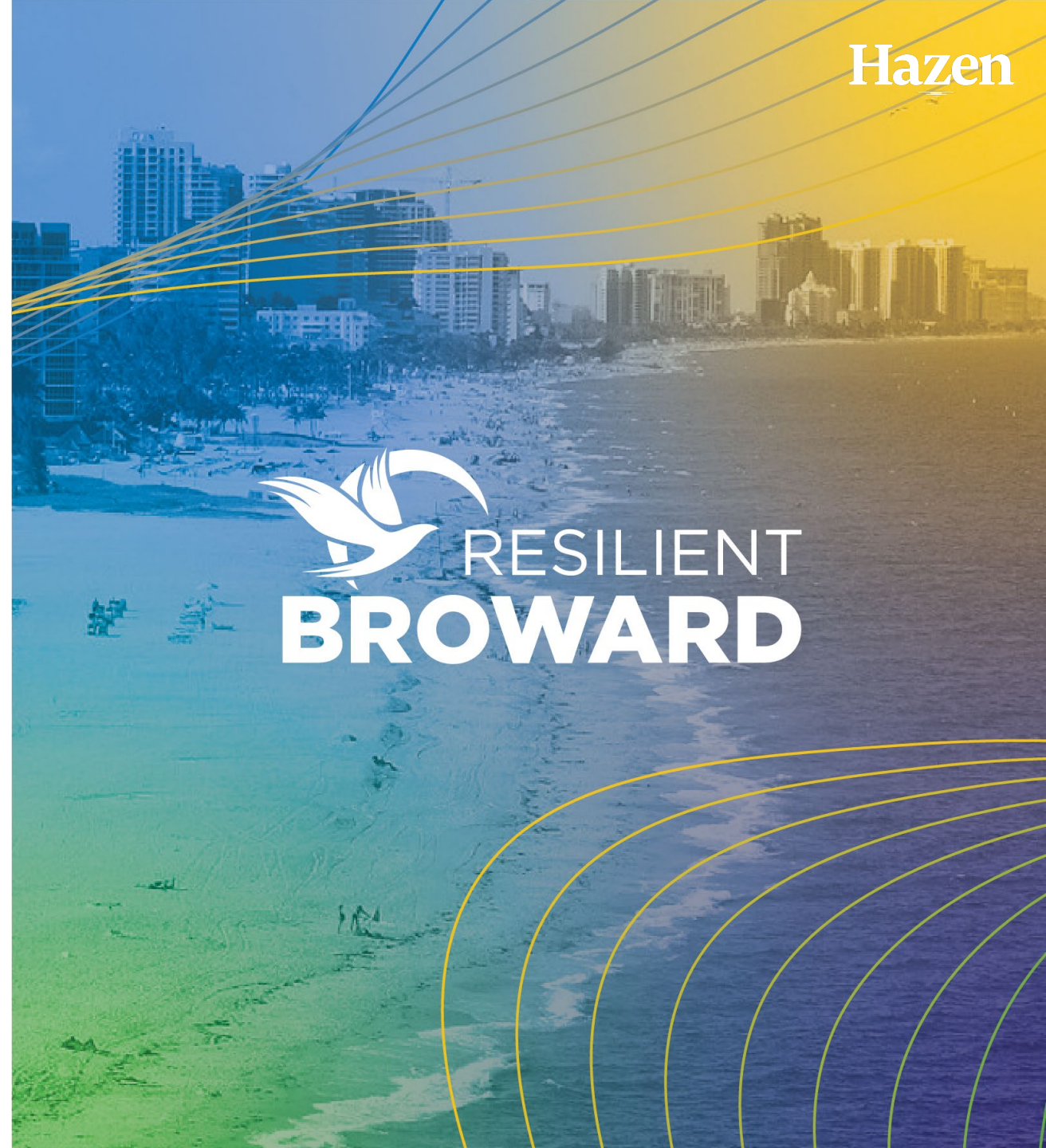




Resilience Steering Committee Countywide Risk Assessment and Resilience Plan

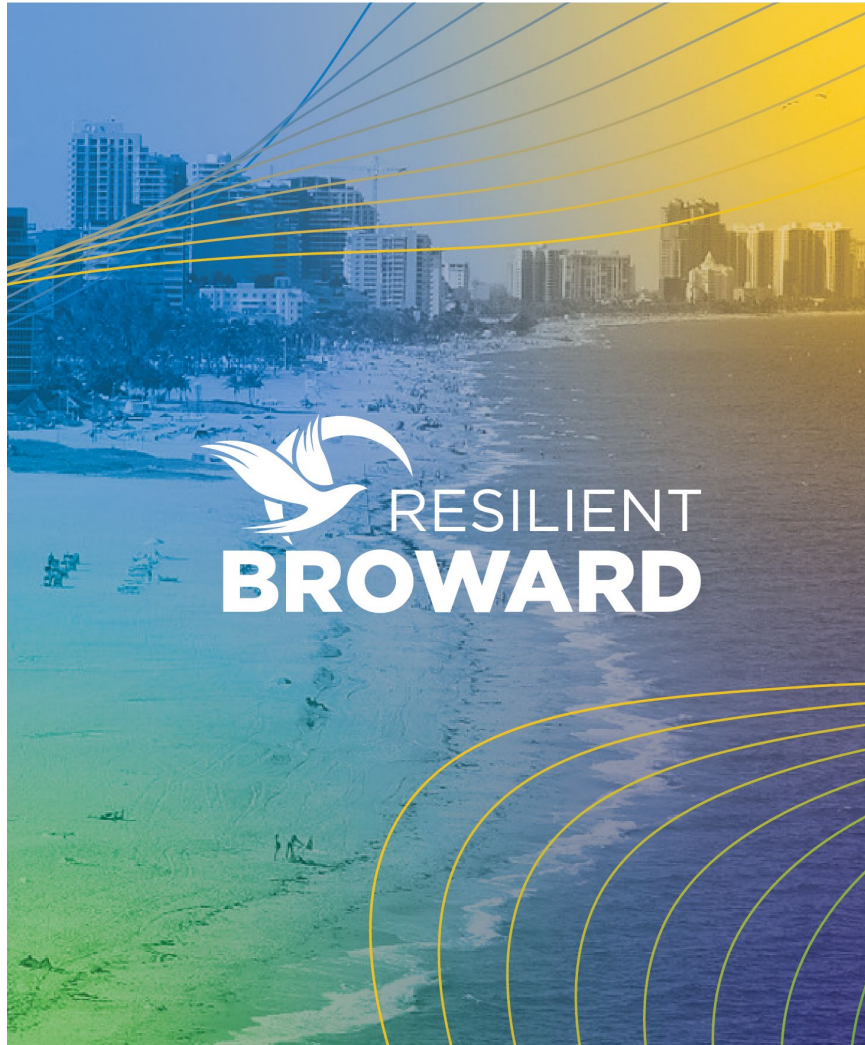
December 14, 2022



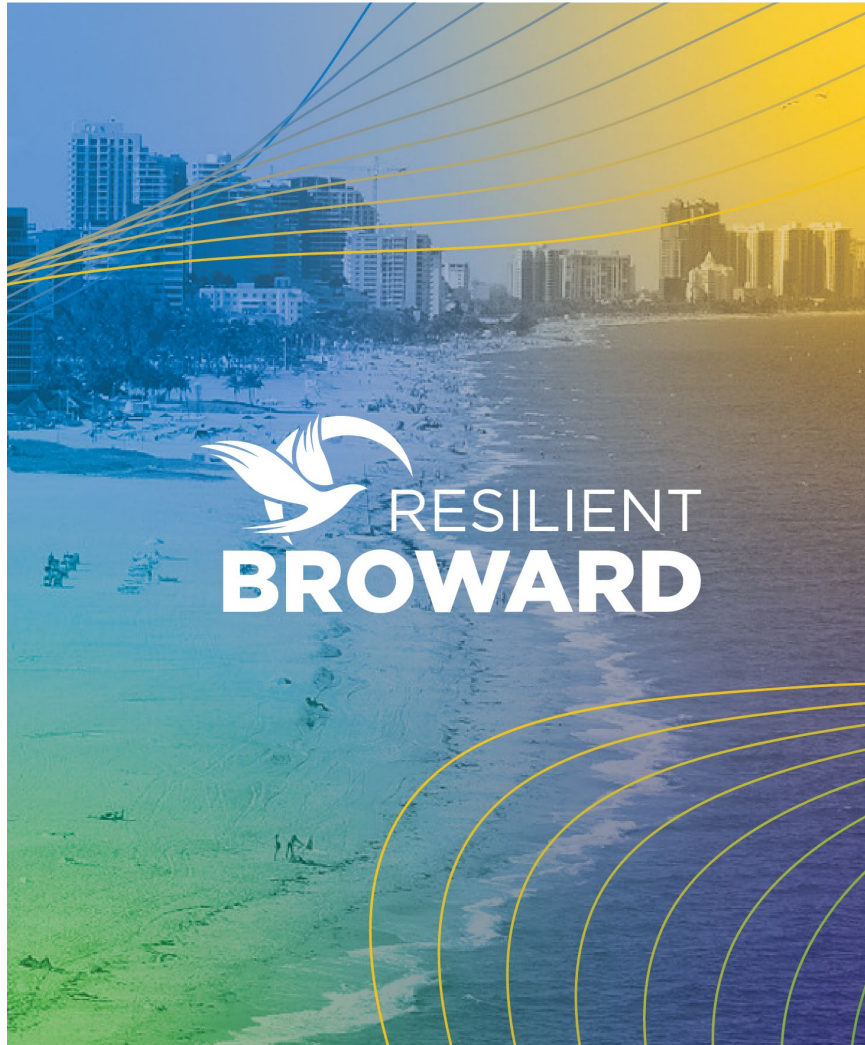
Outline



1. **Summit Highlights**
2. **Update on Data Collection**
3. **Update on Hydrologic Modeling**
4. **Update on Economic Modeling**
5. **Update on Platform Development**
6. **County Asset Analysis**
7. **Next Steps**



1
Summit Highlights

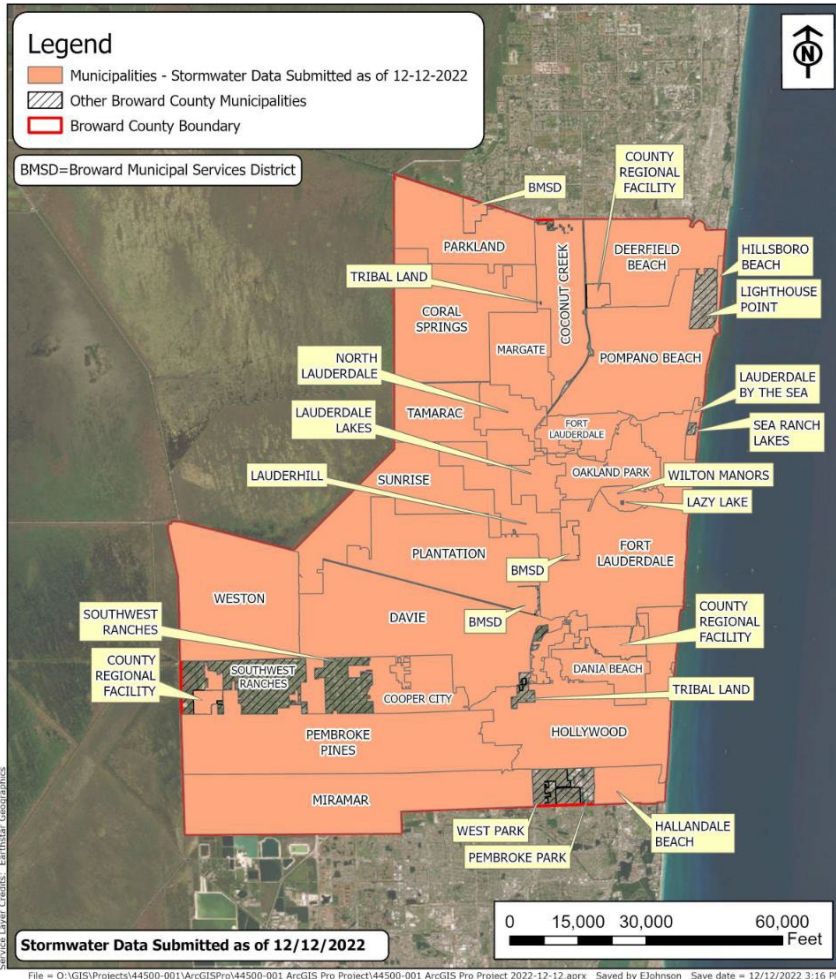


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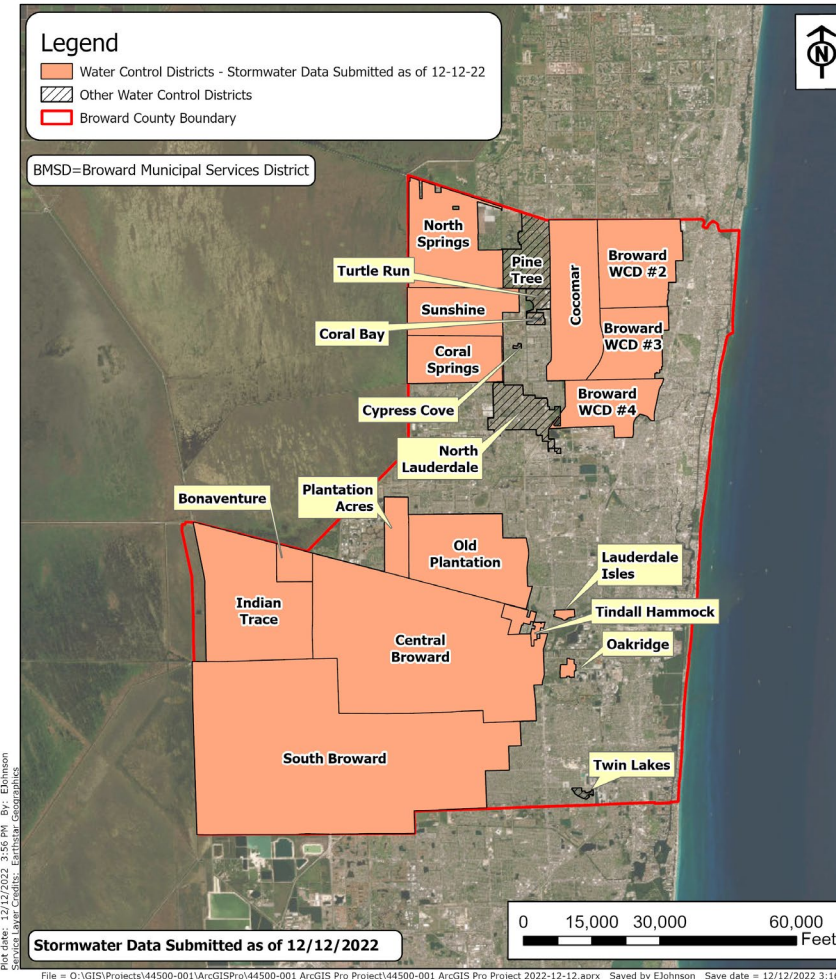
Update on Data Collection

Submitted Stormwater Data

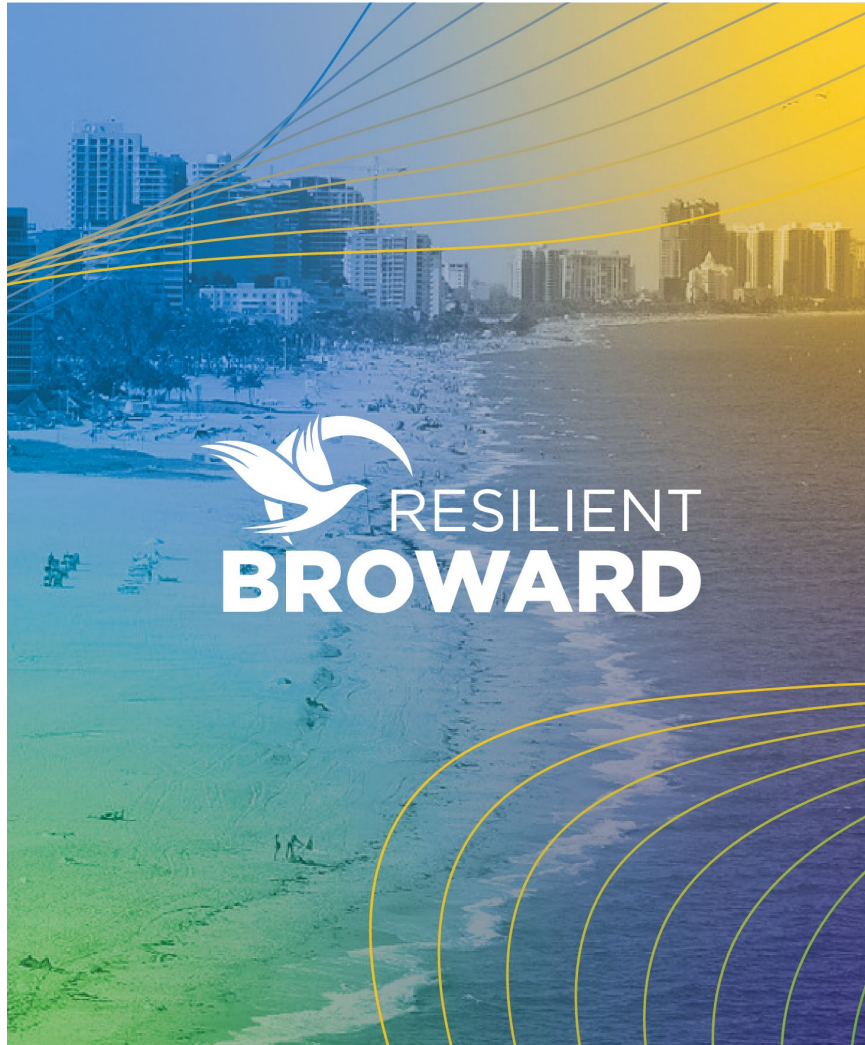
Municipalities



Water Control Districts



- Data collection phase is complete
- Continuing project with submitted data, complemented with data obtained from ERP permits



3

Update on Hydrologic Modeling

Update – Model Refinement

- Model eastern boundary extension**
- Addition of canals**
- Impervious areas**
 - Image training process
- Drainage routing revision** In progress
 - Guided by collected stormwater data
- Groundwater layering reduction for efficiency**
- Model numerical stability tests** In progress
 - Use a maximum stress scenario

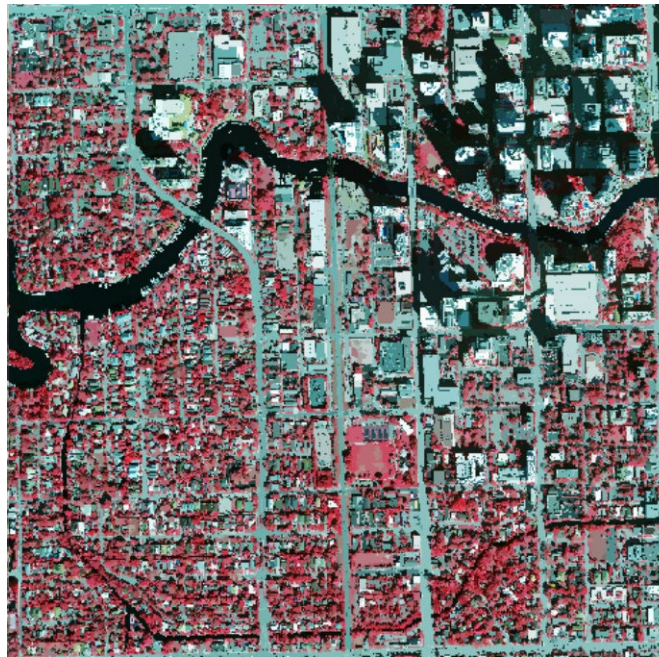
Model Refinement – Pervious and Impervious Area Classification

- Areas classified as impervious and pervious areas to accurately depict the runoff in the model
- Classification performed based on unique spectral characteristics, using Machine Learning

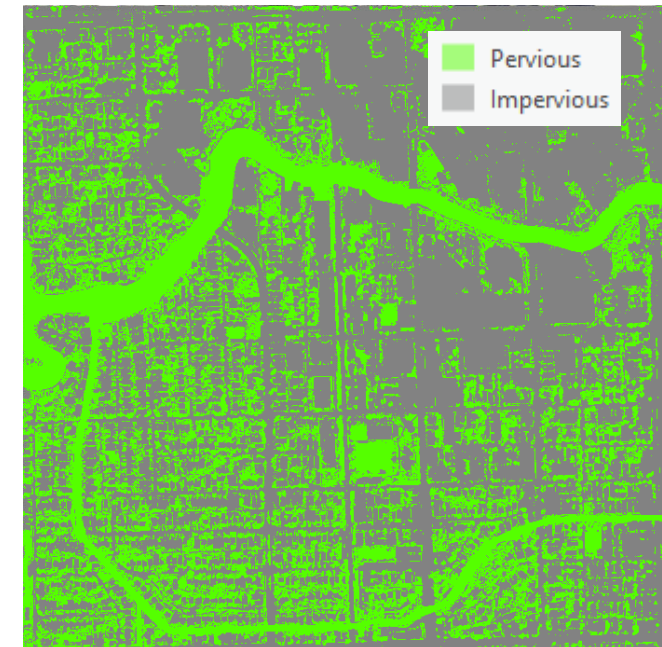
1 Aerial imagery (Visible and Infrared)



Grouped pixels



Machine learning algorithm assign pervious-impervious classification



Model Refinement – What is next?

Drainage routing revision

- Guided by collected stormwater data.....

Anticipated completion by third week of December

Model numerical stability tests

- Use a maximum stress scenario.....

Anticipated completion by third week of December

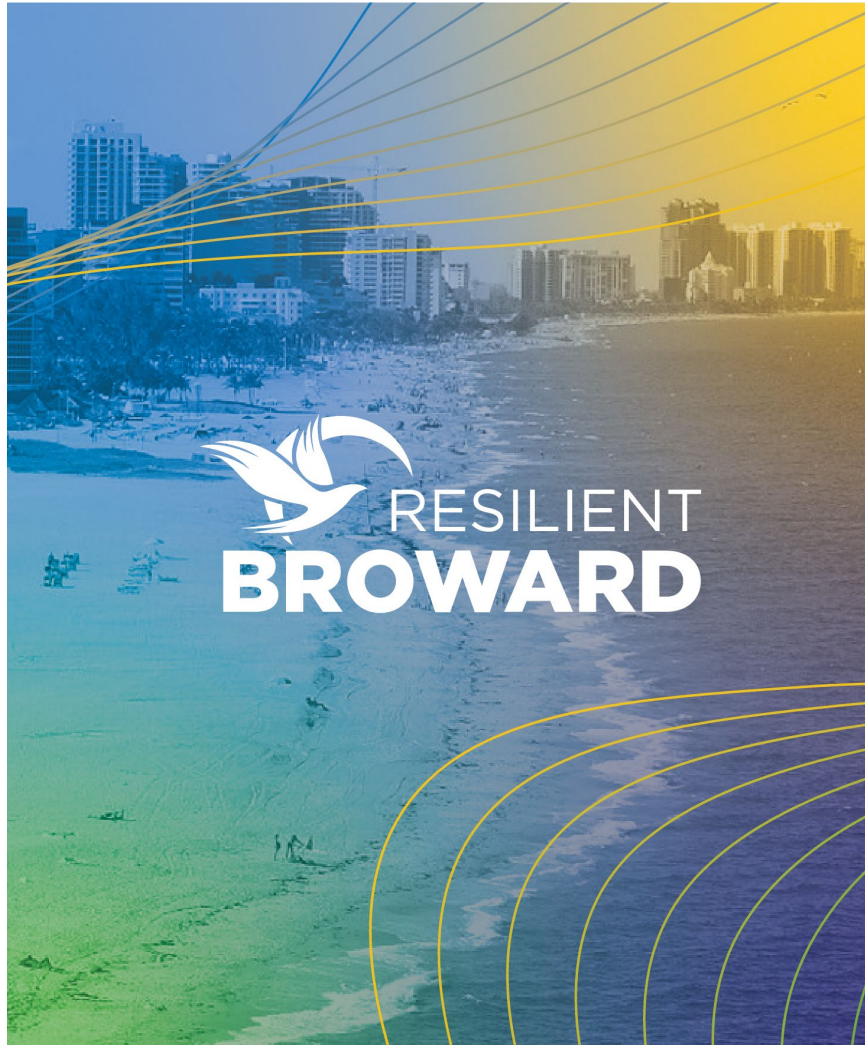
Run No-Action Scenarios

- 24+ Resilience Plan Scenarios (including sunny day flooding and higher frequency events scenarios).....
- 30 Vulnerability Assessment Scenarios

Anticipated completion by second week of January

Coordination with SFWMD (FPLOS) and USACE (C&SF Project)

In progress throughout the project



4

Update on Economic Modeling

Economic modeling will focus dollar value estimations on five channels through which flooding could impact County's economy under baseline

1. Disrupted economic activity

Direct impacts of flood events

- Damaged buildings, assets and infrastructure (replacement, repair or abandonment value)
- Business downtime losses (business and employee income and profit)

Indirect impacts of flood events

- Changes in economic activity (output), income, employment and tax revenue from:
 - A. Supply chain loss of demand or disruption
 - B. Financial sector response to loan delinquency and default

Vulnerable communities impacted by flood and labor market change

2. Reduced insurance availability / affordability

- Increasing flood risk expected to cause:
 - A. Higher insurance premia
 - B. Lower insurance capacity
- Severe flood events might hasten these changes if insurers face large losses
- Higher premia could increase rates of underinsurance, reducing ability of households and businesses to recover from flood events
- Real estate values and investment could also be harmed
- Identify socially vulnerable communities

3. Change in real estate values

- Uninsured properties damaged by floods can cause financial distress to property owners.
- Increased flood risk is expected to reduce real estate values through:
 - A. Increased property repair costs
 - B. Lost net operating income
 - C. Increased insurance premia
 - D. Amenity loss
- Identify socially vulnerable communities

Economic modeling will focus dollar value estimations on five channels through which flooding could impact County's economy under baseline

4. Fiscal Risks to County

- Increased flood risk could result in:
 - A. Increased county cost for relief and recovery efforts (shared with FEMA and Florida)
 - B. Reduced county revenue in short run and/or long run from lower sales tax and tourism development tax revenues.

Short run is due to the resulting economic disruption and long run is due to reductions in population, household spending, and tourism.
 - A. Reduced county revenue in long run as property tax revenue decreases over time due to reductions in real estate value and population.
- These impacts could lead to a reduction in County services and a lower County credit rating.

5. Recreational and Environmental Amenities

Recreational Amenities

- Short-term interruption in access to recreation opportunities
- Long-term loss of recreation opportunities
- Substitution possibilities will be assessed
- Willingness-to-Pay per person - day of recreation by type times number of days lost

Environmental Amenities

- Value is willingness to pay to protect local ecosystems damaged or lost
- Value depends on ecosystem type and extent of damage

Economic modeling will address three additional channels through which flooding could impact County's economy but with less focus on dollar valuation

6. Disruption to Public Services

- Public services include health care, emergency response, education, food and shelter, water and electric supply, and wastewater and stormwater management
- Flood events could cause temporary:
 - i. Closure of buildings that provide public services
 - ii. Disruption of public service operations and access through flooding of critical infrastructure
- Reduced public service access can exacerbate negative impacts of flooding, for example, by increasing mortality or morbidity.

7. Reduced Investment

Increasing flood risk could:

- i. Lower expected investment returns
- ii. Change perceptions of investment risk in the County

These outcomes could:

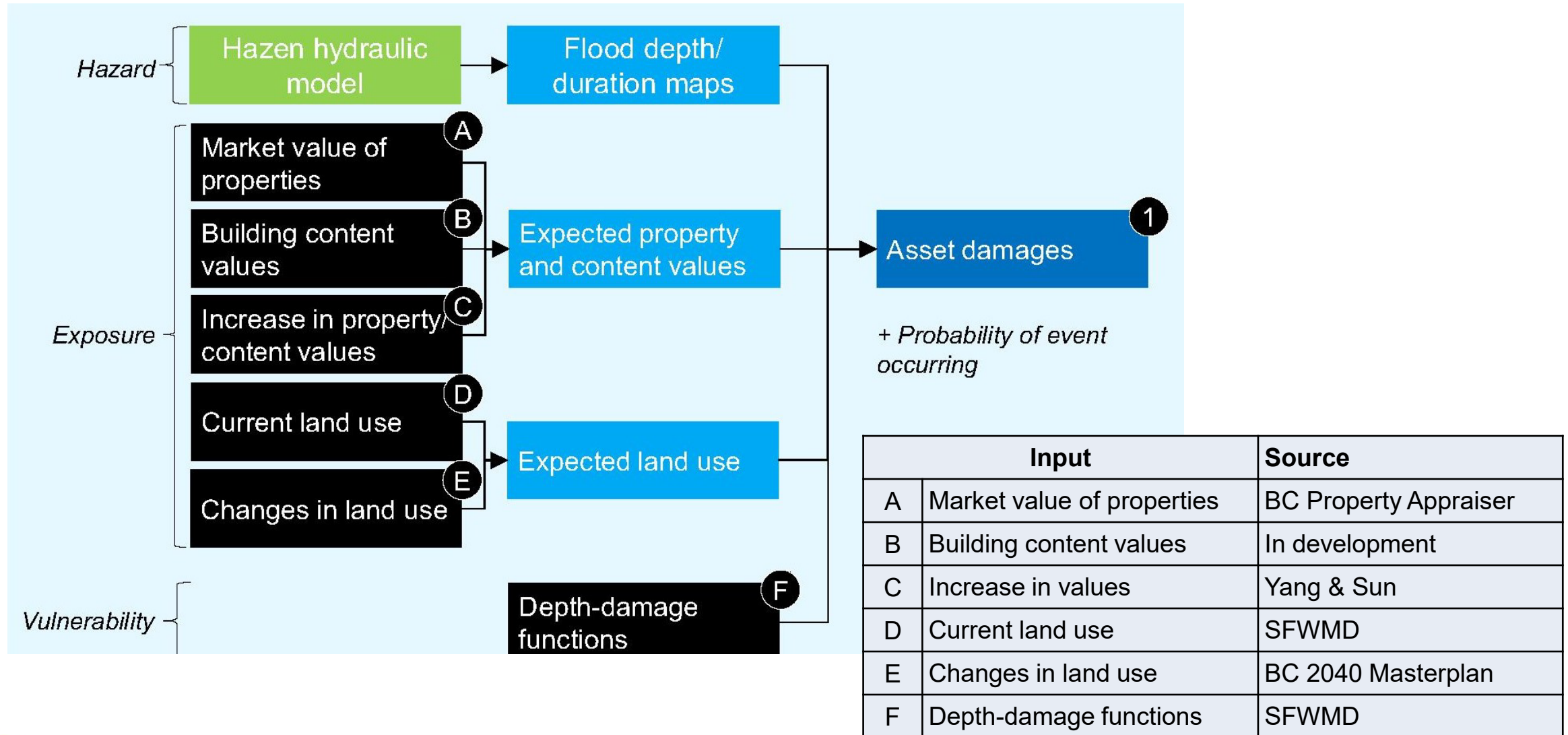
- i. Increase the cost of borrowing
Change the types and amounts of investments within the County
- ii. Reduce the County's economic growth and structure.

8. Demographic Change and Reduced Tourism

Severe flood risk may cause:

- i. Permanent out-migration as the County becomes a less desirable home, further depressing real estate values and eroding the County's tax base.
- ii. Temporary reduction in tourism capacity as hotels and critical infrastructure are affected.
- iii. Change perceptions of the County as a stellar tourism destination, reducing tourism demand and Tourist Development Tax revenue.

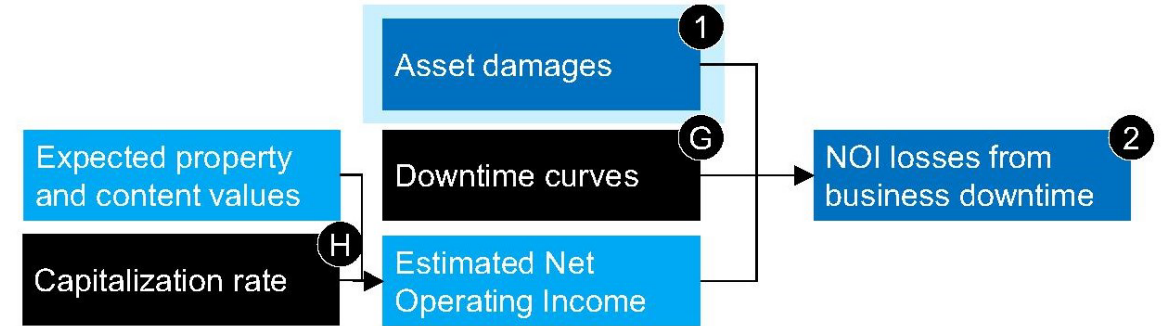
Economic Module 1: Dollar value of damages from predicted flood events



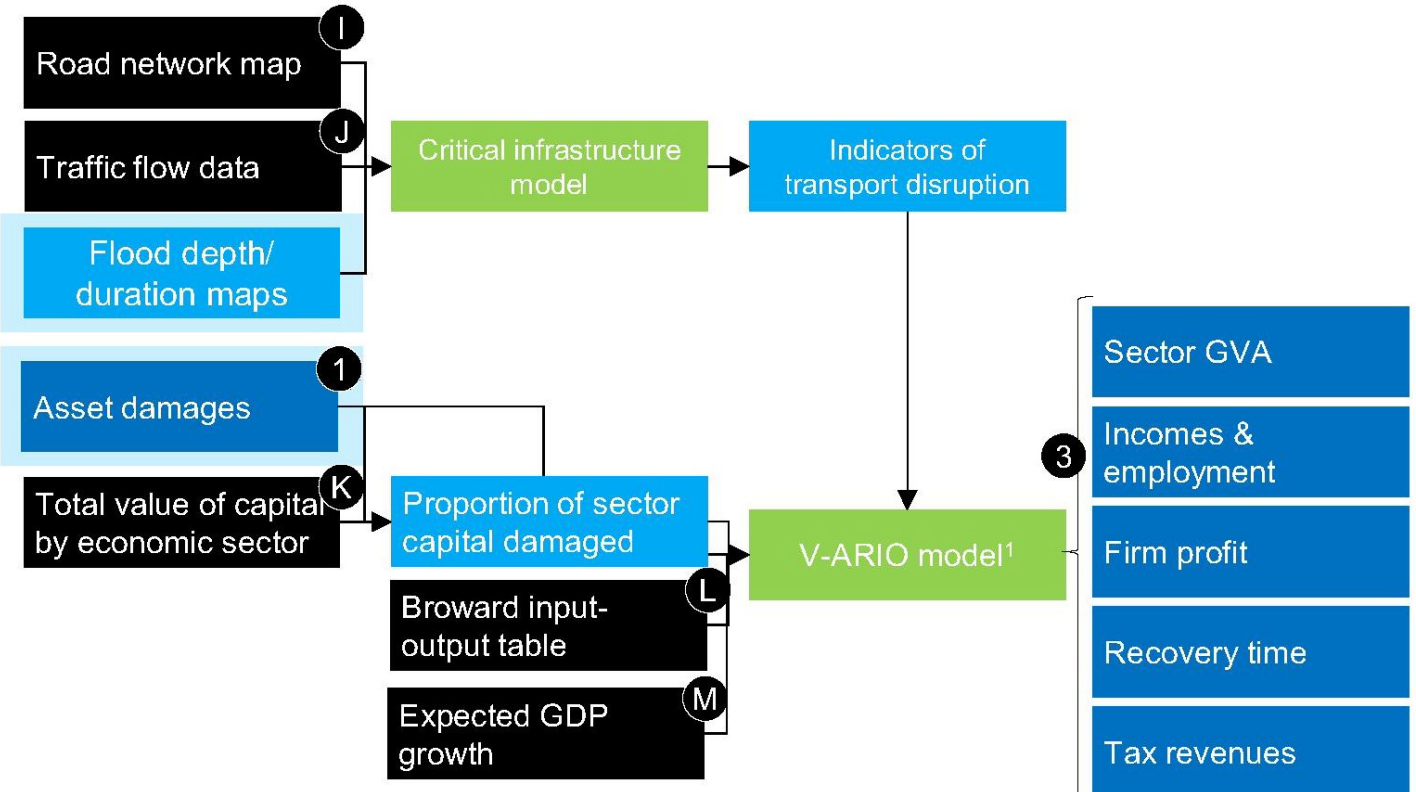
Economic Modules 2 and 3: Business downtime and indirect losses

Input		Source
G	Damage-downtime functions	FEMA
H	Capitalization rates	CBRE Group
I	Road network map	National Transportation Dataset
J	Traffic flow data	In development
K	Total value of capital by economic sector	Bureau of Economic Analysis
L	Broward input-output table	IMPLAN Regional Economic data for Broward Co.
M	Expected GDP growth	Yang & Sun

Module 2: Direct losses from business downtime



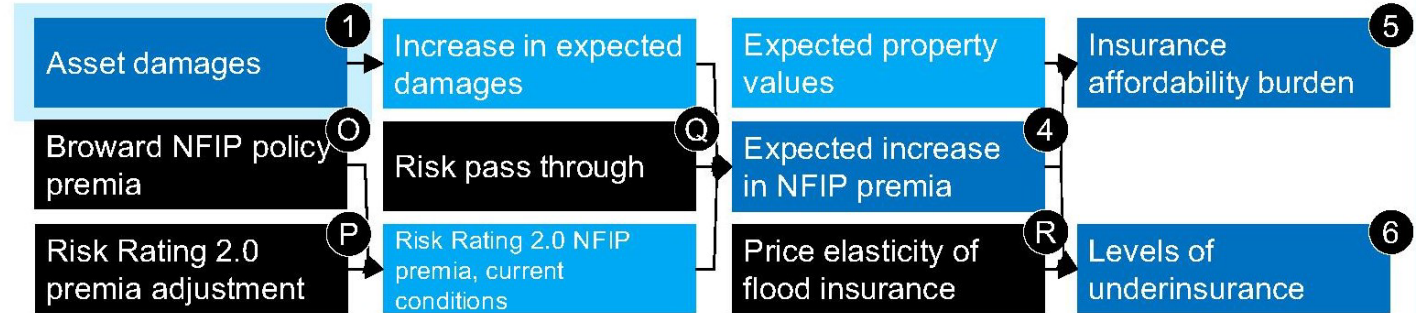
Module 3: Indirect losses from flood events



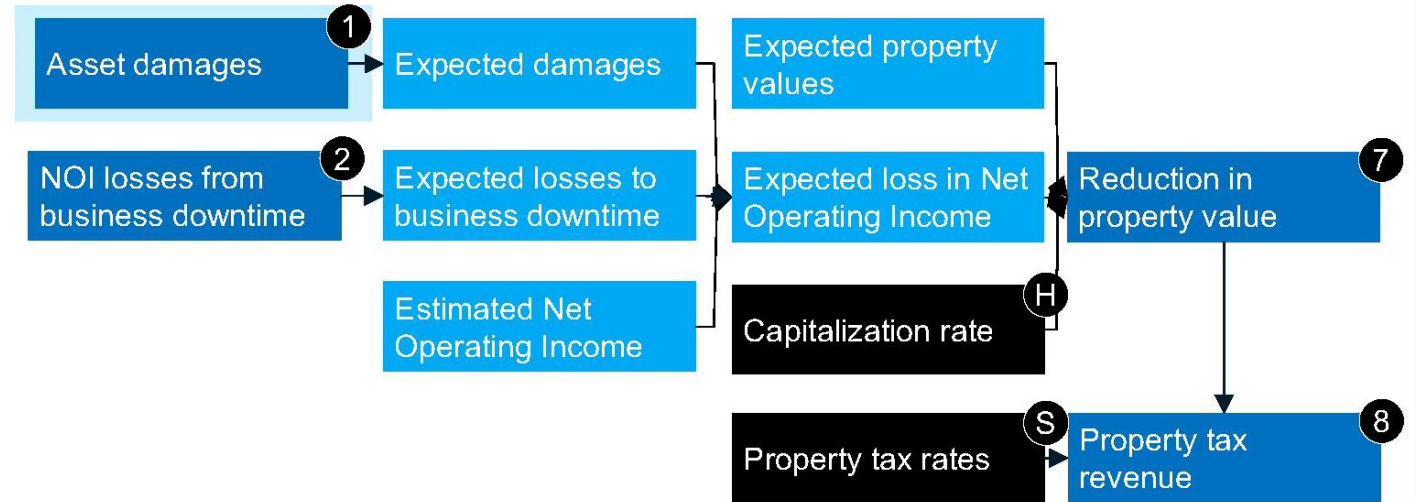
Economic Modules 4 and 5: Insurance premia and real estate values

	Input	Source
O	Broward NFIP policy premia	FEMA NFIP Open Data
P	Risk Rating 2.0 premia adjustment	American Society of Floodplain Managers
Q	Risk pass through	In development
R	Price elasticity of flood insurance	Netusil et al (2017)
S	Property tax rates	Broward County

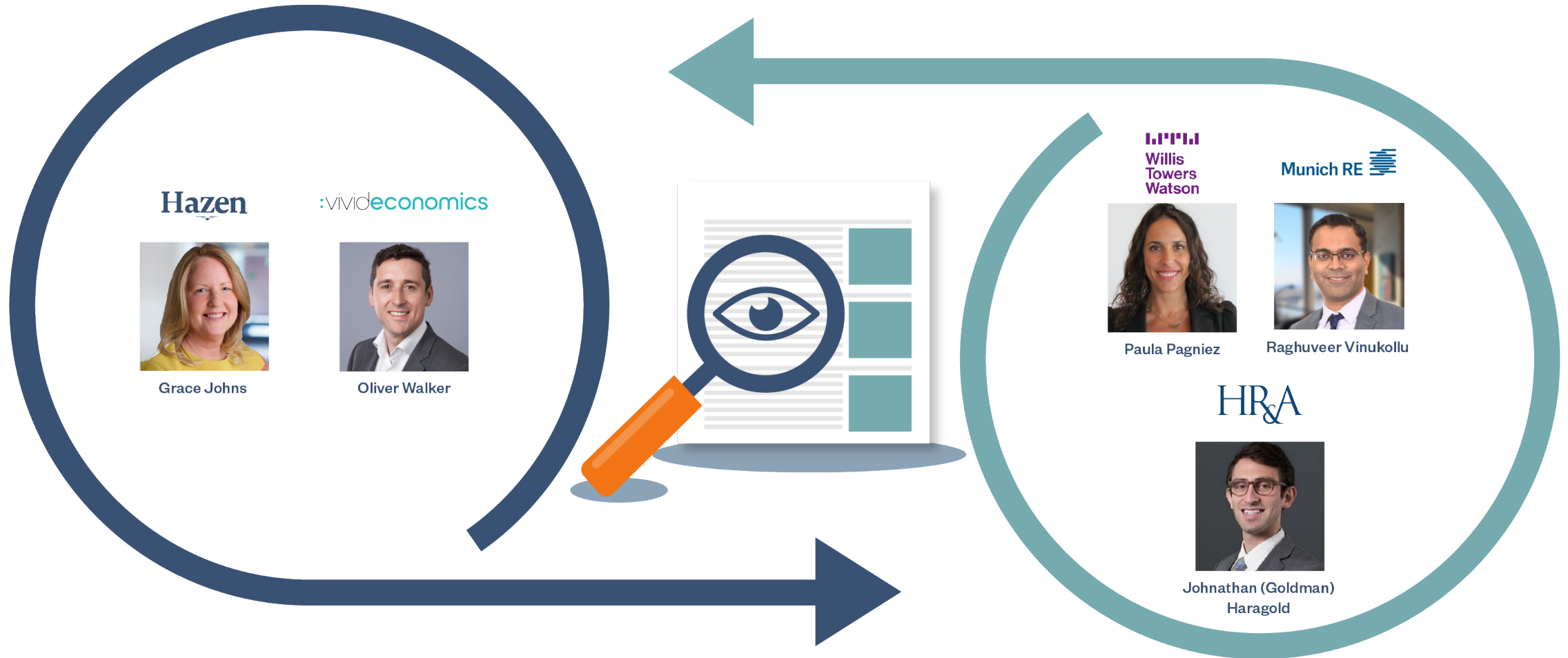
Module 4: Impacts on NFIP insurance premia

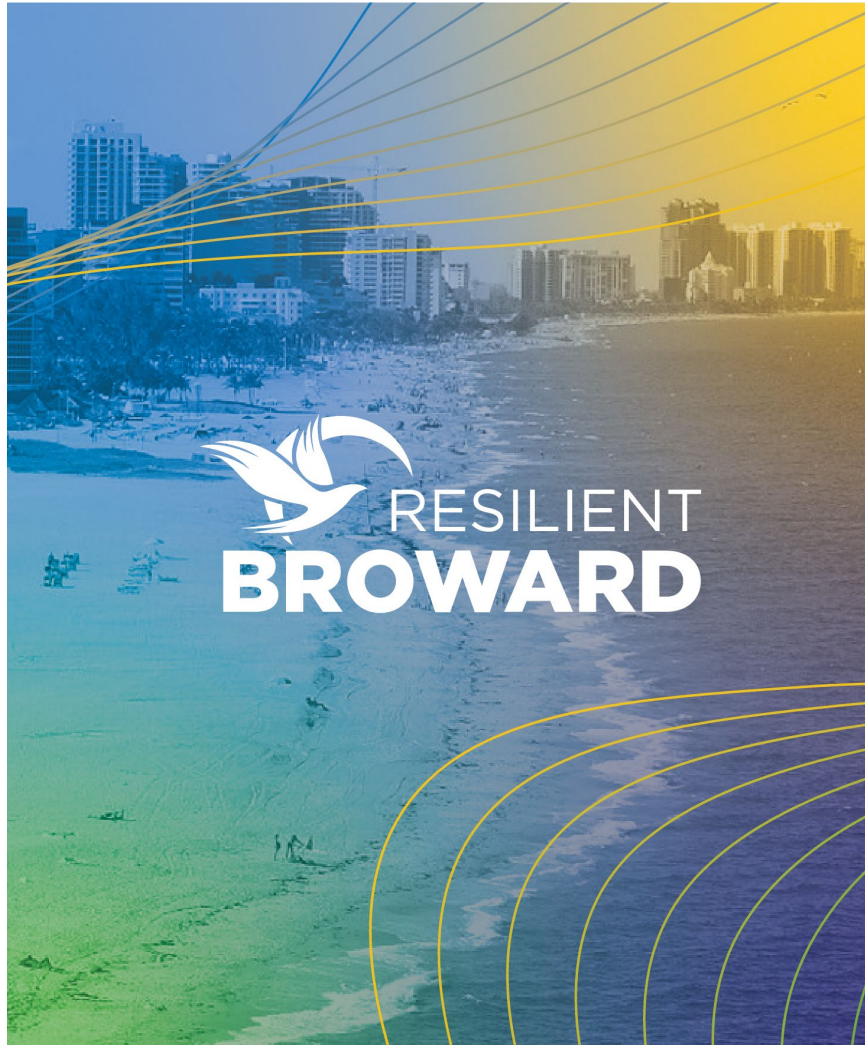


Module 5: Impacts on real estate values



We will be engaging additional economics expertise to assist our core team





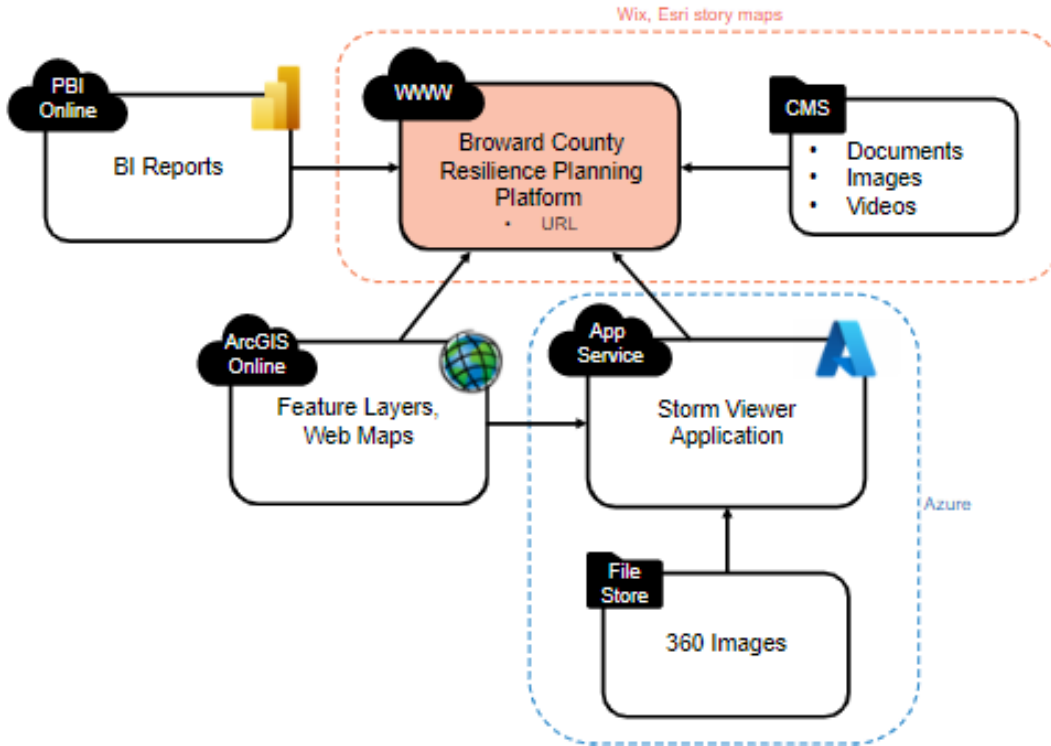
5

Update on Platform Development

Hazen

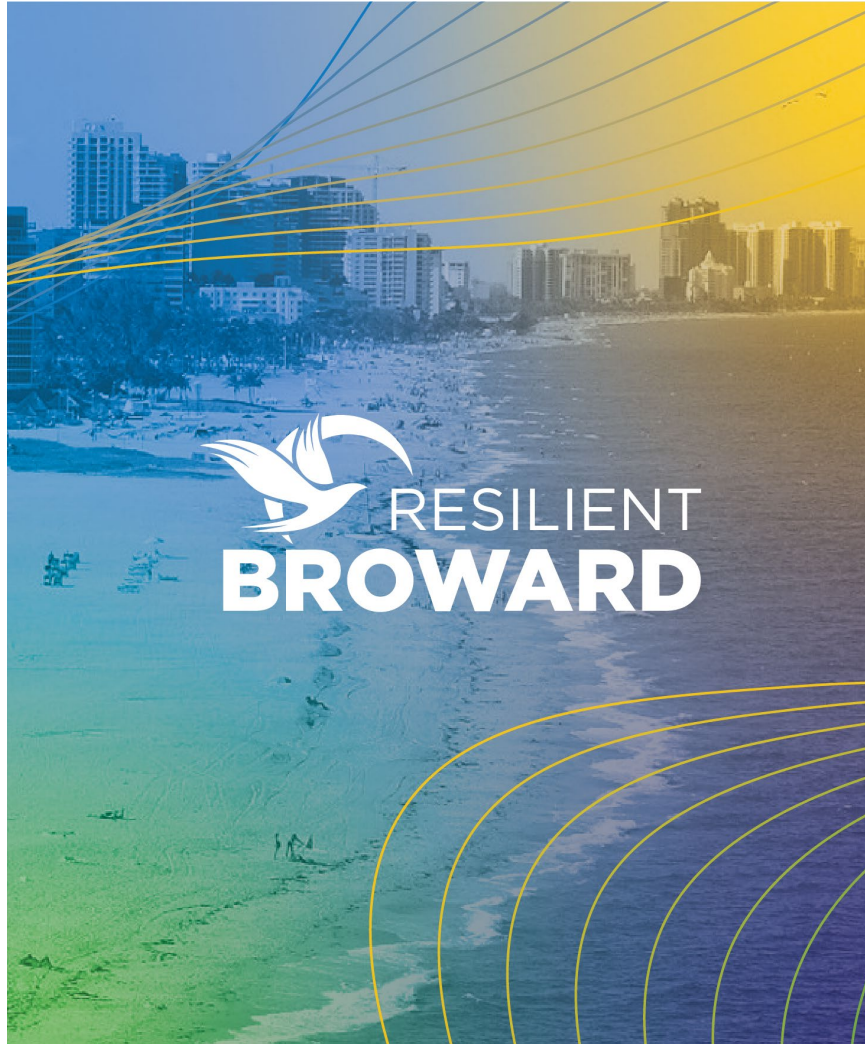
We are coordinating with County ETS to ensure compliance with County requirements...

High-Level Architecture



- **ETS review of solution architecture**
 - Ensure adherence to ETS governance
- **Full hand-off to County at end of project**
- **Long term maintenance and support**
 - Documentation
 - Roles and responsibilities
 - Updates and patches
 - *Public website*
 - *Storm Viewer Application*
 - *GIS*
 - *Power BI*

...for the development and the handoff of the platform.



6

County Asset Analysis

This task includes four primary components

1. Perform risk assessment of County-owned assets
2. Assess design phase projects
3. Conceptualize site adaptations
4. Develop standard methodology for review of future Capital Improvement Plan projects

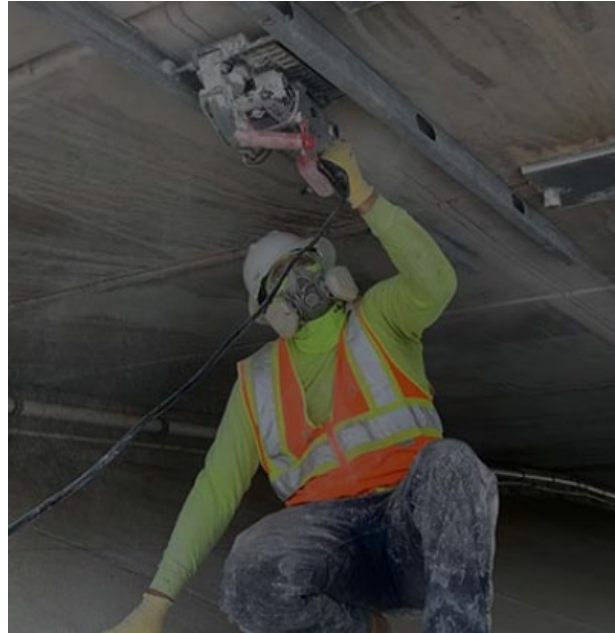
1 – The risk assessment of County-owned assets...

- Prepare inventory
- Develop risk factor
- Convene with County to review methodology
- Assign weights and rankings with County
- Results in prioritization for site-specific adaptations



...will follow FDEP guidelines for vulnerability analyses and be easily transferrable for future analyses.




2 – The assessment of existing projects will be coordinated with County agencies



- **Review** projects in feasibility or design phase
- **Determine** where resilience efforts could be included
- **Develop** prioritization process based on Risk Assessment for funding purposes

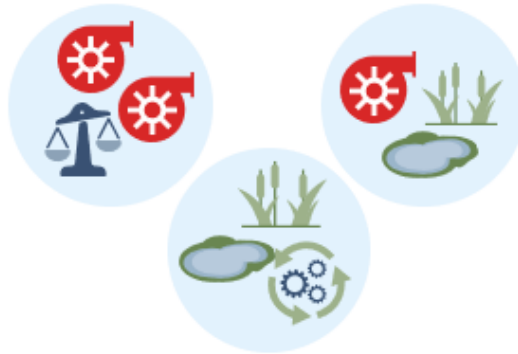
3 – Site-specific adaptations will be conceptualized

Sample Types of Adaptation / Mitigation Strategies:

- Pump Stations 
- Natural Barriers 
- Storage/Impoundments 
- Regulation Changes 
- Operation Changes 
- Et cetera.

Sets of Strategies

are combinations of different types of mitigation strategies in different parts of the County.



- Develop conceptual site adaptation representations
- Estimate benefits
- Prepare planning level cost estimate for adaptation

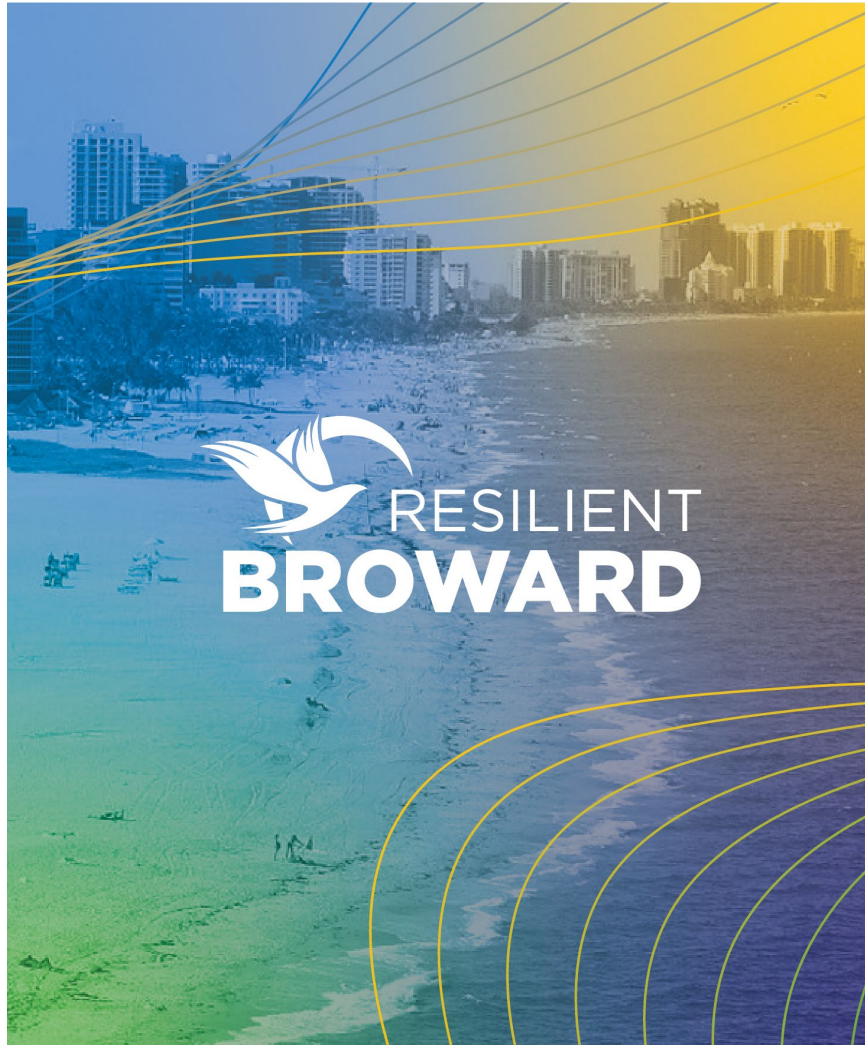
...for future design development.

4 – The Team will also develop the capital planning checklist...



- Minimum finished floor elevations established properly?
- Critical infrastructure installed at appropriate elevations?
- Includes appropriate adaptation measures?
- Incorporates other resilience elements?
- Includes best neighborly practices (harmonization)?

...to facilitate resilience reviews of future projects during the annual budget process.

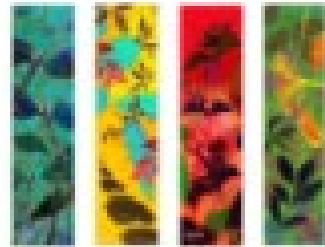


7

Next Steps/Upcoming Activities

Communications with Stakeholders

- **Strategic Planning** will be provided through our specialty subconsultant:
Joyce Coffee, Climate Resilience Consulting
- **Preliminary Vision** – Includes interacting with multiple entities



Xavier Cortada



THE STATE OF HISPANIC & IMMIGRANT BROWARD 2022

Broward County Equity Initiative



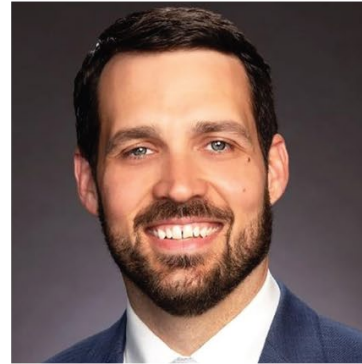
Engagement of our Blue Ribbon Panel



Daniel Stander



Michael Sukop, PhD



Hugh Roberts, PE



Cheryl Holder, MD



Jeff Hébert



Rowan Douglas, CBE

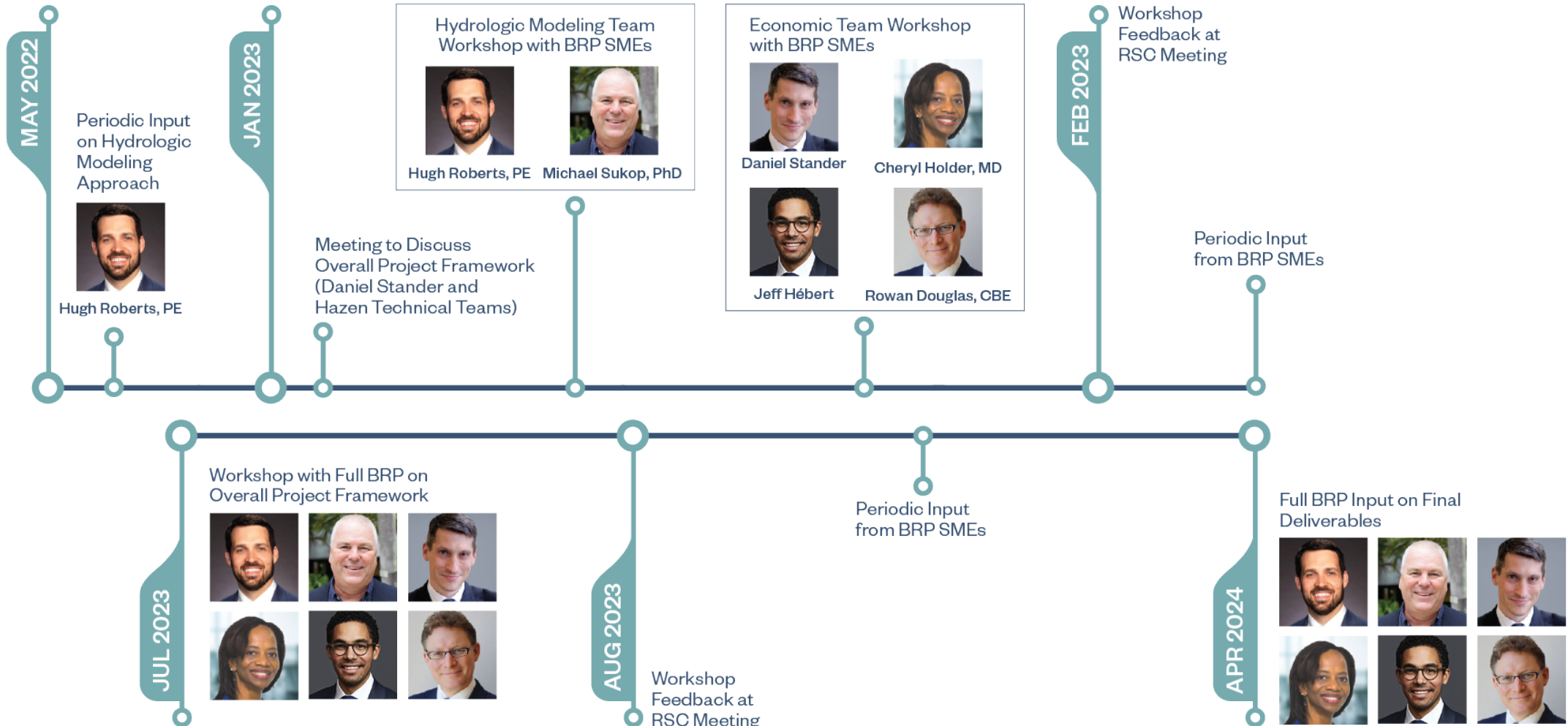
- Risk Modeling
- Social Equity
- Equitable Redevelopment
- Hydrology/Hydraulics
- Climate Change
- Economics

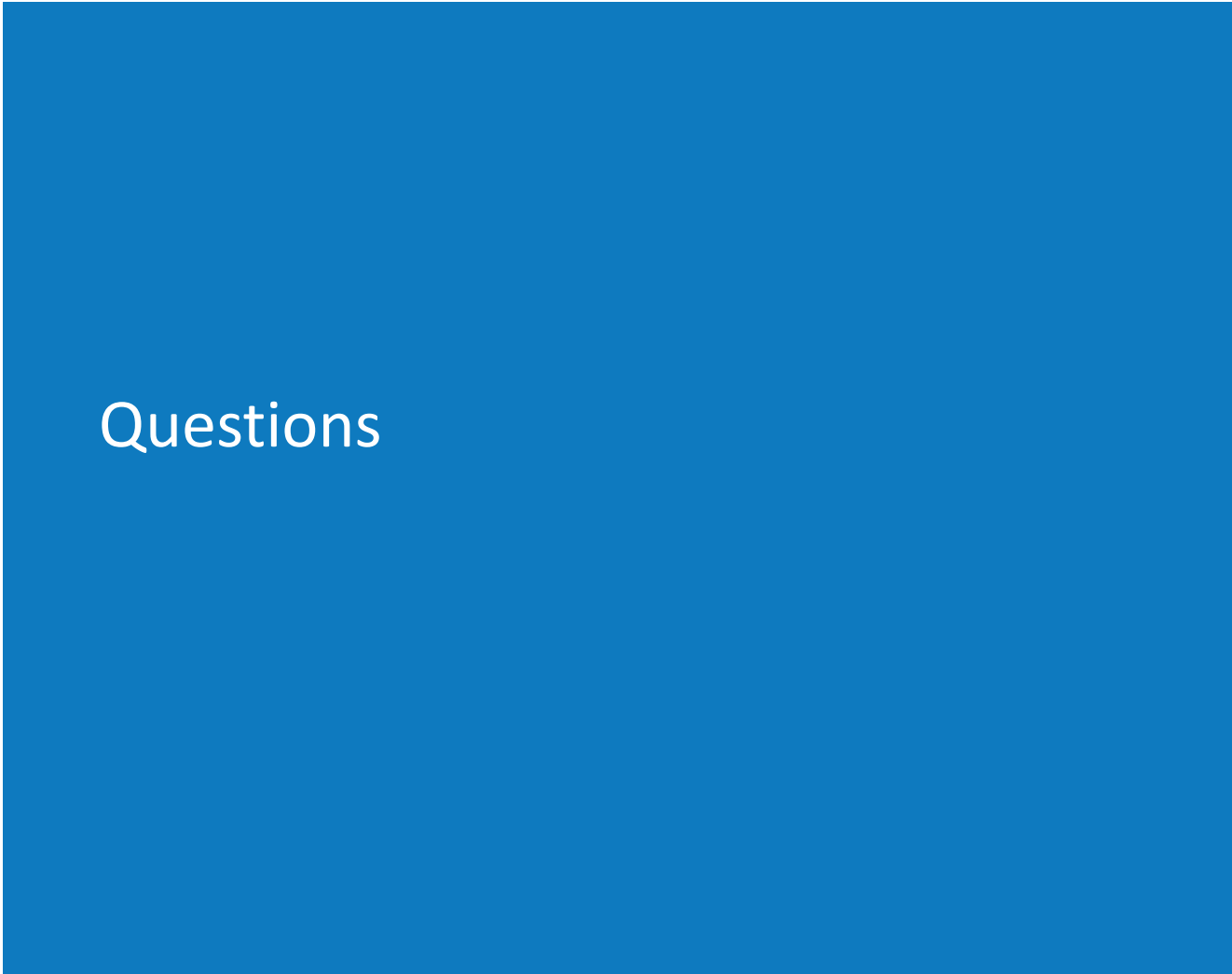
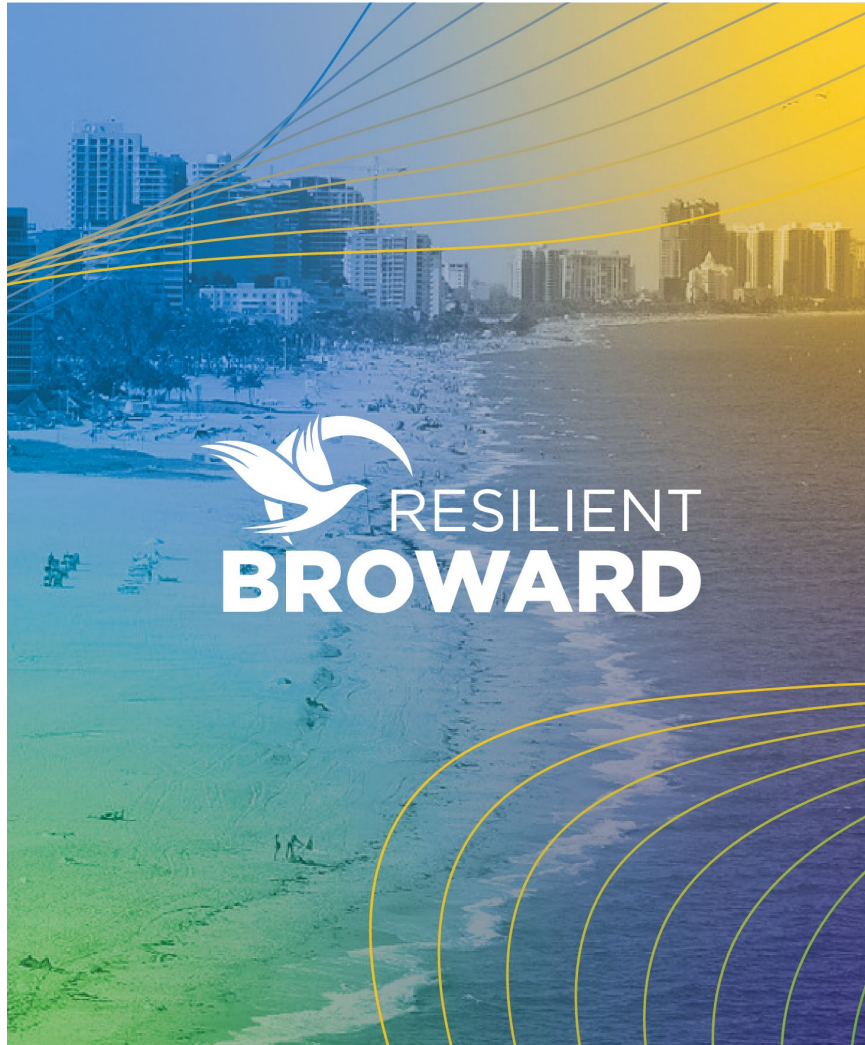
Anticipated Blue Ribbon Panel (BRP) Involvement



Overall Blue Ribbon Panel Leadership

Daniel Stander





Hazen