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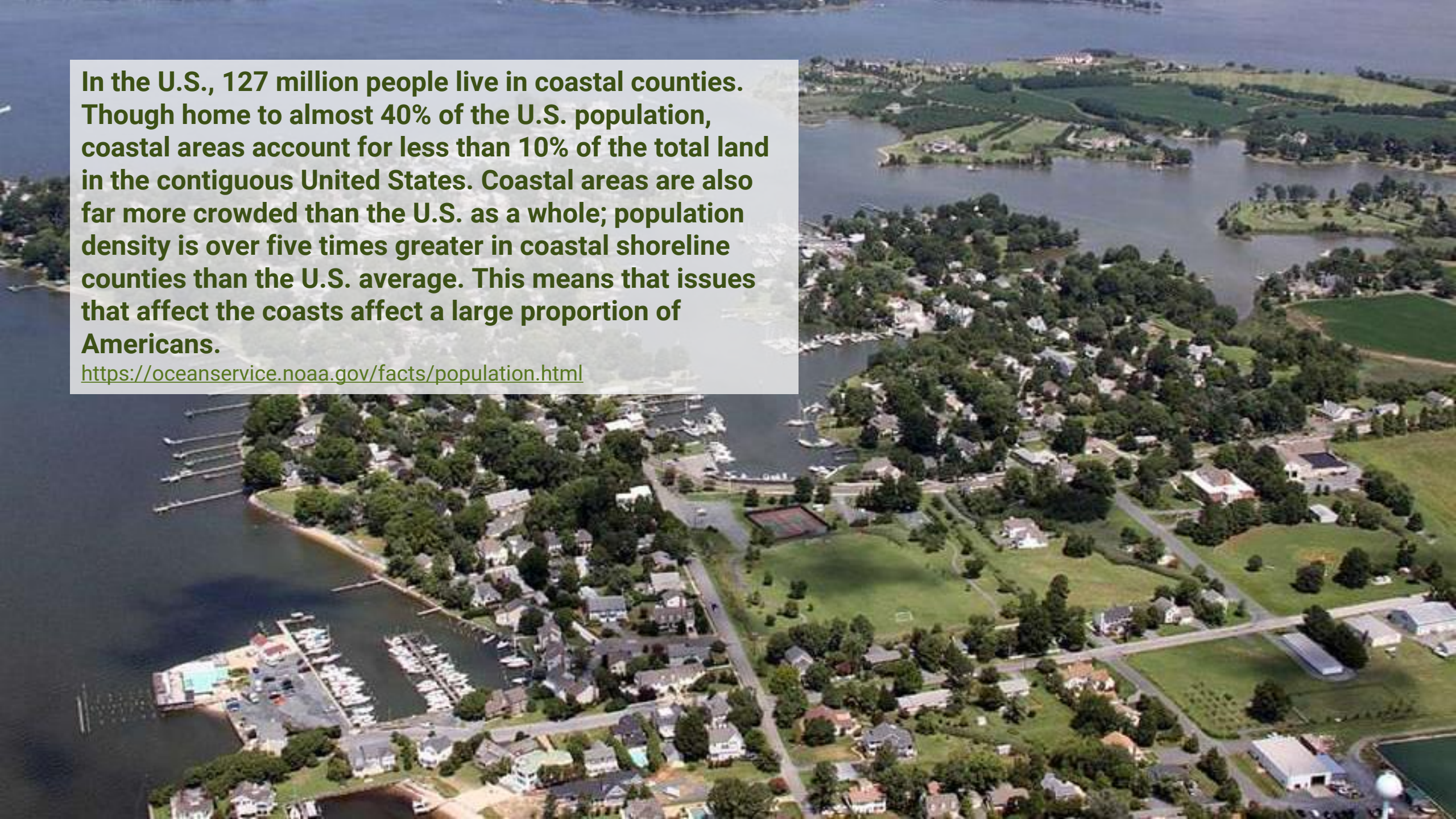
Brave the Storm: Strategies for Coastal Resilience

AUGUST 11, 2021

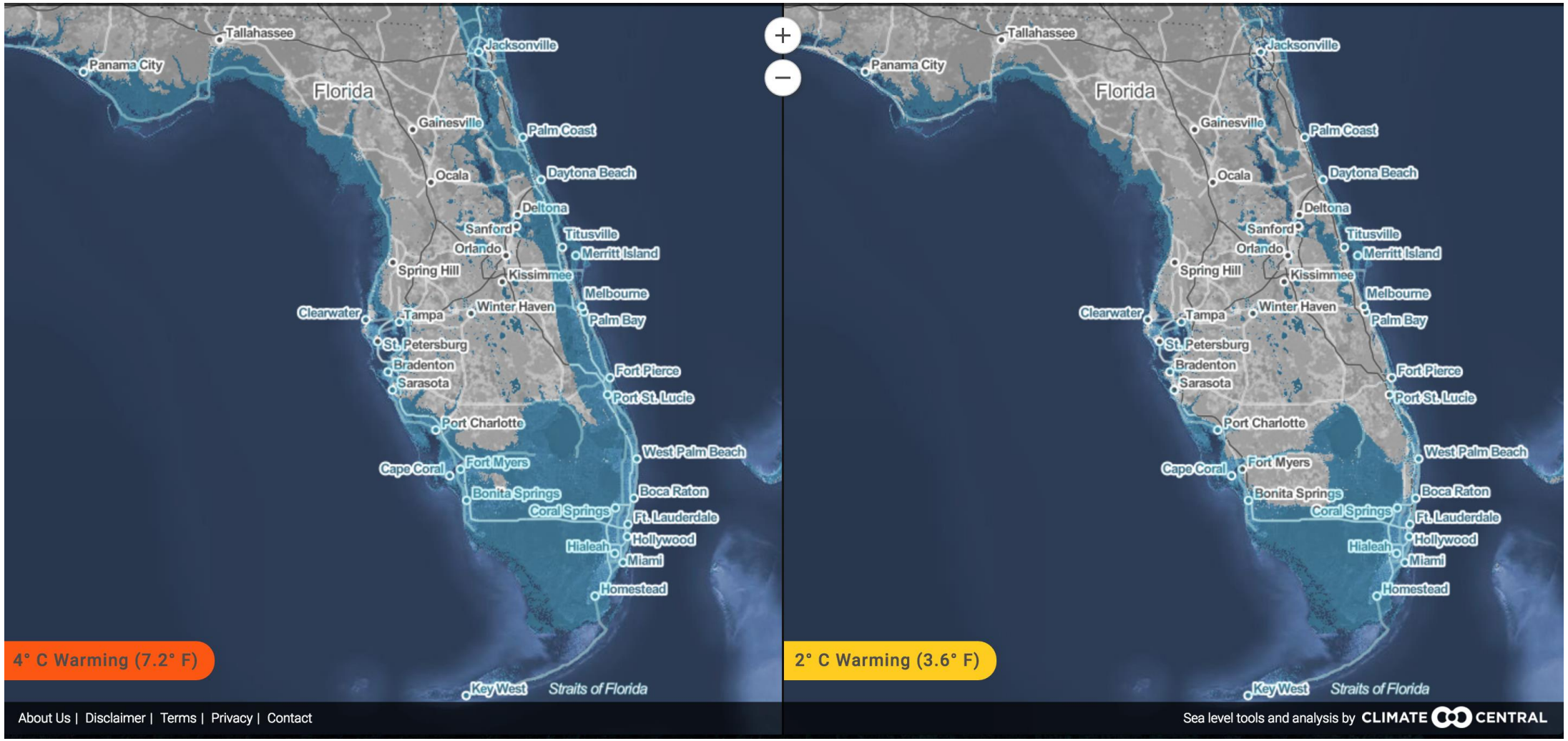
James Moore
Global Solutions Director
Cities & Places Jacobs
Moderator



In the U.S., 127 million people live in coastal counties. Though home to almost 40% of the U.S. population, coastal areas account for less than 10% of the total land in the contiguous United States. Coastal areas are also far more crowded than the U.S. as a whole; population density is over five times greater in coastal shoreline counties than the U.S. average. This means that issues that affect the coasts affect a large proportion of Americans.

https://oceanservice.noaa.gov/facts/population.html

Coastal Resilience Challenges: Sea Level Rise



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Current Impacts: Tidal Flooding & Water Infrastructure

Future Impacts: Permanent Inundation

Coastal Resilience Challenges: Intensified Rain Events

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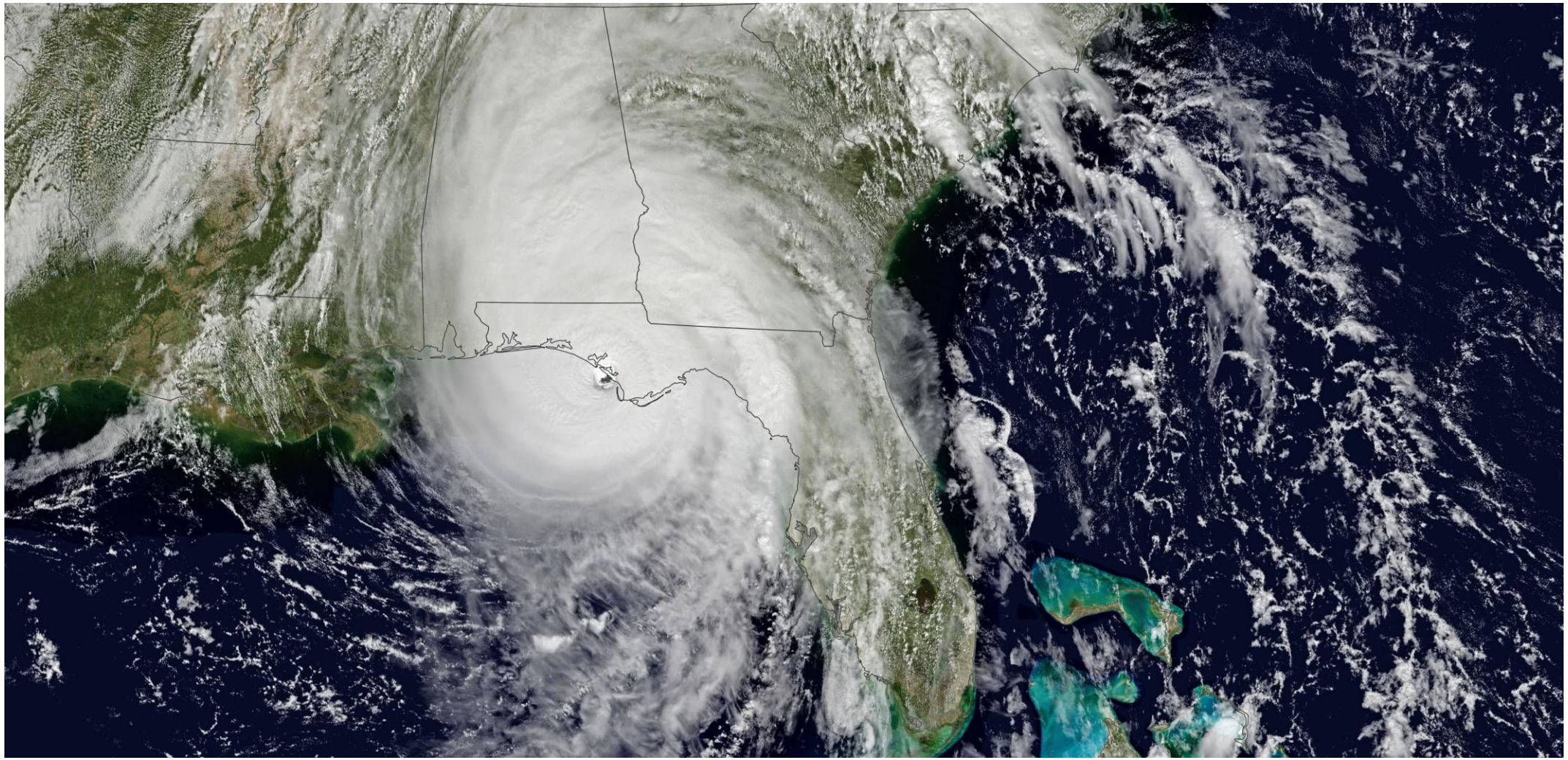
Coastal Resilience Challenges: Intensified Storm Events



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Impacts: Increased Wind Damage

Impacts: Increased Storm Surge

Impacts: Increased Flooding

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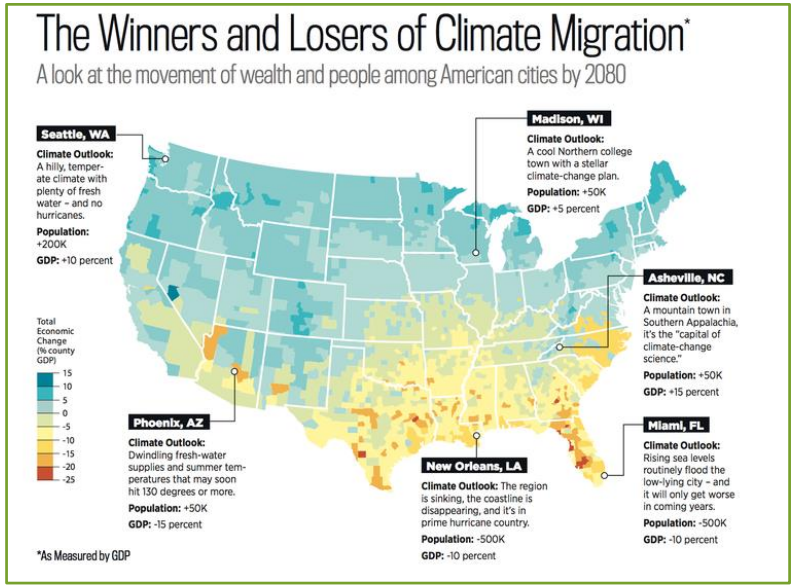
Coastal Resilience Responses

Harden

Mitigate / Adapt



Migrate / Retreat

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Harden / Protect

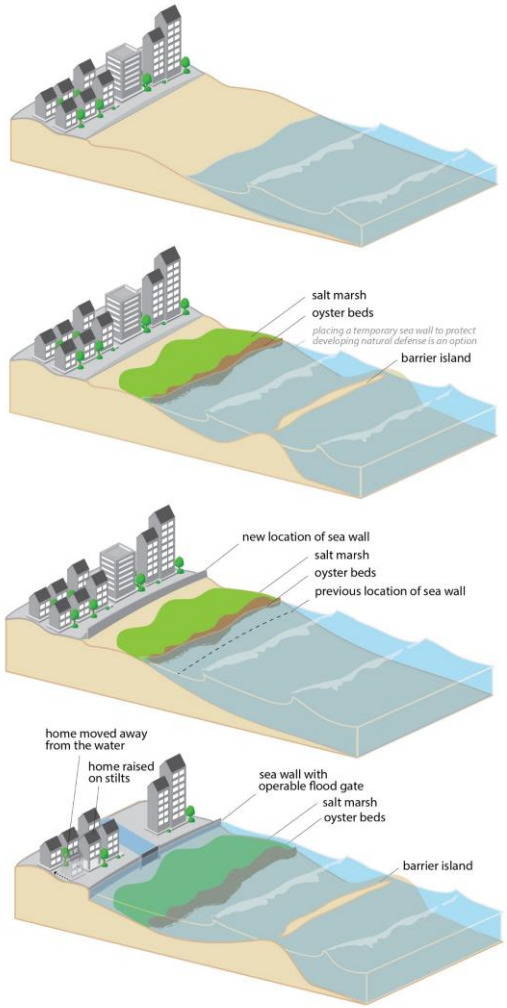
Mitigate / Adapt

Minimal Defense
Many communities have developed right along the ocean with only minimal natural defenses from a small strip of beach between them and the ocean.

Natural
Natural habitats that can provide storm and coastal flooding protection include salt marsh, oyster and coral reefs, mangroves, seagrasses, dunes, and barrier islands. A combination of natural habitats can be used to provide more protection, as seen in this figure. Communities could restore or create a barrier island, followed by oyster reefs and salt marsh. Temporary infrastructure (such as a removable sea wall) can protect natural infrastructure as it gets established.

Managed Realignment
Natural infrastructure can be used to protect built infrastructure in order to help the built infrastructure have a longer lifetime and to provide more storm protection benefits. In managed realignment, communities are moving sea walls farther away from the ocean edge, closer to the community and allowing natural infrastructure to recruit between the ocean edge and the sea wall.

Hybrid
In the hybrid approach, specific built infrastructure, such as removable sea walls or openable flood gates (as shown here) are installed simultaneously with restored or created natural infrastructure, such as salt marsh and oyster reefs. Other options include moving houses away from the water and/or raising them on stilts. The natural infrastructure provides key storm protection benefits for small to medium storms and then when a large storm is expected, the built infrastructure is used for additional protection.



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Migrate /Retreat

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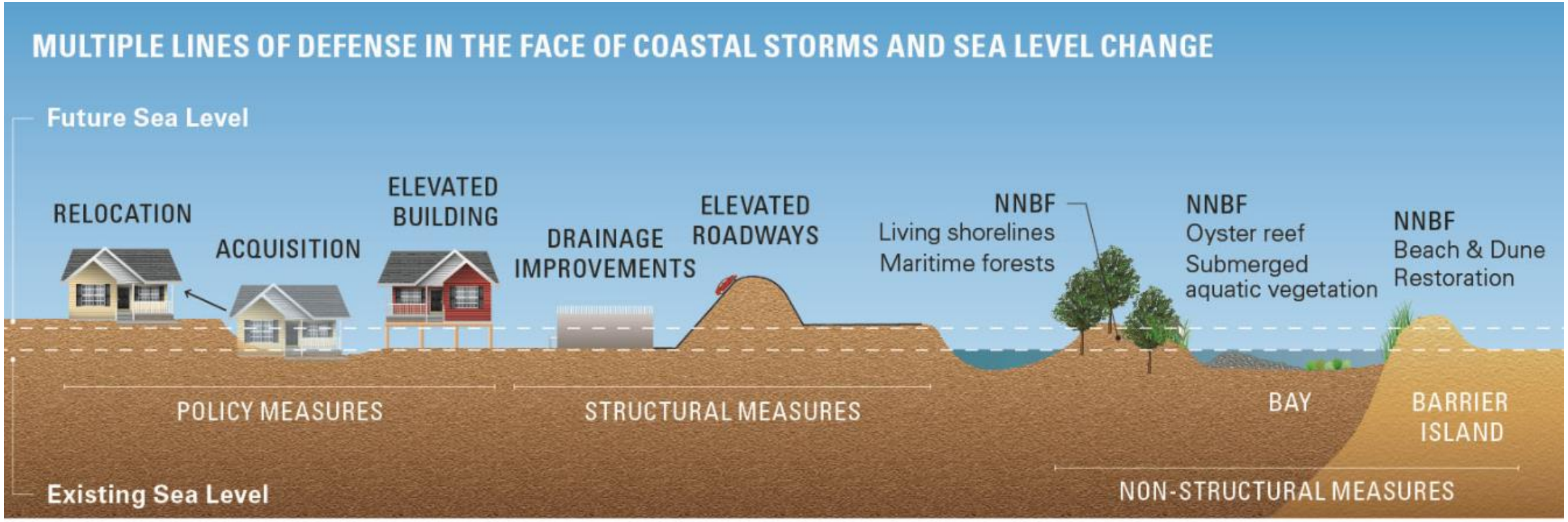
In Practice: Combining Multiple Approaches



Dr. Lynette Cardoch
Director of Resilience & Adaptation
Moffatt & Nichol

Tackling Uncertainty

- Temporal uncertainty
- Non-stationarity

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Miami-Dade Back Bay Coastal Storm Risk Management Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement

Draft Feasibility Study

May 29, 2020

US Army Corps of Engineers ®
Norfolk District

MIAMI-DADE COUNTY

LOCAL NEWS

Christina Vazquez, Reporter

Published: September 15, 2020 1:31 pm
Updated: September 15, 2020 4:59 pm

Tags: Miami-Dade County

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Army Corps of Engineers proposes flood wall to fortify Miami-Dade coastline

A 20-Foot Sea Wall? Miami Faces the Hard Choices of Climate Change.

A proposal to construct barriers for storm surge protection has forced South Floridians to reckon with the many environmental challenges they face.

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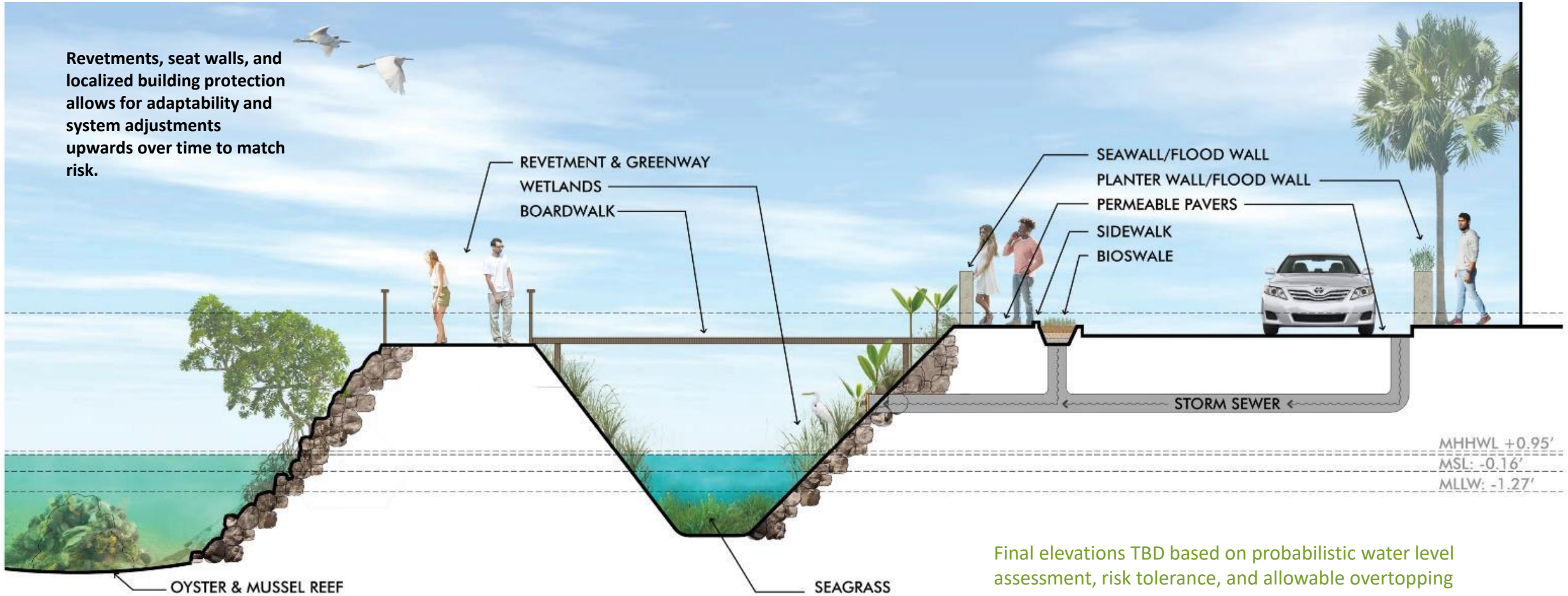
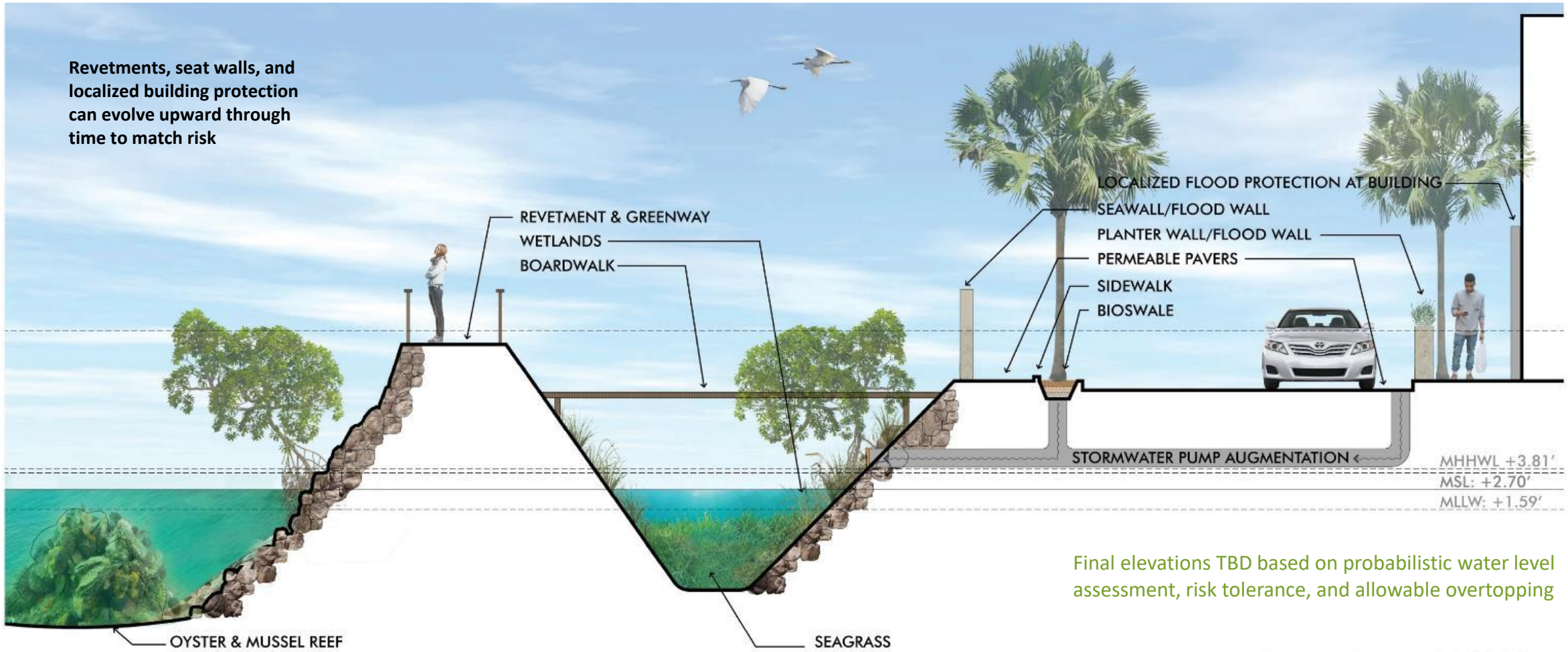
Opportunities - 2030



Final elevations TBD based on probabilistic water level assessment, risk tolerance, and allowable overtopping

Opportunities - 2079



Final elevations TBD based on probabilistic water level assessment, risk tolerance, and allowable overtopping

Promenade Plan View

Promenade Section

Promenade Section

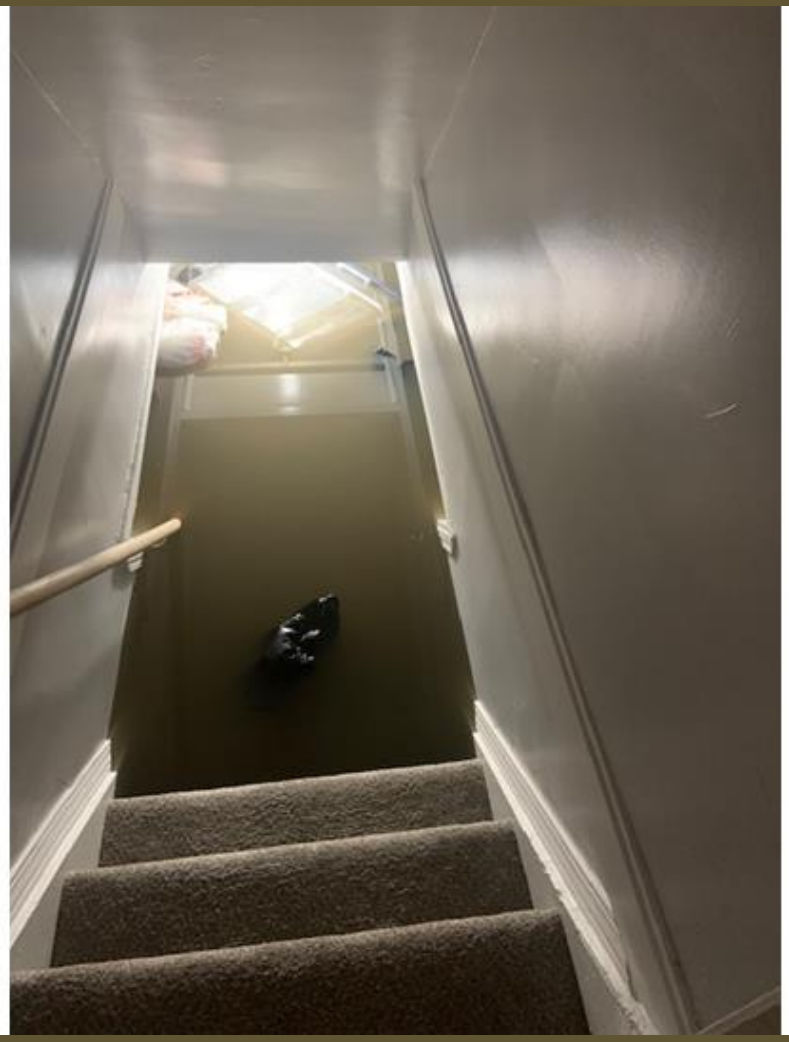
Dr. Jalonne L. White-Newsome
CEO/Founder
Empowering a Green Environment and Economy

"The purpose of resilience is not to build the capacity to endure more harm"

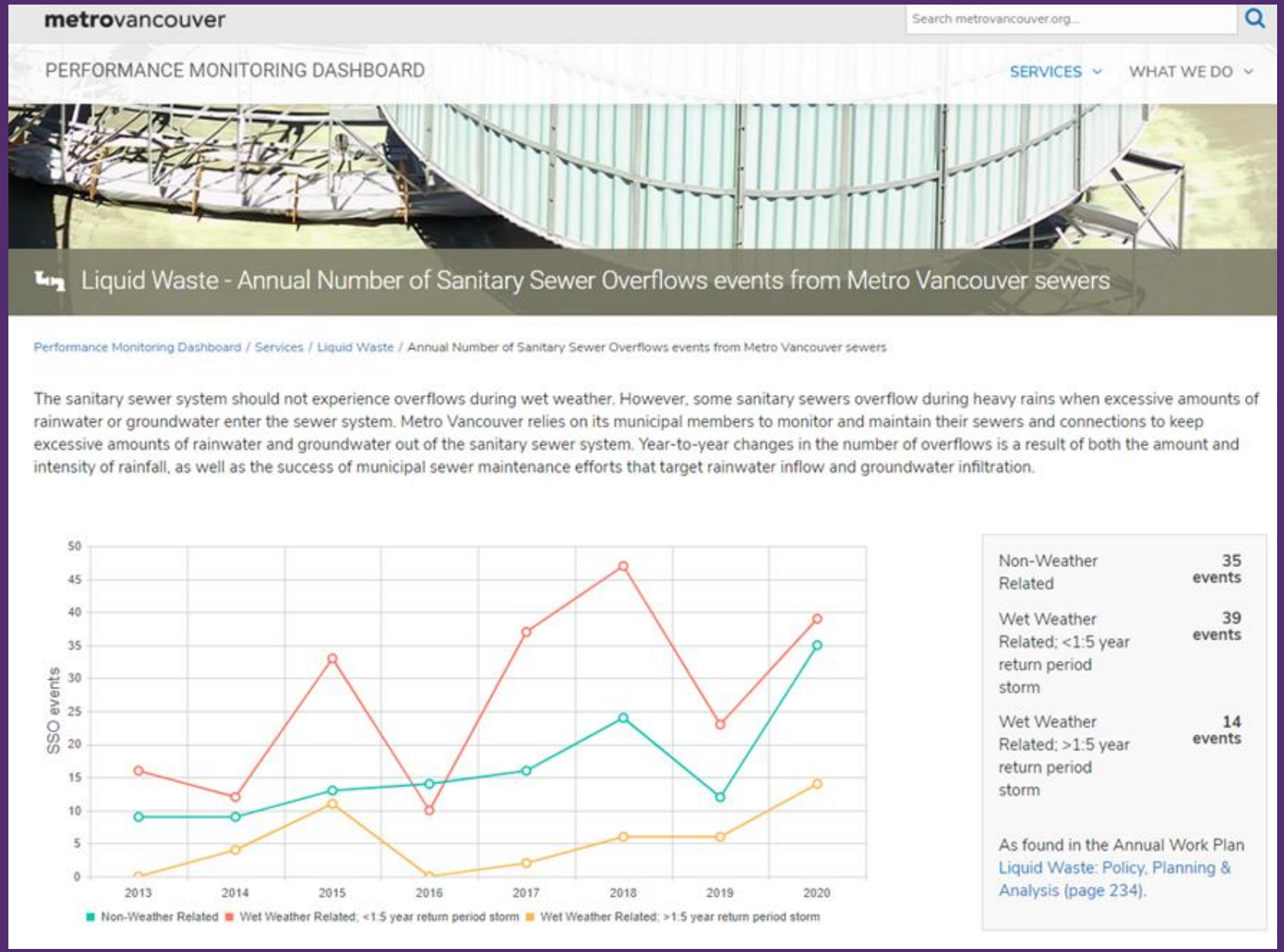
Profiles of Populations Socially Vulnerable to Floods

(adapted from Table 1, National Academy of Sciences, 2019)

Characteristic	Experienced impacts from flooding
Age – children and elderly	• Higher mortality • Higher morbidity • Higher mental trauma during and post-flood • Lower recovery rates
Race, immigration status, language - Nonwhite, recent immigrants, undocumented immigrants, non-native English speakers	• Higher death and injury rates • Negative post-flood health outcomes • Less flood insurance • Lower trust in authority for post-flood assistance
Income - poor	• Limited mitigation and recovery resources • Limited post-flood housing • Higher post-flood health impacts • Disproportionately reside in flood-prone areas • Differential rates of flood exposure, evacuation, and return • Lower recovery rates
Housing Tenure - renters	• Limited flood mitigation funding • Less access to post-disaster housing programs • Lower post-flood return rate
Transportation - Household lacking vehicle access	• Evacuation barriers
Education - Low educational attainment	• Lower flood awareness and understanding of flood mitigation • Lower rates of flood insurance coverage and settlements




Failing Infrastructure: Increases Vulnerability



Failing Infrastructure: Exacerbates Injustice

International Journal of
Environmental Research and Public Health

MDPI

Article

"We're Just Sitting Ducks": Recurrent Household Flooding as An Underreported Environmental Health Threat in Detroit's Changing Climate

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Received: 24 October 2018; Accepted: 16 December 2018; Published: 20 December 2018

check for updates

Abstract: Recurrent inland urban flooding is an understudied phenomenon that warrants greater attention, particularly in post-industrial cities where aging infrastructure, disinvestment, and climate change threaten public health. We conducted semi-structured interviews in 2017–2018 with 18 Detroit residents experiencing recurrent household flooding. We used standard qualitative coding analysis to generate 30 theoretically- and in vivo- derived themes related to flood experience, socioeconomic and health factors, and household, community, and policy interventions for reducing environmental exposures before, during, and after flood events. Snowball sampling yielded interviewees across both high- and low-risk areas for flood events, indicating vulnerability may be widespread and undocumented in formal ways. Residents described exposure to diverse risk factors for chronic and infectious diseases, particularly for seniors and young children, and emphasized stressors associated with repeated economic loss and uncertainty. Opinions varied on the adequacy, responsibility, and equity of local and federal relief funding and programs. We expand knowledge of flood-related vulnerability, offer innovative suggestions for risk communication based on residents' experiences, and recommend additional research for documenting patterns of recurrent flooding and response, even for precipitation events that are not characterized as extreme or disaster-level in the media or by agencies. These findings should guide local public health, emergency preparedness, sustainability, water and sewage, and community leaders in post-industrial cities.

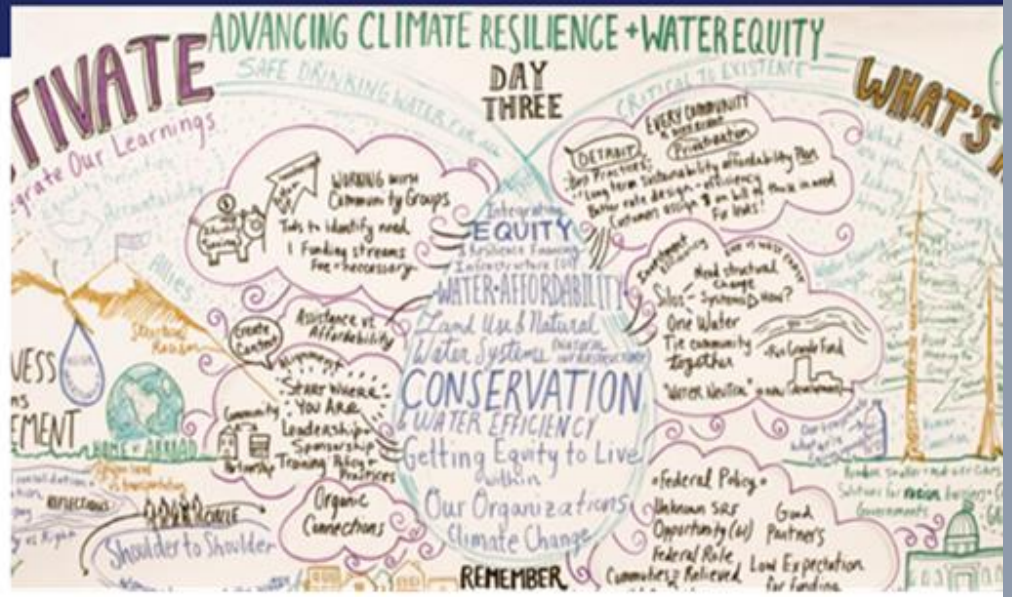
Keywords: flooding; water; infrastructure; climate change; vulnerability; risk communication; disinvestment

COMMENTARY

White-Newsome: Racism has made water hazardous to our health, but climate leaders are hopeful the Biden-Harris administration will bring change

January 21, 2021

Environment

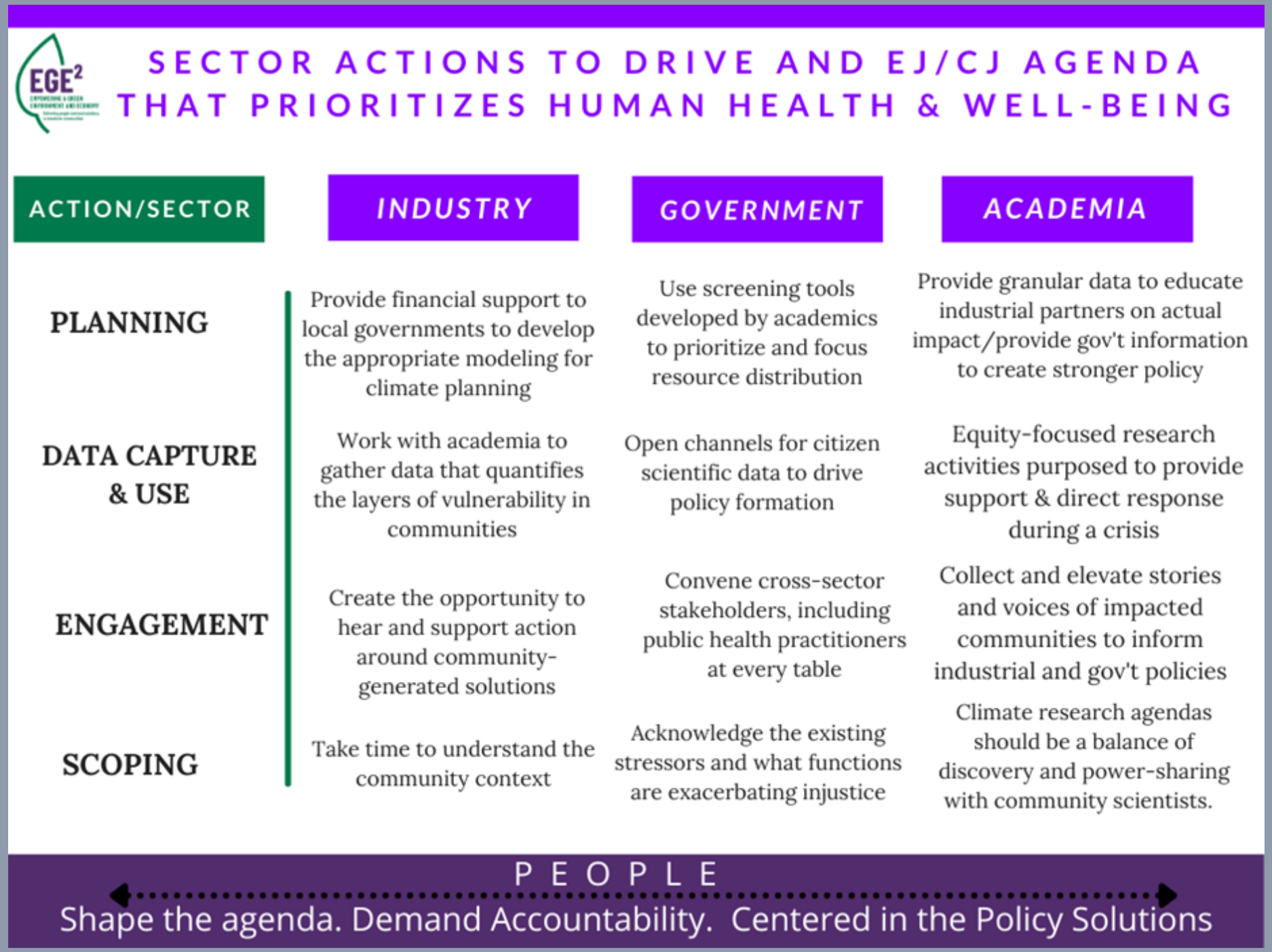


Failing Infrastructure: Allows Unaccountability

strategies for equitable resilience must include:

- Partnership
- Tools
- Practice
- A.D.A.P.T.-ING

Partnership



Tools

Choice Points (Making Decisions)

A decision-making framework that can be used to advance equity and counteract the implicit and explicit biases that negatively shape decisions made within public bureaucracies.

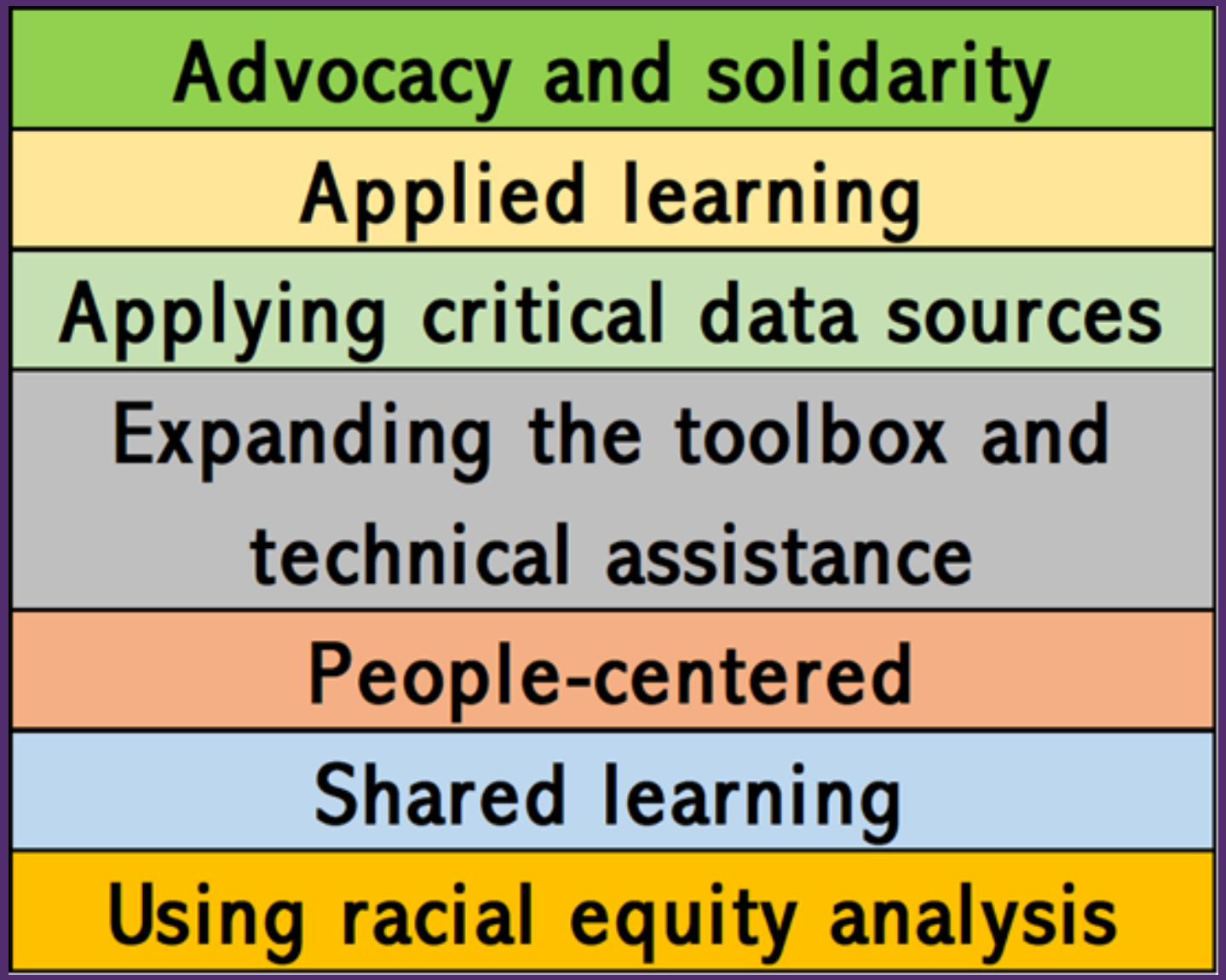
- *What are the decision-making points that affect outcomes?*
- *What decisions/actions may be reinforcing the status quo, implicit bias, and inequities?*
- *What alternative actions could produce different outcomes?*
- *Which actions will best advance equity and inclusion?*
- *What reminders, supports, and accountability systems can be structured into routine practices to keep equity a high priority?*

Social Equity Criteria (Measuring Decisions)

- Procedural Fairness – involves the examination of problems or issues related to due process, equal protection & the application of eligibility requirements within policies and programs.
- Quality/Process Equity – involves a review of the level of consistency in the quality of existing services delivered to groups and individuals.
- Access/Distributional Equity – involves a review of current policies, services, and practices to determine the level of access to services/benefits and an analysis of reasons for inequitable access.
- Outcomes – involves an examination of whether policies and programs have the same impact for all groups and individuals served.

Practice

7 Promising Practices for Advacing Equitable Climate Resiliency in Planning (Forthcoming, Fall 2021)



Policymakers, Designers, Planners must....

Acknowledge harm

Demand accountability

Address Racism, Power & Privilege

Prioritize Equity

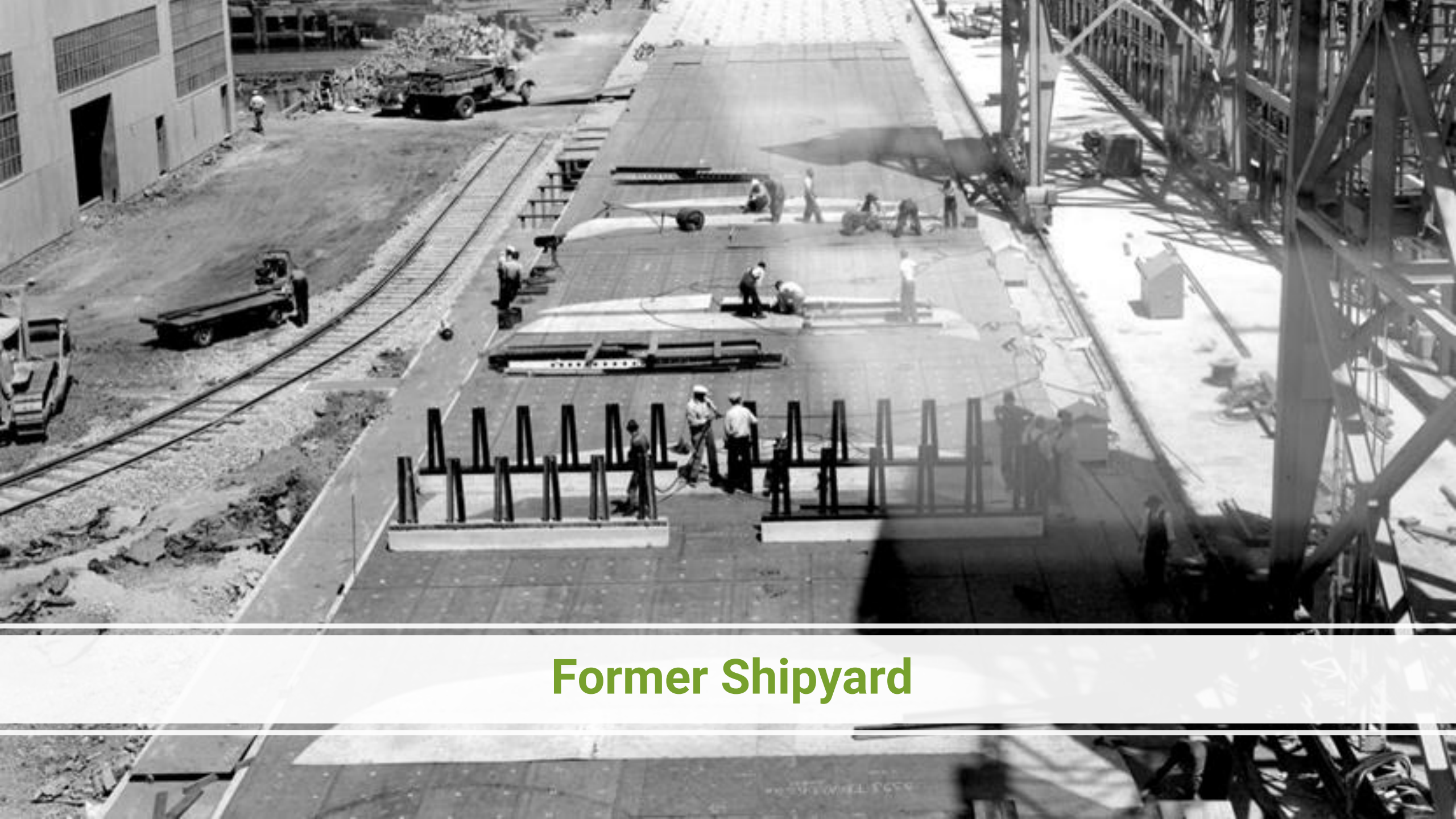
Transform Systems

Catherine Reilly

Senior Development Director

Brookfield

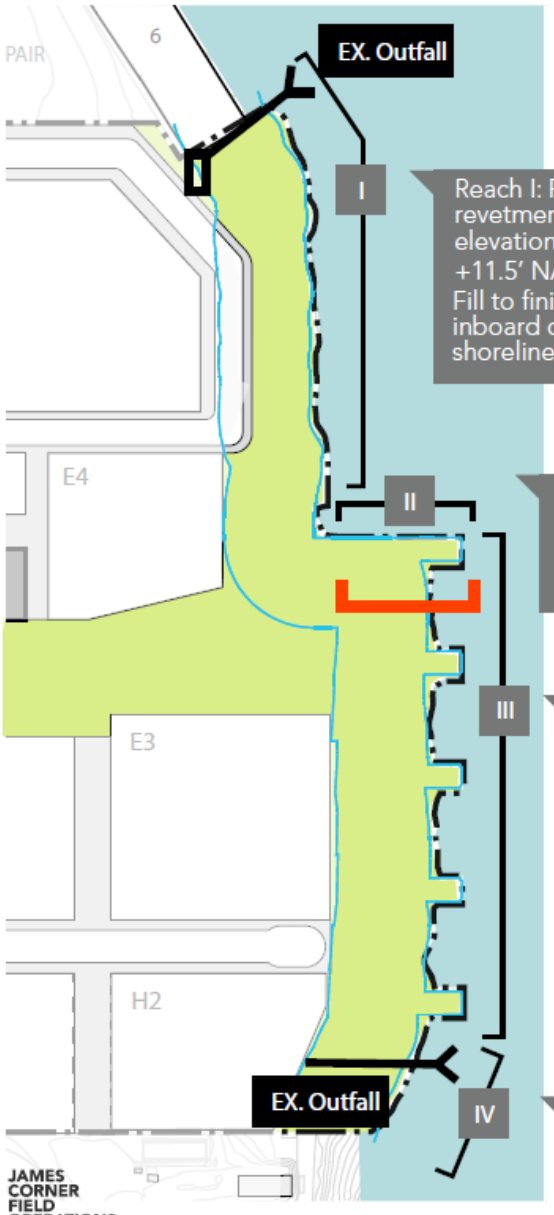
Case Study: Pier 70, San Francisco, CA



Former Shipyard

INTRODUCTION
SITE CONTEXT

PIER 70
SHORELINE IMPROVEMENT

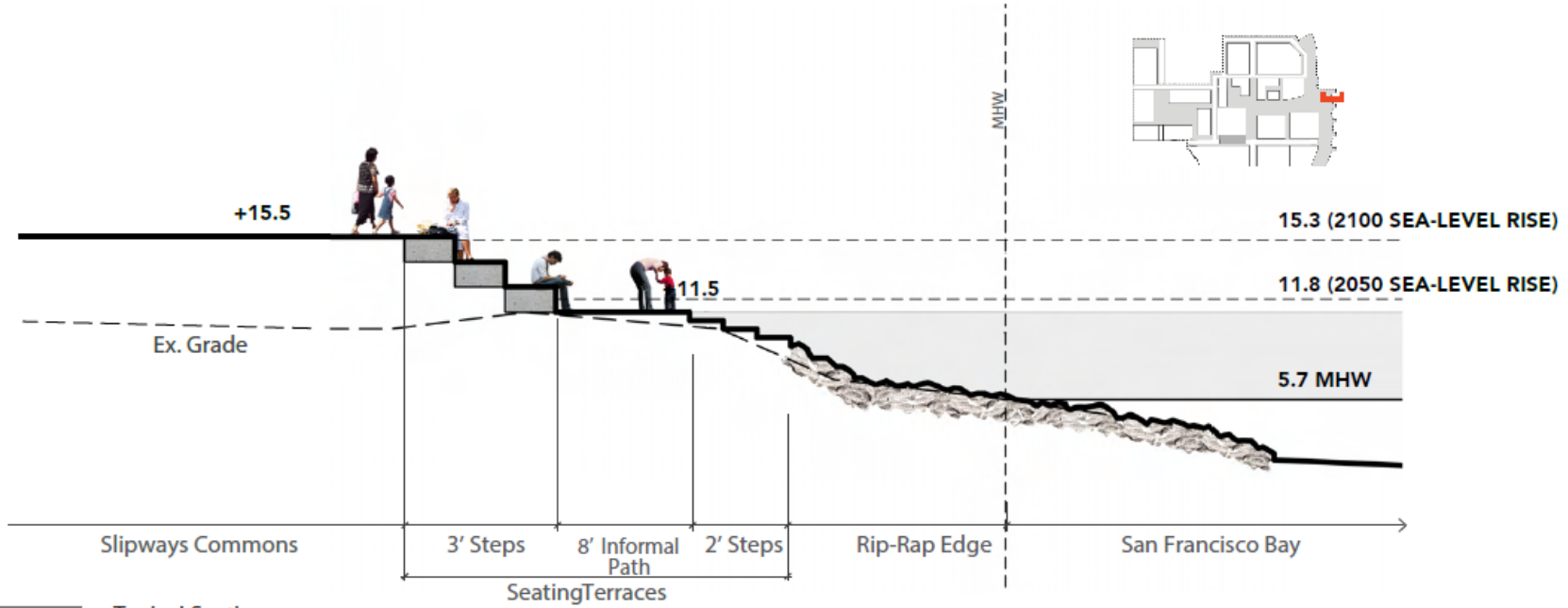


Reach I: Rip-rap revetment at MHW to elevations +11.0' to +11.5' NAVD
Fill to finish grade inboard of continuous shoreline path.

Reach II: Bulkhead wall repair or replacement.
Alternative 1: Sheet Pile Wall.
Alternative 2: Soldier Pile Wall

Reach III: Repair existing slope protection with armored stone and crushed rock leveling course Rip-rap revetment, hardscape steps, or cantilevered/pile platform for +11.5' NAVD
Fill to finish grade inboard of continuous shoreline path.

Reach IV: Improve revetment to between +11.5 and +12.0 NAVD. Above +12.0, revetment or concrete block mats.



Typical Section

Water Level	NAVD88 (feet)
Mean High Water	**5.7**
Mean Higher High Water	**6.4**
Upland Base Flood Elevation	
100-Year Flood	**9.4**
100-Year Flood 2050 (12" - 24")	**10.8 - 11.8**
100-Year Flood 2100 (36" - 66")	**12.8 - 15.3**
Shoreline Base Flood Elevation	
100-Year Flood	**11.7 - 13.4**
100-Year Flood 2050 (12" - 24")	**12.7 - 15.4**
100-Year Flood 2100 (36" - 66")	**14.7 - 18.9**

* Range shown for 2050 and 2100 includes projected and high scenarios of sea level rise from National Research Council NRC (2012) Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.

PLACES
WATERFRONT TERRACE LAWN

JAMES CORNER FIELD OPERATIONS

Historic Buildings

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Building 12

Building 15

Building 21

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Buildiing 12

Funding Sources

- Initial Construction for First 100 Year Protection
  - Developer fronts money for initial construction.
  - Port uses special taxes on the project (community facilities district tax) and tax increment to reimburse the developer and pay for feasibility gaps for historic rehabilitation.

- Future Sea Level Rise Improvements
  - Separate CFD special tax will kick in in future for to be determined sea level rise improvements. Can be used outside project area.

- Parks Maintenance
  - Project self-funds through another CFD special tax for maintenance of parks.

Moderated Discussion

Dr. James Moore
Global Solutions Director
Cities & Places, Jacobs
(Moderator)

Dr. Jalonne White-Newsome
Founder
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