

Implementation of adaptations must provide for future, incrementally beneficial investment



Eleven Departments Participated in the Sample Risk Assessment…

- Resilient Environment Division
- Construction Management
- Construction Engineering
- Highway Construction engineering
- Parks
- Aviation Construction PM
- Aviation
- Facilities maintenance
- Administration
- Port
- Transportation

…To ensure that the methodology is consistent and appropriate for each Department.

We performed the risk analysis for a sample set of 20 critical assets

Risk Factor = Criticality Score * Vulnerability Score

DEFINITIONS

- **Risk Factor:** Numerical indicator quantifying the level of risk associated with an asset. The calculation of the Risk Factor combines vulnerability and criticality characteristics. Risk Factor is used for comparison and prioritization.
- **Criticality Score:** Numerical score that indicates how critical an asset is, informed by County's input and based on several factors as described later in this document. This is scored by County.
- **Vulnerability Score:** Numerical score that indicates how exposed an asset is to flooding hazards. The calculation of the Vulnerability Score is informed by the results of County's Hydrological and Hydraulic (H&H) model (hazard) and the asset elevation (exposure). This is scored by Hazen.

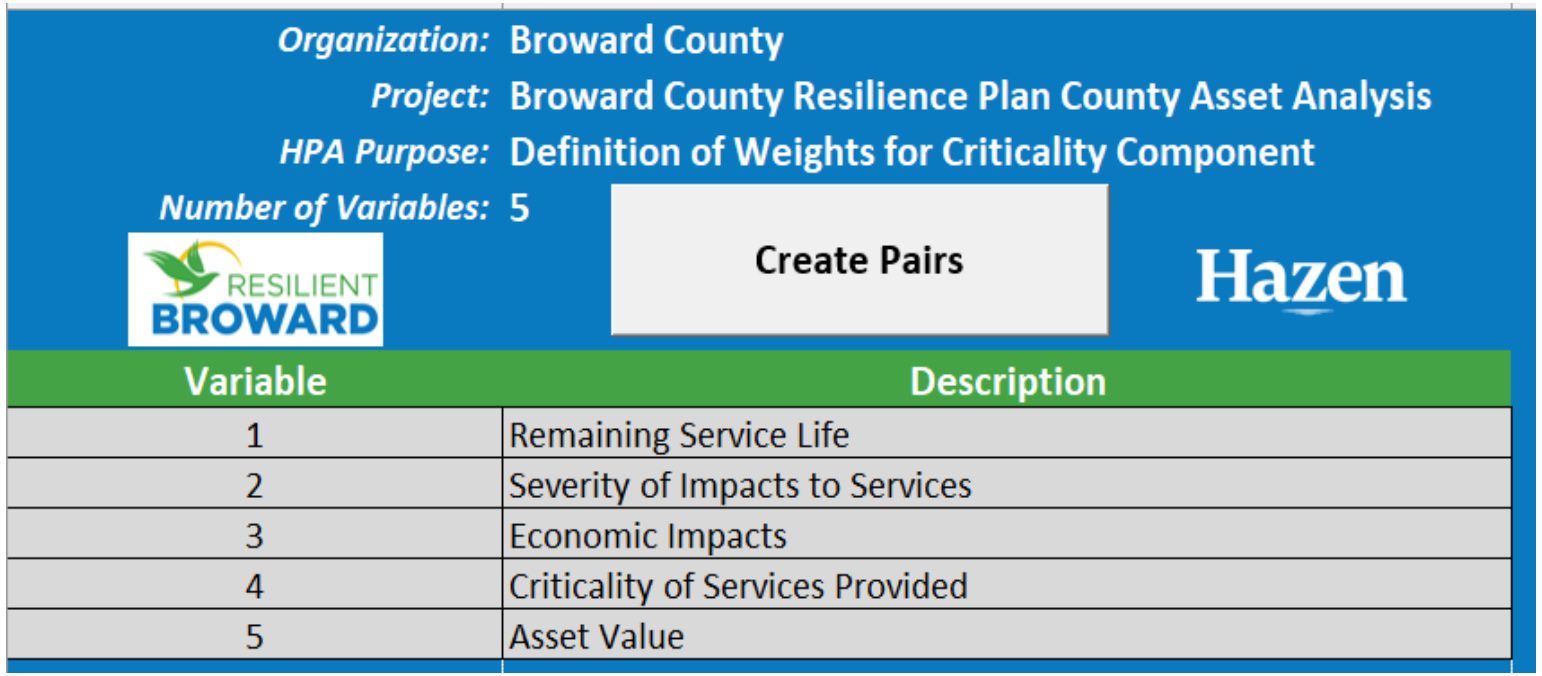
To determine criticality, each asset must be scored for each criteria. The team initiated the analysis with criteria and scoring as follows

Score (Points)	Remaining Useful Life	Severity of Impacts to Services	Economic Impacts	Criticality of Services Provided	Asset Value
1	Less than 5 years	Not Sensitive	No impact	Least Critical	Less than $400,000
2	10 years – 5 years	Slightly Sensitive	Not significant to the community	Slightly Critical	$400,000 - $1,000,000
3	30 years - 10 years	Moderately Sensitive	Fairly significant to the community	Moderately Critical	$1,000,000 - $5,000,000
4	50 years – 30 years	Very Sensitive	Moderately significant to the Community	Very Critical	$5,000,000 - $10,000,000
5	Over 50 years	Most Sensitive	Significant to the Community	Most Critical	Greater than $10,000,000

Note: Each factor should be scored independently by selecting the appropriate description associated with a point score.

…The scoring technique for each criteria were reviewed with the group and confirmed.

Then, County/Hazen utilized a pairwise comparison tool that allowed the group to properly select the weights for the criteria.



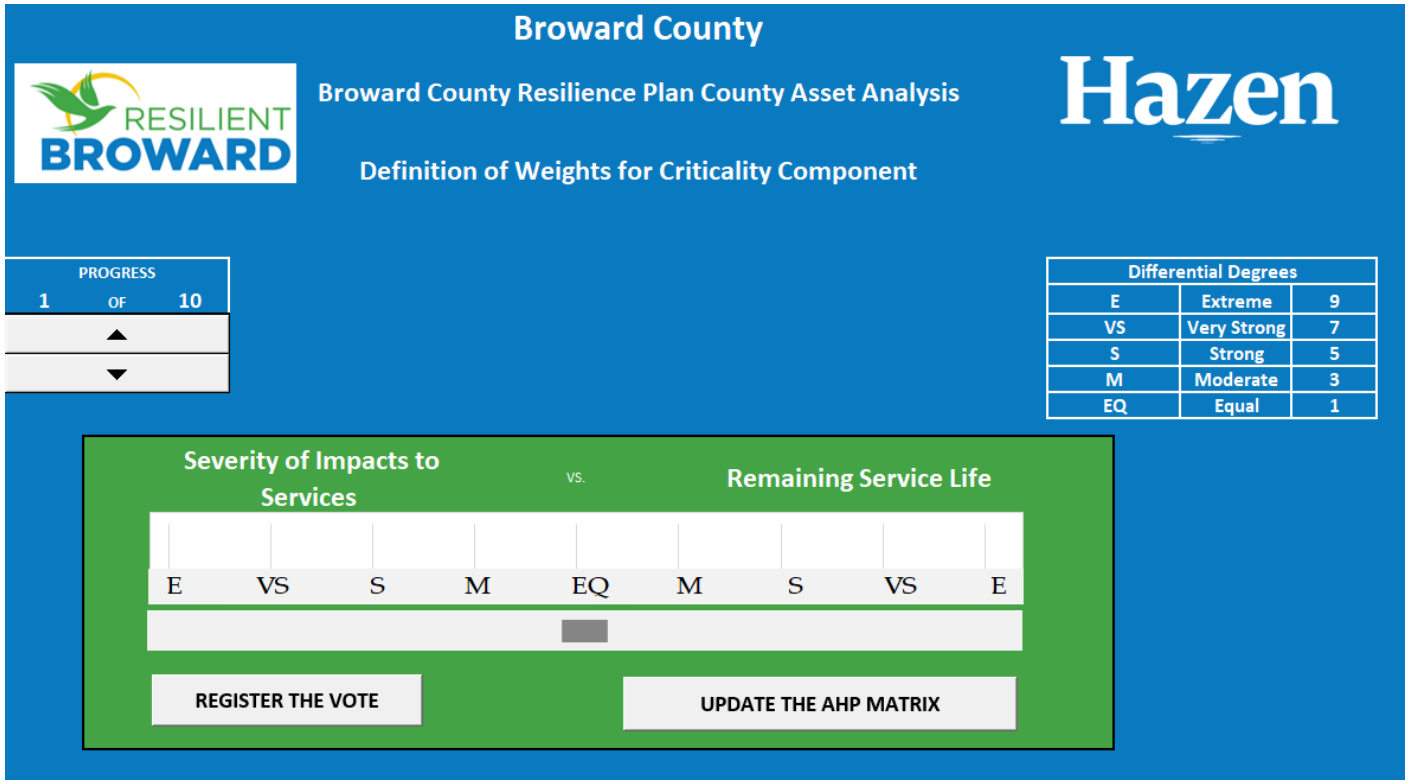
Organization: Broward County
Project: Broward County Resilience Plan County Asset Analysis
HPA Purpose: Definition of Weights for Criticality Component
Number of Variables: 5

Create Pairs

Variable	Description
1	Remaining Service Life
2	Severity of Impacts to Services
3	Economic Impacts
4	Criticality of Services Provided
5	Asset Value

In a pairwise comparison, voters assess all combinations.
Results are tabulated and processed.
The process was used to obtain weights for the criteria.

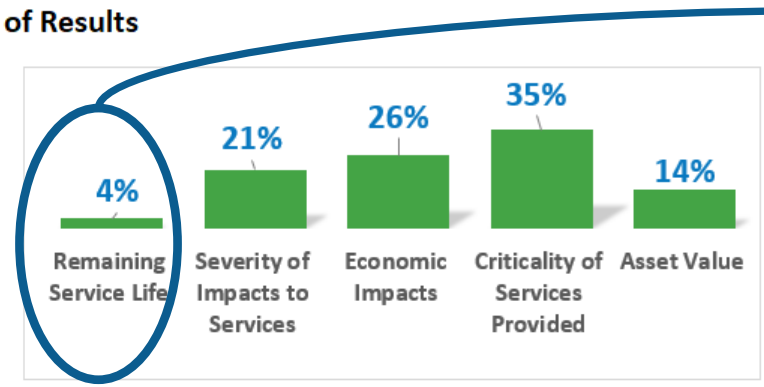
The tool created all possible pairs. The group voted on each pair, assigning the degree of importance to each criterion as related to the other component of each pair.

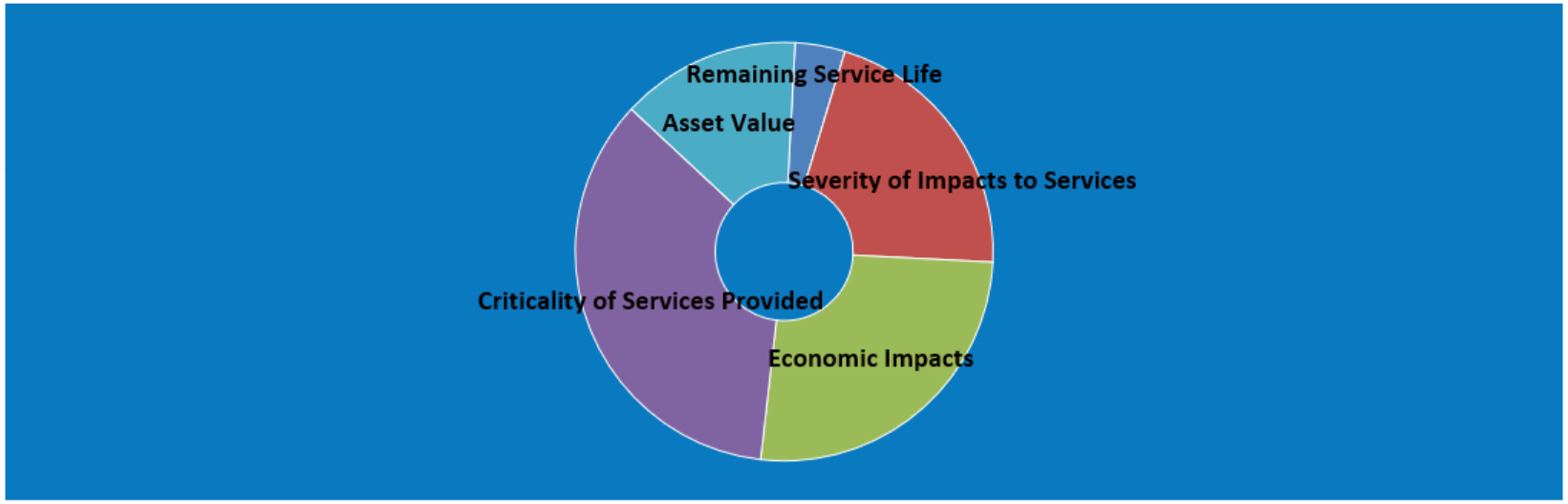


The output of the tool showed us the compiled results of all the pairwise comparisons.

The weights resulted from the pairwise comparison exercise.

Variable	Description	Weight	Order	Cummulative Weight
1	Remaining Service Life	4%	5	4%
2	Severity of Impacts to Services	21%	3	25%
3	Economic Impacts	26%	2	51%
4	Criticality of Services Provided	35%	1	86%
5	Asset Value	14%	4	100%



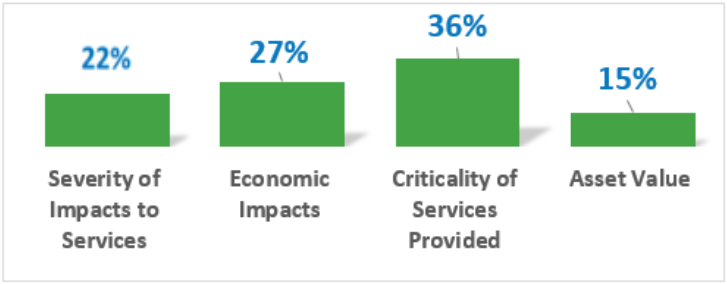


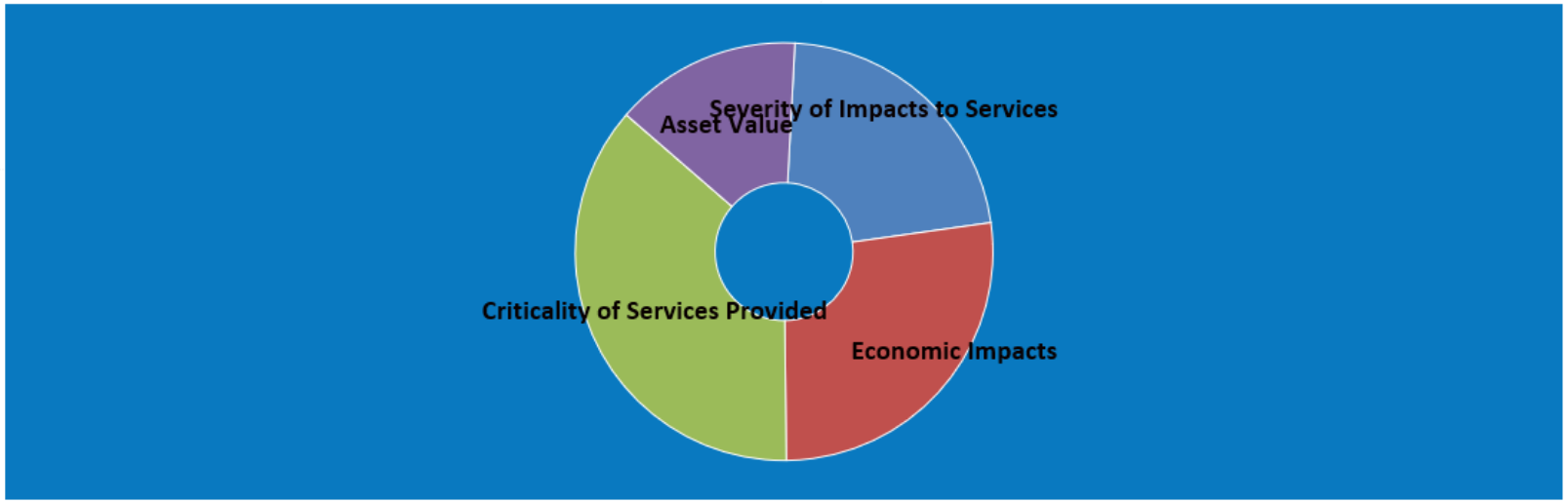
County/Hazen decided to drop this criterion and spread the 4% among the other four criteria.

The County revised the criteria to remove the “remaining useful life” criterion and reassigned the four percentage points

Summary of Results

Variable	Description	Weight	Order	Cummulative Weight
2	Severity of Impacts to Services	21%	3	22%
3	Economic Impacts	26%	2	49%
4	Criticality of Services Provided	35%	1	85%
5	Asset Value	14%	4	100%





20 Critical Assets were then Ranked by the County:

The 20 example assets are listed on this table.

Asset No.	Asset	Severity of Impacts to Services	Economic Impacts	Criticality of Services Provided	Asset Value
1	Animal Care				$5,000,000 -$10,000,000
2	Convention Center				Greater than $20,000,000
3	County courthouse - Broward County Judicial Complex (downtown)				Greater than $20,000,000
4	North Regional Courthouse				$10,000,000 - $20,000,000
5	West Regional Campus (Courthouse, Library and EOC)				Greater than $20,000,000
6	Governmental Center (East)				Greater than $20,000,000
7	Governmental Center West				Greater than $20,000,000
8	Transit facility on Ravenswood				Greater than $20,000,000
9	Transit facility, Lauderhill				Less than $1,000,000
10	Stirling Road Library				$1,000,000 - $5,000,000
11	North county beach park				Less than $1,000,000
12	BSO fire station				Less than $1,000,000
13	BARC Central				$10,000,000 - $20,000,000
14	BARC Booher				$5,000,000 - $10,000,000
15	Tradewinds Park (North)				$5,000,000 - $10,000,000
16	C.B. Smith Park (south)				$1,000,000 - $5,000,000
17	Central Broward Regional Park (East)				$5,000,000 - $10,000,000
18	Markham Park (West)				$1,000,000 - $5,000,000
19	Delevoe Park (BMSD)				$5,000,000 - $10,000,000
20	Edgar P. Mills Multi-Purpose Center				$10,000,000 - $20,000,000

Hazen entered values for this criterion

County scored the assets for each of these three criteria

The Results of Ranking the Sample Set of 20 Critical Assets:

Asset No.	Description/Location	Severity of Impacts to Services	Economic Impacts	Criticality of Services Provided	Asset Value (Building)	Criticality Score	Criticality Rank No.
5	West Regional Campus (Courthouse, Library and EOC)	4 Very Sensitive	4 More Than Value of Asset	5 Most Critical	Greater than $20,000,000	4.51	1
13	BARC Central	5 Most Sensitive	2 Less Than Value of Asset	4 Very Critical	$10,000,000 - $20,000,000	3.68	2
8	Transit facility on Ravenswood	3 Moderately Sensitive	3 Equal to Value of Asset	4 Very Critical	Greater than $20,000,000	3.66	3
14	BARC Bocher	5 Most Sensitive	2 Less Than Value of Asset	4 Very Critical	$5,000,000 - $10,000,000	3.53	4
6	Governmental Center (East)	4 Very Sensitive	3 Equal to Value of Asset	3 Moderately Critical	Greater than $20,000,000	3.52	5
7	Governmental Center West	4 Very Sensitive	3 Equal to Value of Asset	3 Moderately Critical	Greater than $20,000,000	3.52	5
20	Edgar P. Mills Multi-Purpose Center	4 Very Sensitive	2 Less Than Value of Asset	4 Very Critical	$10,000,000 - $20,000,000	3.46	7
12	BSO fire station	4 Very Sensitive	3 Equal to Value of Asset	4 Very Critical	Less than $1,000,000	3.28	8
2	Convention Center	3 Moderately Sensitive	4 More Than Value of Asset	2 Slightly Critical	Greater than $20,000,000	3.21	9
9	Transit facility, Lauderhill	3 Moderately Sensitive	3 Equal to Value of Asset	4 Very Critical	Less than $1,000,000	3.06	10
3	County courthouse - Broward County Judicial Complex (downtown)	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	Greater than $20,000,000	2.89	11
17	Central Broward Regional Park (East)	4 Very Sensitive	3 Equal to Value of Asset	2 Slightly Critical	$5,000,000 - $10,000,000	2.86	12
4	North Regional Courthouse	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	$10,000,000 - $20,000,000	2.74	13
15	Tradewinds Park (North)	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	$5,000,000 - $10,000,000	2.59	14
19	Delevoe Park (BMSD)	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	$5,000,000 - $10,000,000	2.59	14
16	C.B. Smith Park (south)	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	$1,000,000 - $5,000,000	2.44	16
18	Markham Park (West)	4 Very Sensitive	2 Less Than Value of Asset	2 Slightly Critical	$1,000,000 - $5,000,000	2.44	16
11	North county beach park	4 Very Sensitive	1 Significantly Less Than Value of Asset	2 Slightly Critical	Less than $1,000,000	2.02	18
10	Stirling Road Library	3 Moderately Sensitive	1 Significantly Less Than Value of Asset	1 Least Critical	$1,000,000 - $5,000,000	1.59	19
1	Animal Care	2 Slightly Sensitive	1 Significantly Less Than Value of Asset	1 Least Critical	$5,000,000 - $10,000,000	1.52	20

Key
Hazen Input
County Selection
Criticaility Score
Criticality Ranking

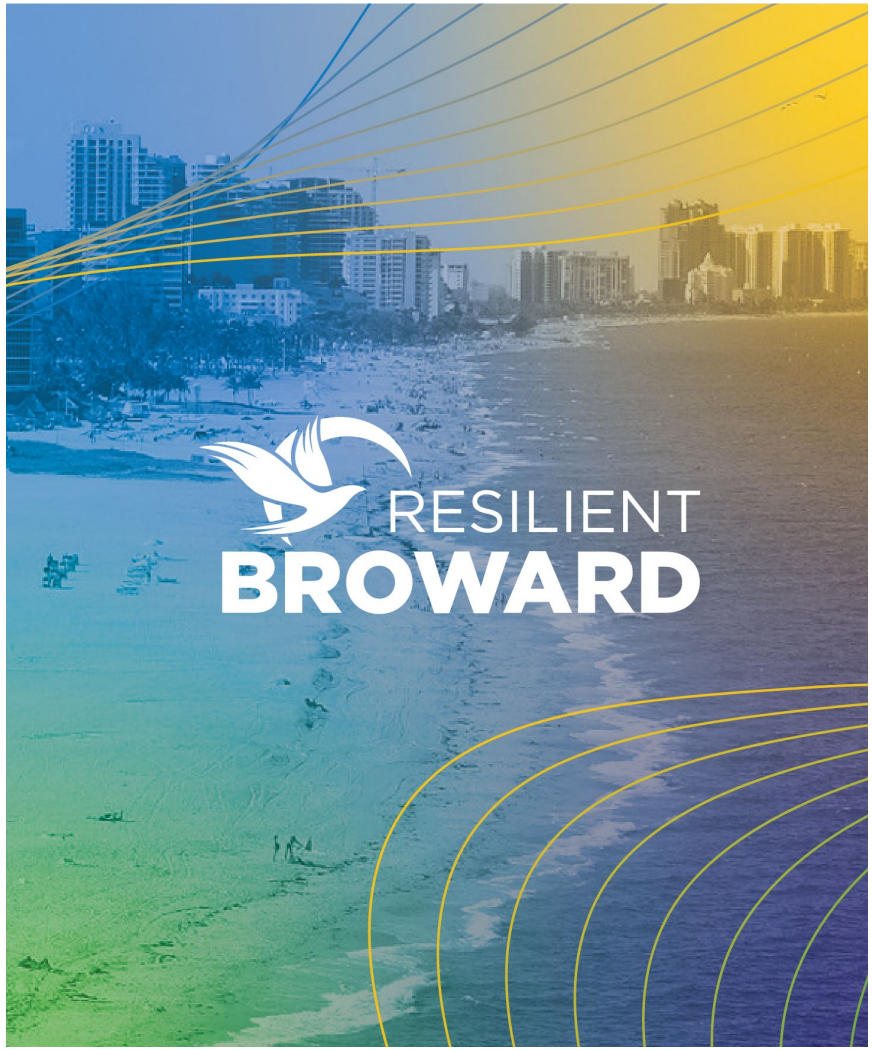
CRITICALITY FACTOR	Weight [%]	Score Range	
		Min	Max
Severity of Impacts to Services	22%	1	5
Economic Impacts	27%	1	5
Criticality of Services Provided	36%	1	5
Asset Value	15%	1	5
	100%		

Notes: 1) Theoretical Max Criticality Score is 5
2) The Criticality Score will be multiplied by the Vulnerability Score for the Final Ranking

The Final Risk Factor will be the Product of the Criticality Score and the Vulnerability Score

Risk Factor = Criticality Score * Vulnerability Score

- **Risk Factor** – Numerical indicators quantifying the level of risk associated with a critical asset by combining vulnerability and criticality characteristics. Used for comparison and prioritization.
- **Criticality Score** - Numerical score that indicates how critical an asset is, informed by County's input, asset's overall value, and consequences of failure.
- **Vulnerability Score** - Numerical score that indicates how exposed an asset is to flooding hazards, informed by results of County's inundation model and finished floor elevation or critical flood elevation.



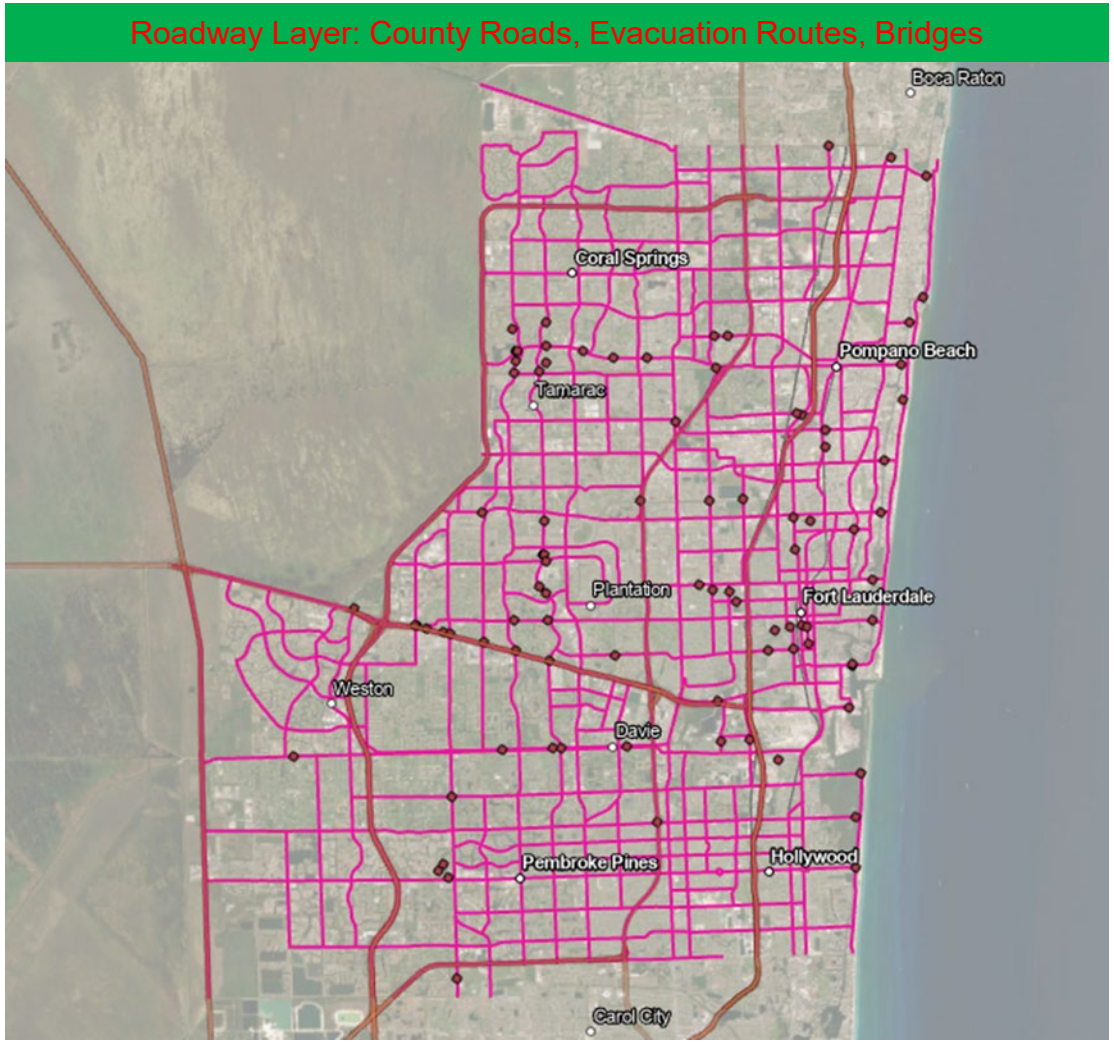
7b.

Roadway Risk Analysis Methodology

Hazen

The Data Collection Task included:

- County Roads
  - 1,044 features
- Evacuation Routes
  - 2,469 features
- Bridges
  - 101 Features
- Transit Facilities
  - 40 Features
- FEC Parcel
  - 42 features
- CSX Parcel
  - 60 Features



The Proposed Roadway Risk Analysis Methodology involved selected the scoring and weights for the roadway criticality factor

- Factors taken into consideration:
  - Roadway Classification including evacuation routes
  - Average Annual Daily Traffic (AADT)
- Higher weight assigned to roadway classification (55%).
  - Benefits Evacuation Routes and Interstates

Proposed Criticality Factor- Roadways		
Criteria	**Maximum Points**	**Proposed Weight**
Roadway Class		
Evacuation	5	**55%**
Interstate	3	
Arterial	2	
Local	1	
AADT		
>150,000	5	**45%**
>100,000	4	
>50,000	3	
>25,000	2	
>15,000	1	
Total Points		

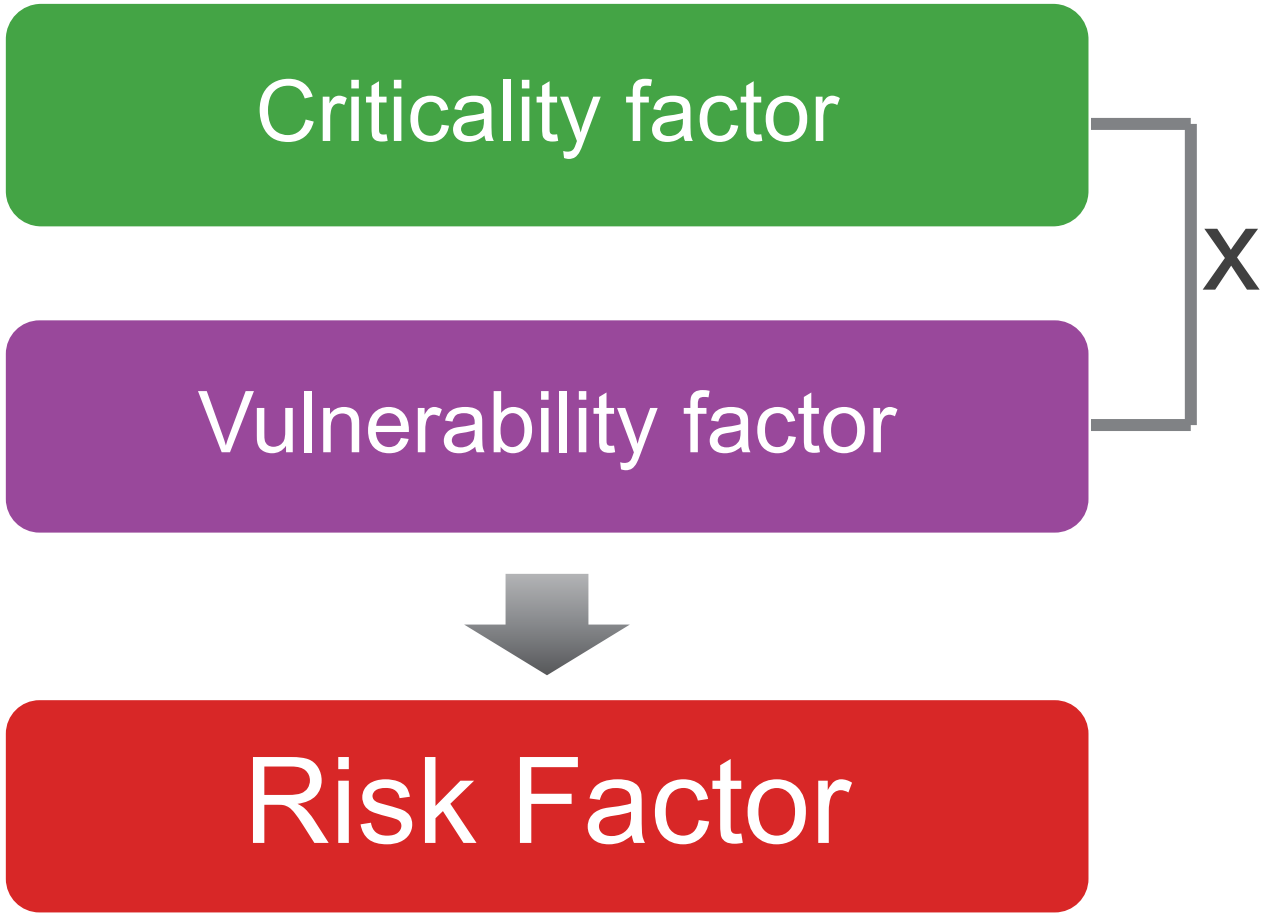
The team also selected scoring and weights for the vulnerability factor, based on percent inundation

- Factors taken into consideration:
  - Percent of roadway inundated
  - Depth of inundation
- Higher weight assigned to depth of inundation (55%).
  - Prioritizes roadways with inundation depths greater than 0.5 ft.
- Weighting percentages for different modeling scenarios will be consistent with critical assets methodology

Proposed Vulnerability Factor- Roadways		
Criteria	**Maximum Points**	**Proposed Weight**
Percent Inundations		
Severe (>75%)	5	**45%**
Major (50-75%)	3	
Moderate (5-49%)	2	
Minor (<5%)	1	
Depth of Inundation		
>2.0 ft	5	**55%**
1.0-2.0 ft	4	
0.5-1.0 ft	3	
<0.5 ft	1	

The Proposed Roadway Analysis Methodology includes calculating the Risk Factor (same method as calculated for the critical assets)

- Combines Criticality Factor and Vulnerability Factor by multiplying
- Consistent with critical assets methodology
- Roadways with Highest scores are ranked first (highest priority)



The Roadway Risk Analysis will be viewable in GIS maps and tables

- Map will display roadway segments impacted by flooding event
- Impacted roadways will be color coded to represent the level of risk
- Tables to include road name, road class, jurisdiction, risk rating, flood depth, AADT

Sample Map

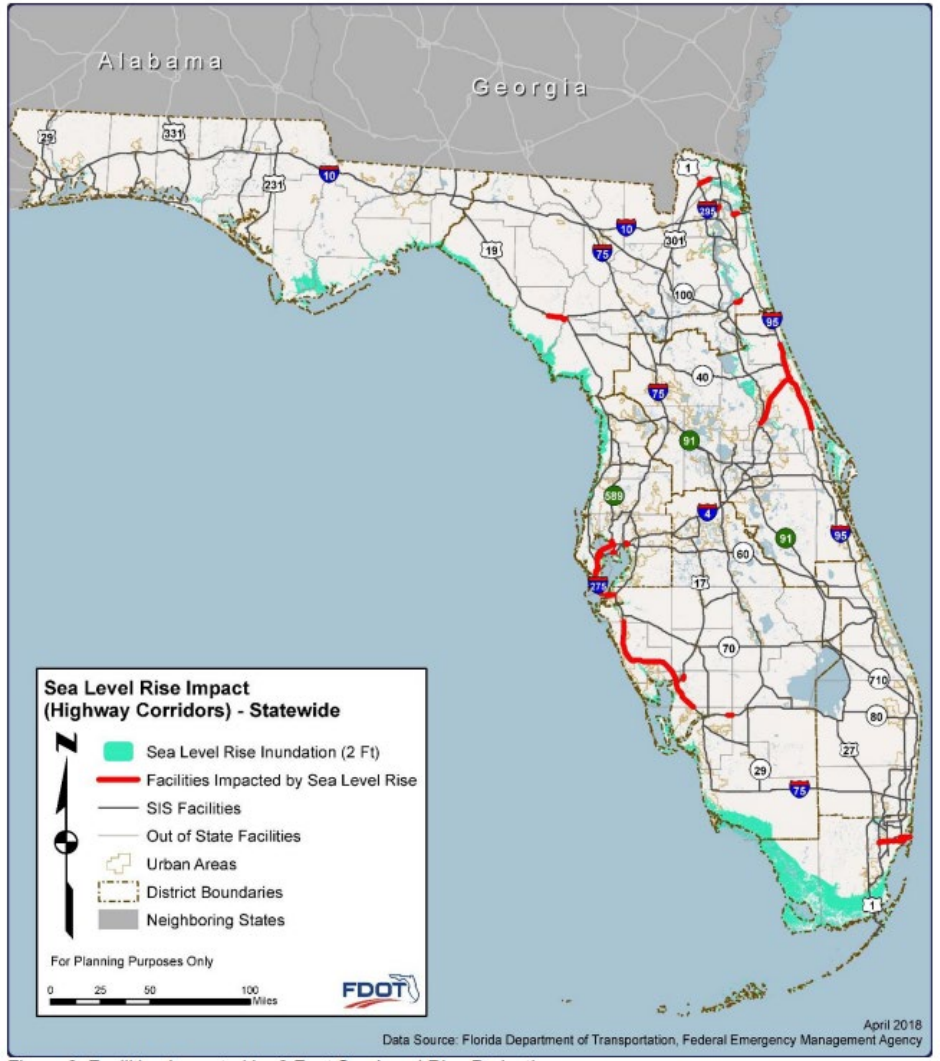
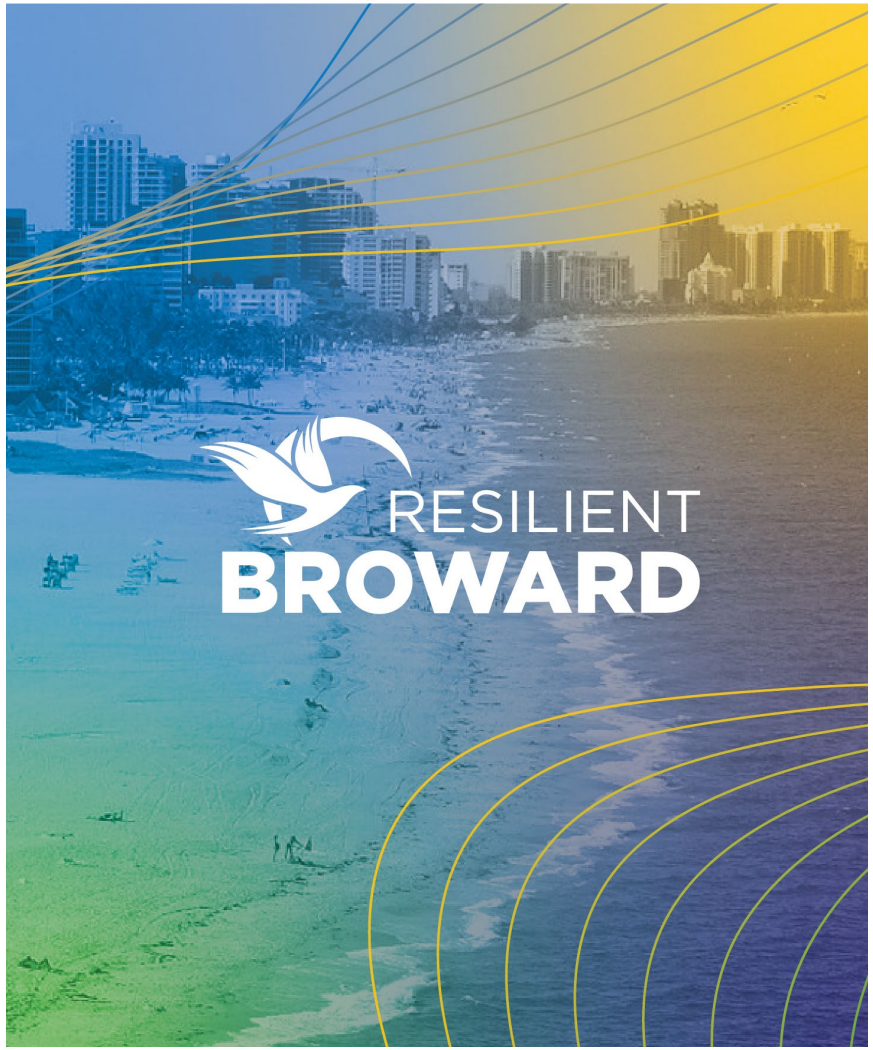


Figure 2: Facilities Impacted by 2 Foot Sea Level Rise Projections

Source: Risk Assessment on SIS Facility, FDOT, May 2018.



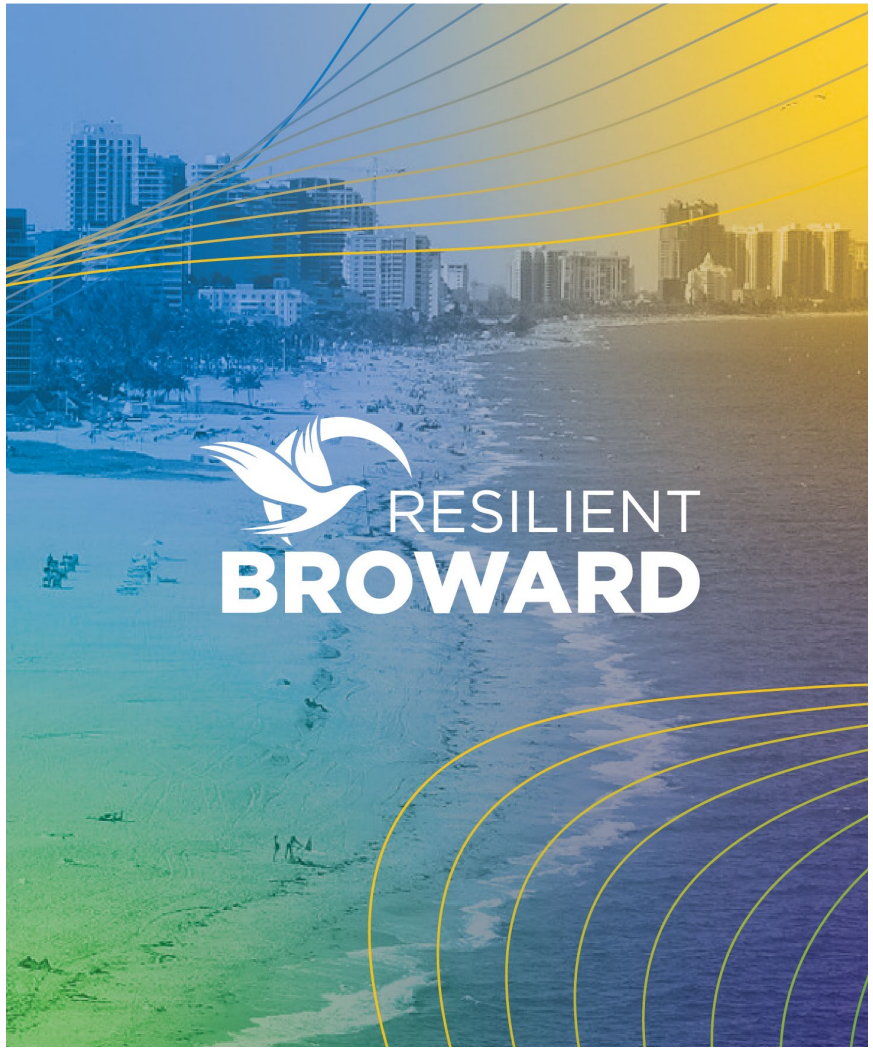
8

Economics Modeling Update

Hazen

Baseline Economic Modeling is progressing and results will soon be shared with the RSC

- **Baseline hydrologic and hydraulic model flooding results (peak stages and inundation durations), estimated direct damages, and event probabilities are in the economic analyses**
- **Upcoming schedule for reviewing and finalizing baseline economic results**
  - *September 14 – draft results review meeting with County staff*
  - *September 25 – draft Economic Modeling Memorandum review with County staff*
  - *October 3 – final Economic Modeling Memorandum submitted to County staff*
  - *October 4 – final Economic Modeling Memorandum submitted to RSC*
  - *October 11 – Economic Modeling presentation to RSC*
- **Baseline model will be updated with adaptation strategies and used to model economic benefits of various suites of adaptation strategies**



Adjournment – Thank You!

Hazen