Stakeholder Advisory Group

Board of Water Supply
City & County of Honolulu

Thursday April 25, 2019

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Program Administrator
Water Resources Division
Honolulu Board of Water Supply
City and County of Honolulu

CLIMATE CHANGE PANEL DISCUSSION

BWS Strategic Plan

Water Utility Climate Alliance

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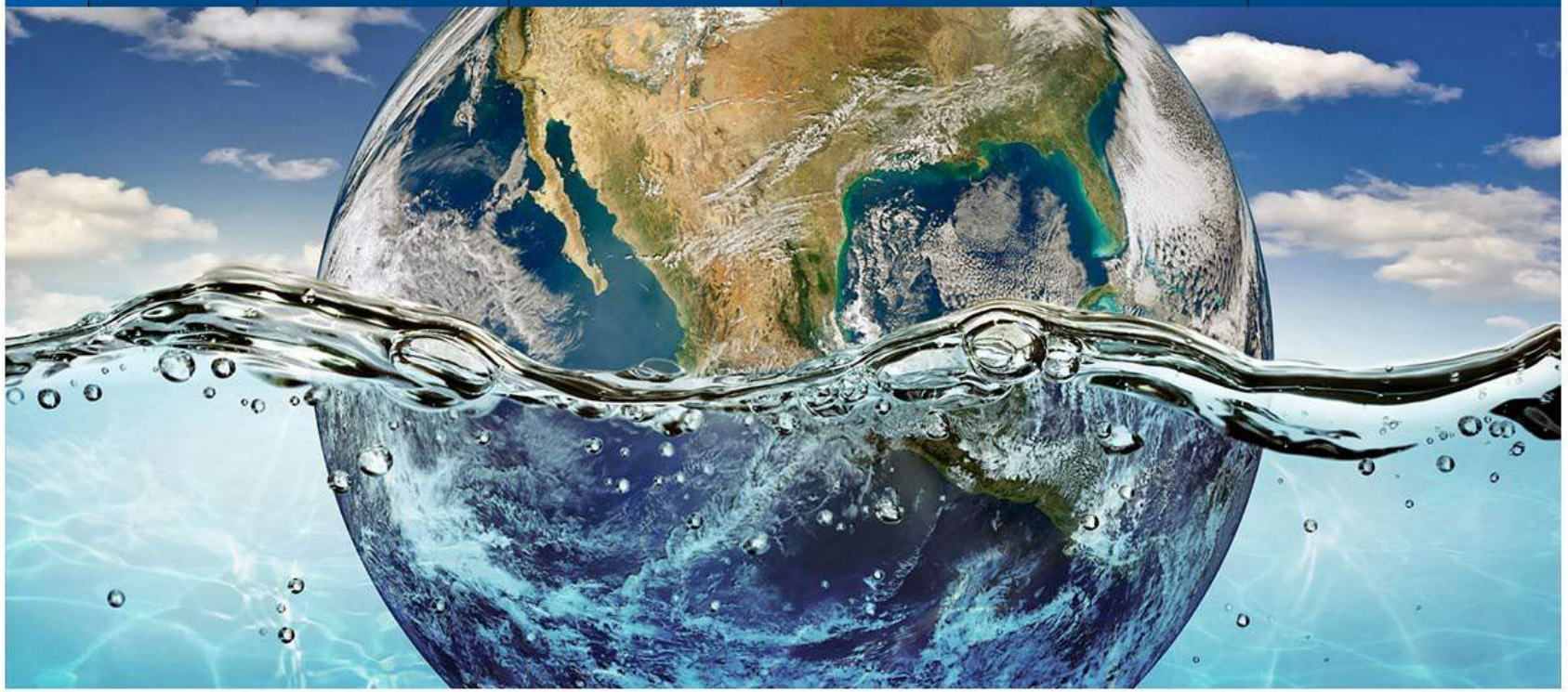


Delivering reliable, high-quality water requires a delicate balance between water supplies and customer demands.

While water managers continually strive to maintain this supply-and-demand balance through long-term water resource planning and demand management, new challenges exist due to the impacts of climate change, putting the world's water resources at risk.

The Water Utility Climate Alliance (WUCA) is dedicated to enhancing climate change research and improving water management decision-making to ensure that water utilities will be positioned to respond to climate change and protect our water supplies.

April 25, 2019

Impacts of Climate Change on Honolulu Water Supplies and Planning Strategies for Mitigation

Barry Usagawa, P.E., Water Resources, Board of Water Supply

Objectives

- Evaluate climate change impacts on Honolulu Board of Water Supply (BWS) infrastructure and water supply
- Develop a suite of strategies to address the anticipated changes

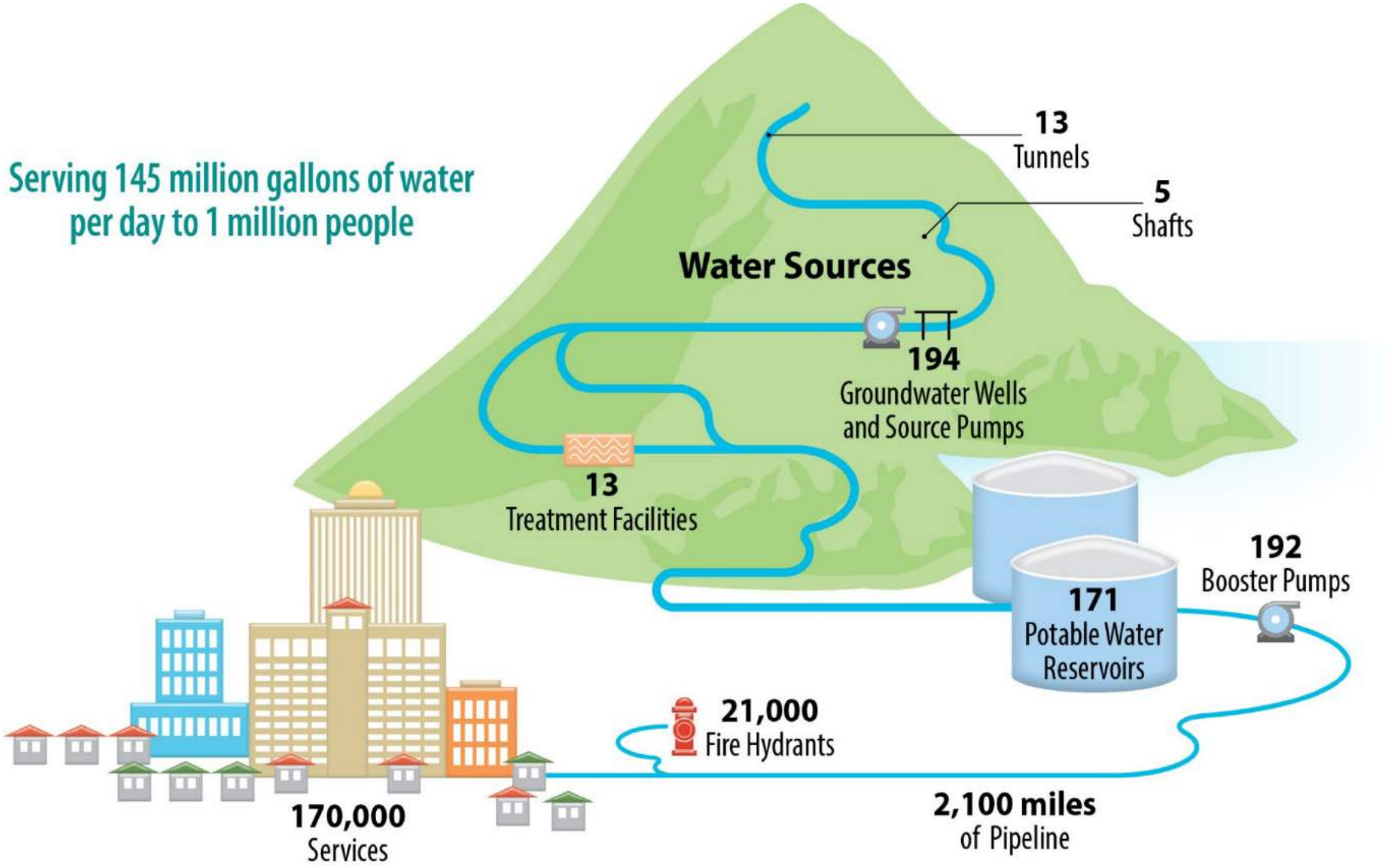
This project supports Water Research Foundation's (WRF) Climate Change Strategic Initiative objective to provide water utilities with a set of tools to assess their vulnerabilities and develop applicable adaptation strategies.

Jointly funded by Honolulu Board of Water Supply and Water Research Foundation through Water Research Foundation's Tailored Collaboration Program

Board of Water Supply

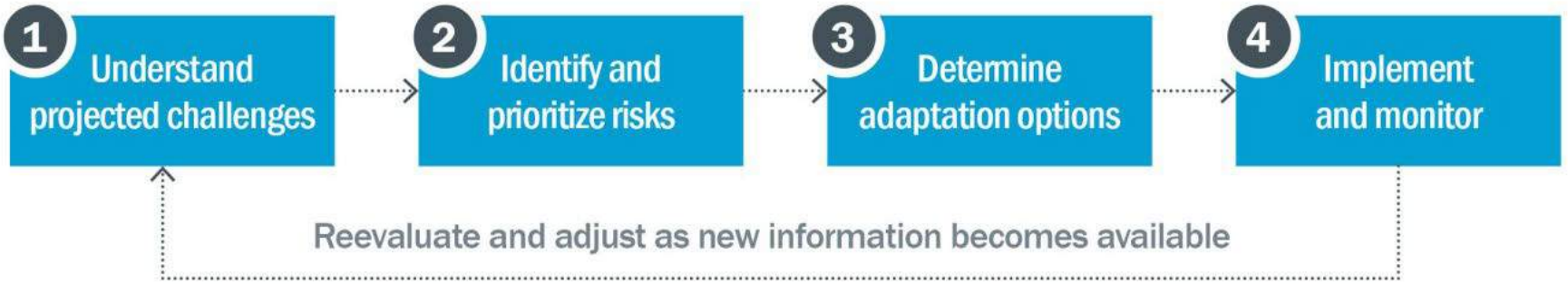
THE Water Research FOUNDATION

The BWS Water System is Large and Complex



Project Approach

- Adaptive management is an iterative process for flexible decision making in the face of uncertainties
- Utilized scenario planning to consider a range of potential changing conditions

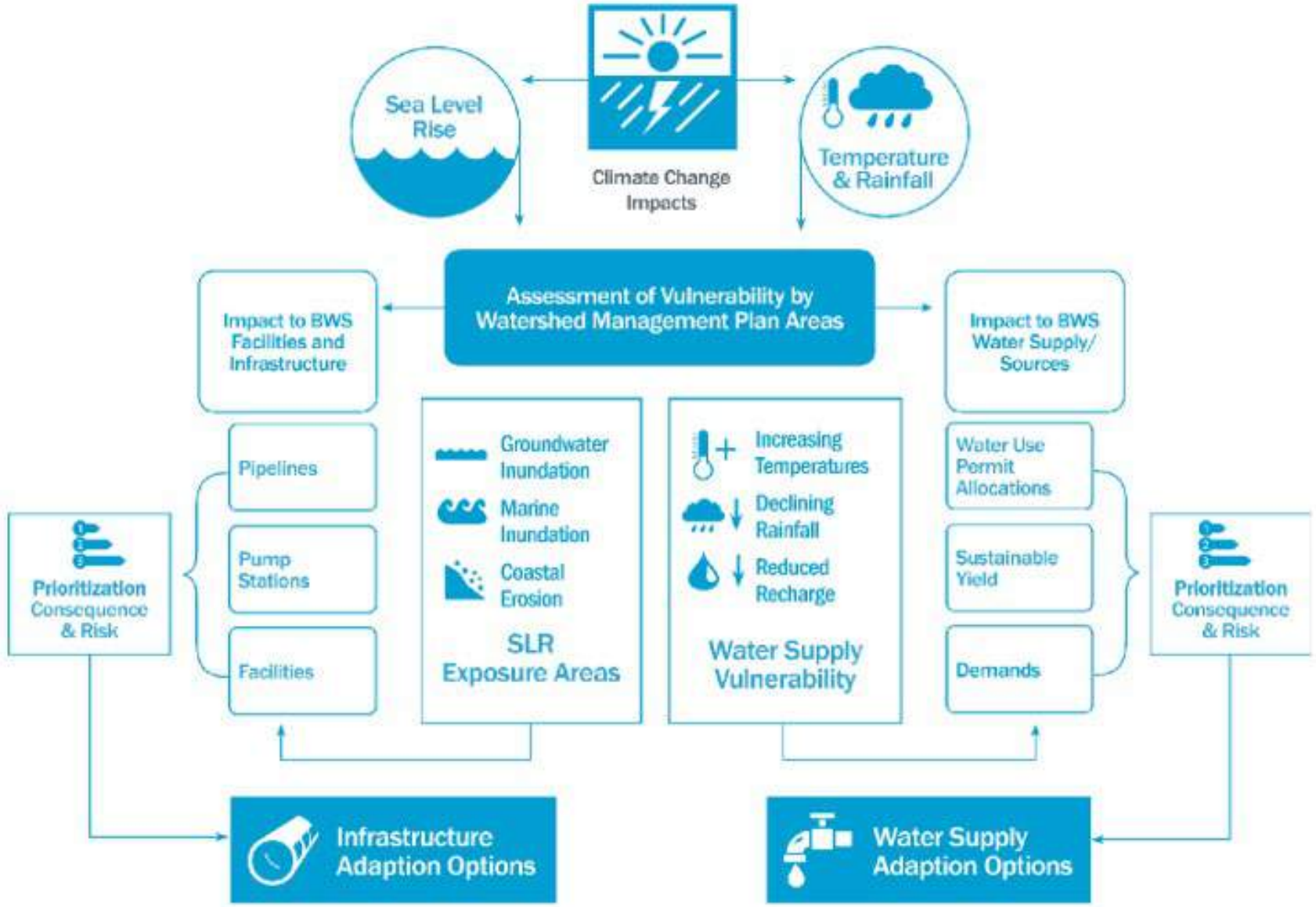


Vulnerabilities & adaptive management strategies identified for 3 time frames:

- Short-term (2020–2030)
- Mid-term (2030–2050)
- Long-term (2050–2100)

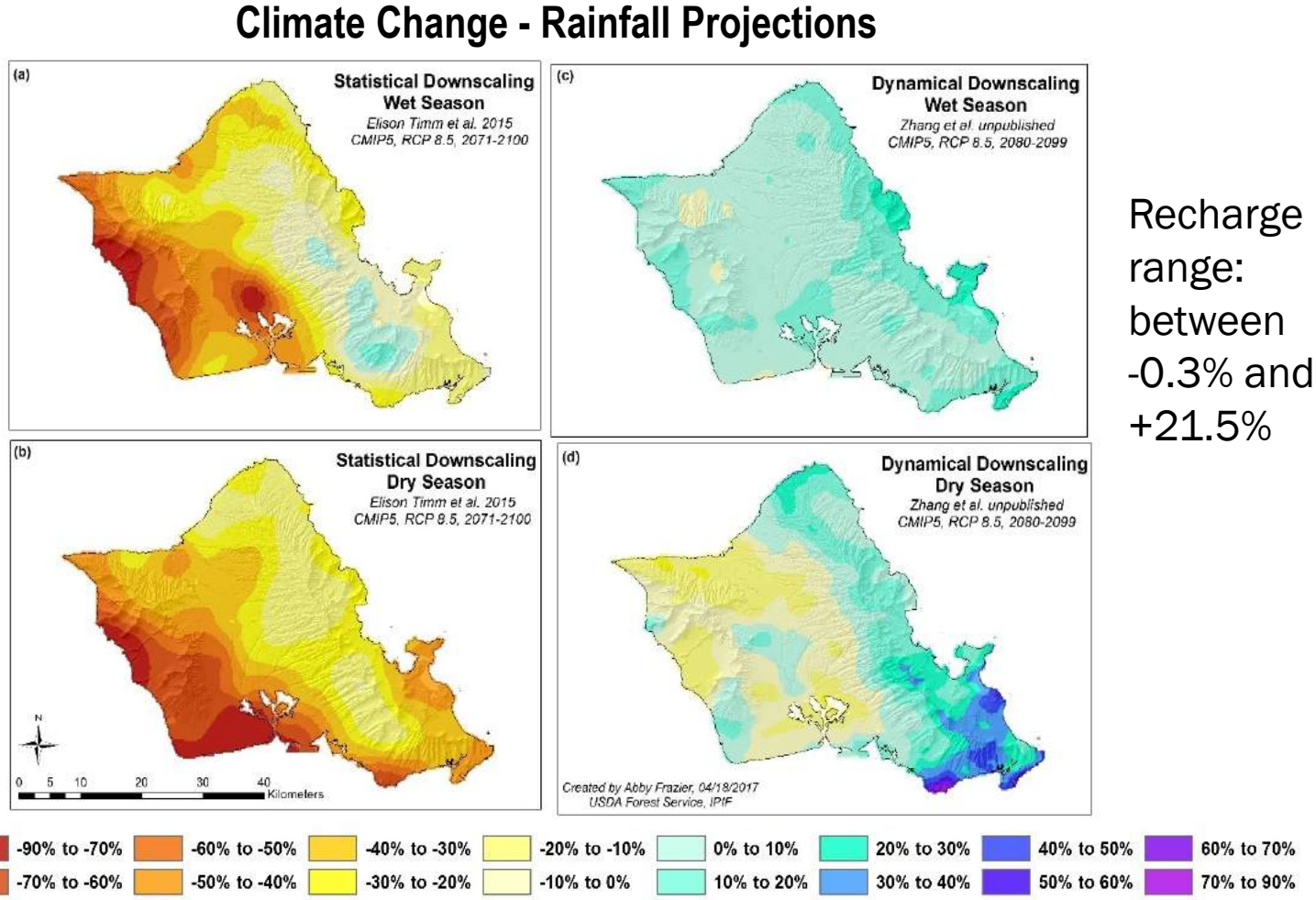
Goal is to develop policies and actions that encourage “no regrets” strategies.

Vulnerability Assessment Approach



Downscaled Climate Models indicate a Range of Rainfall Futures

Recharge range: between -4% and -72%

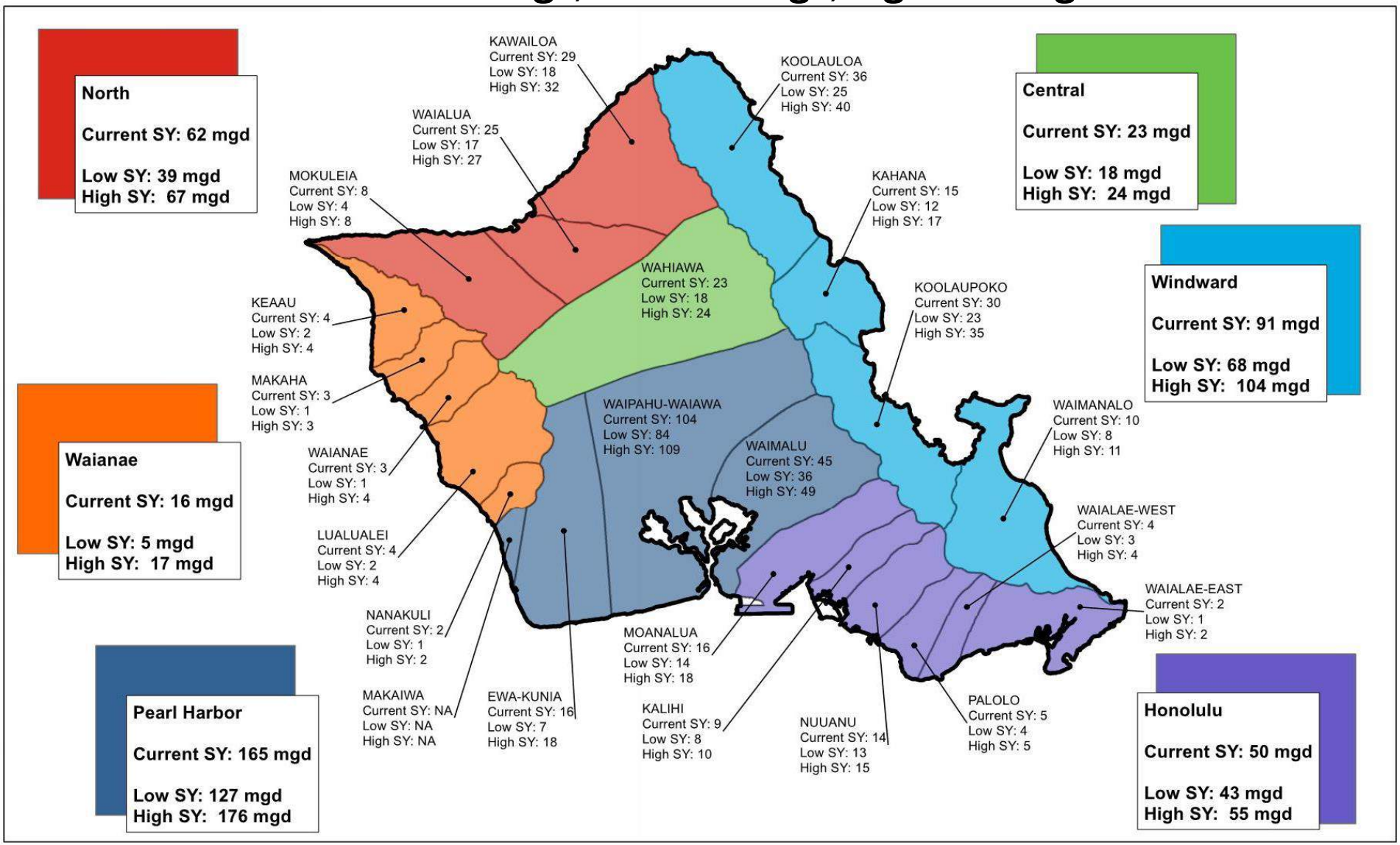


Recharge range: between -0.3% and +21.5%

Source: Figure developed by Abby Frazier April 2017

Current SY and Potential Range of SY from Climate Forecasts

Current: 407 mgd, Low: 300 mgd, High: 443 mgd



Preliminary Supply Adaptation Strategies:

Recharge could decrease Oahu sustainable yields by ~27%. Statistical model From 407 mgd to 300 mgd a difference of 107 mgd, Turk, Report #9, B&C.

- Reduce per capita water demand from 155 gpcd to 100 gpcd through aggressive water conservation, like dual plumbing with recycled water
- Storm water capture in Nuuanu and on-site for new development
- Expanded Reuse at Honouliuli, Mililani, Wahiawa and Schofield WWTP's
- On-site reuse
- Increase transfers from Wahiawa and Waipahu Waiawa aquifers to Waianae and Honolulu. Drill more wells in Wahiawa and Waipahu-Waiawa
- Assertion of Public Trust Water Rights for Domestic Use to retain water use permits in a revocation process
- More desalination in Ewa and possibly for Honolulu
- Desalinated reuse in Honolulu, Waianae and Hawaii Kai where wastewater effluent is too salty for irrigation
- Indirect or Direct Potable Reuse with RO desalination and UV/Ozone disinfection

Infrastructure Impacts from Sea Level Rise

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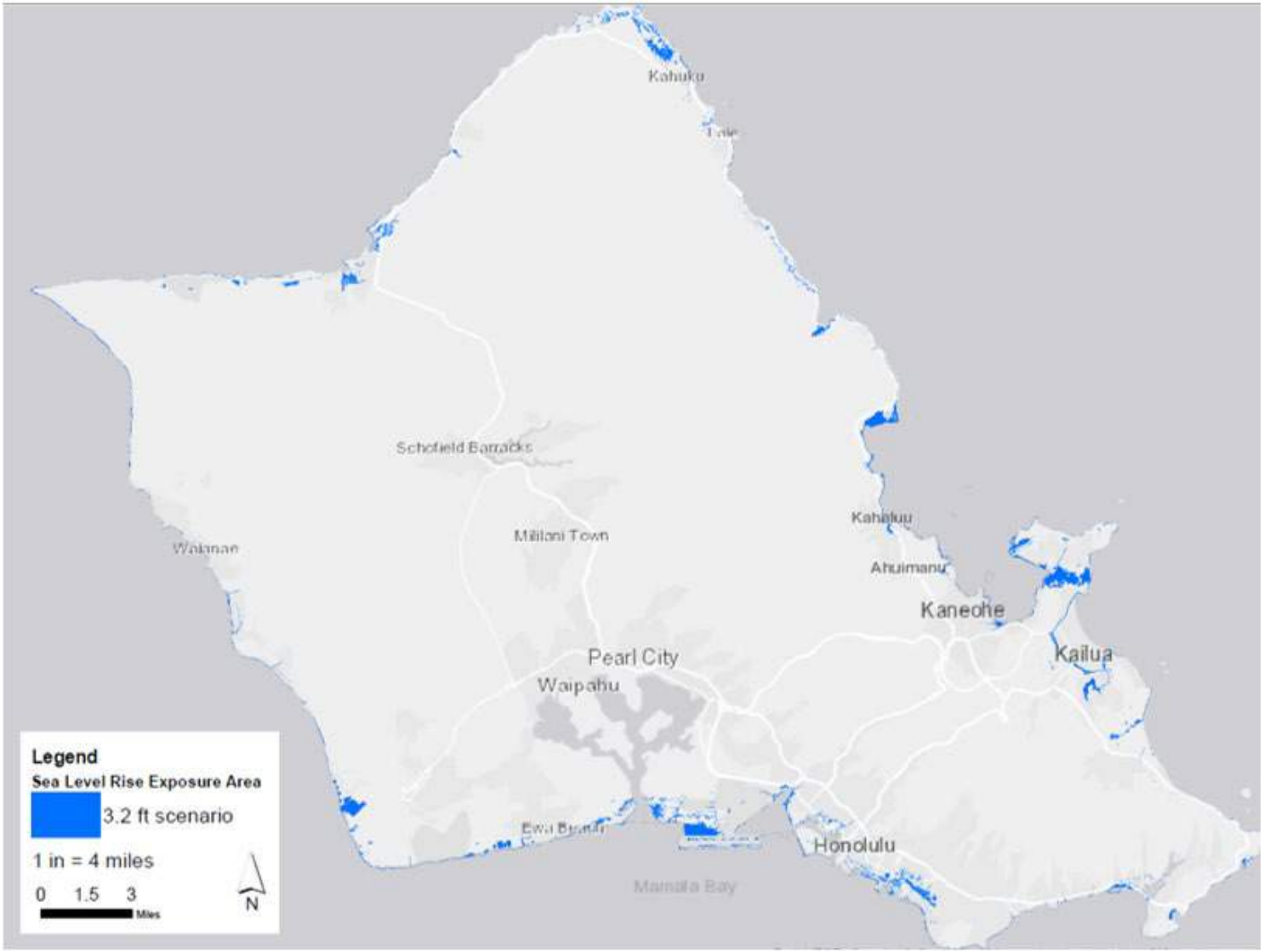
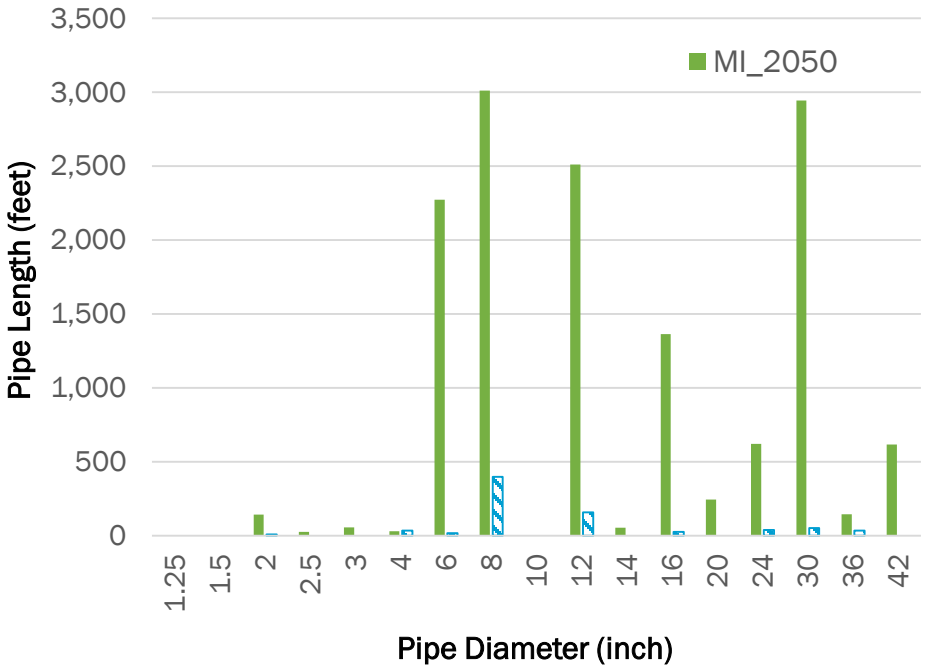
3.2 feet of SLR Exposure Areas on Oahu

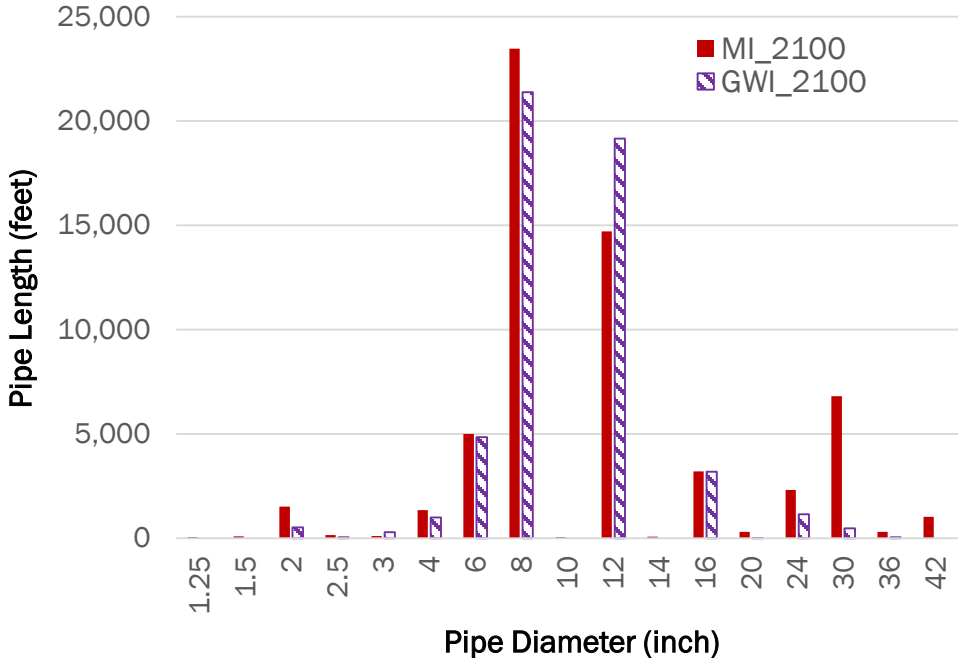


24 Low Elevation/Coastal Water Pipeline Bridge Crossings may be subject to coastal erosion impacts.

Corrosion impacts to 21 miles of metallic pipelines with 3.2’ of SLR by 2100

Pipe Lengths Impacted Island-wide by Hazard (feet)						
Time Period	Year	SLR (feet)	Pipe Length for All Diameters (1.25-inch to 42-inch (feet)		Percent of Total BWS Infrastructure Impacted	
			MI	GWI	MI	GWI
Mid-Century	2050	1	14,038	772	0.1%	0.01%
End-of-Century	2100	3.2	60,409	52,026	0.6%	0.5%





Nimitz & Alakawa, July 3, 2018, 8:00 am, Lowest high tide of the day. Highest tide 1’ higher

2017 - King Tide - Waikiki






Courtesy of OCCSR

2017 - King Tide – Ala Wai Canal







Courtesy of OCCSR

2017 - King Tide - Mapunapuna







Courtesy of OCCSR

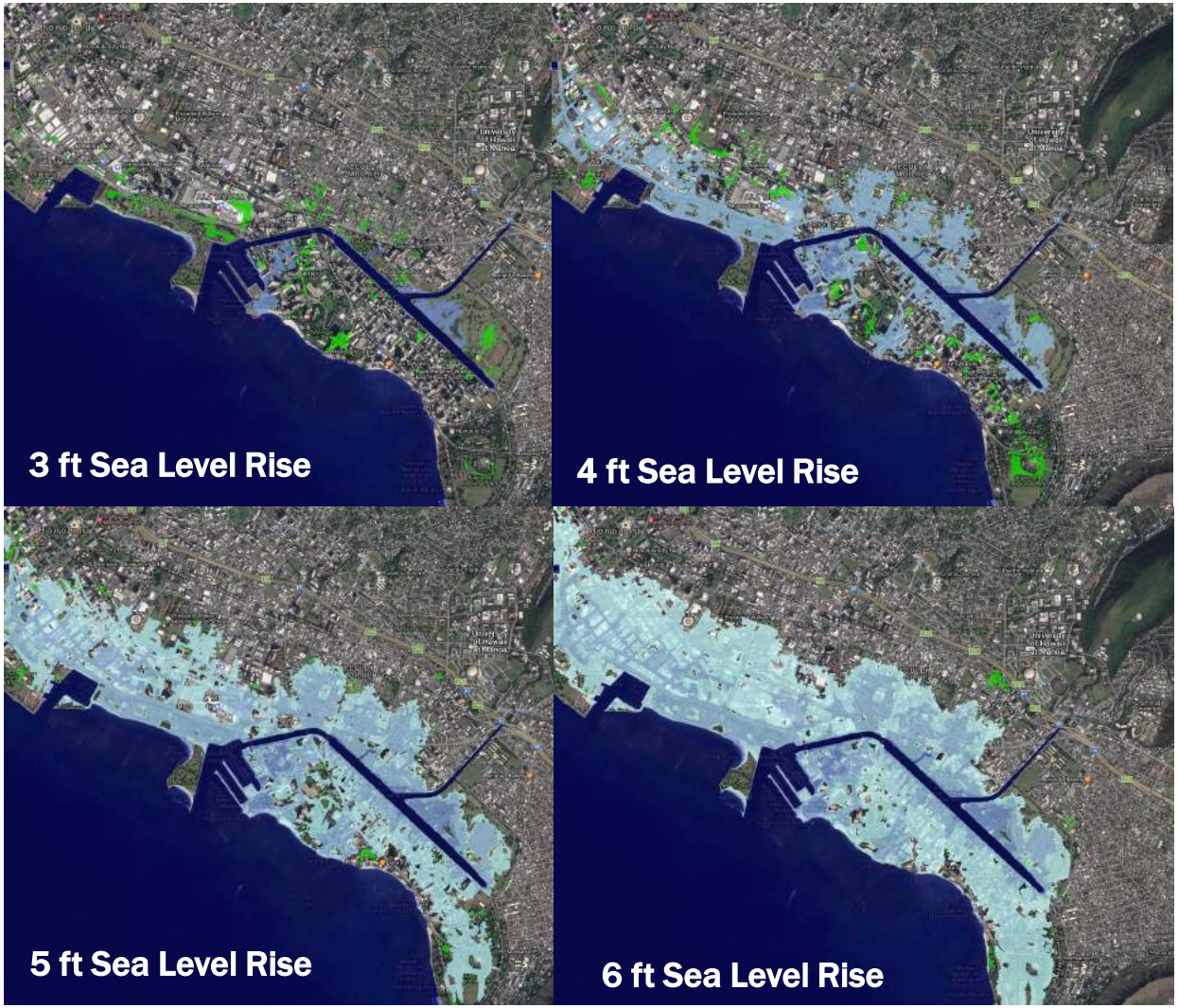
2017 - King Tide – Maunalua, Ala Moana





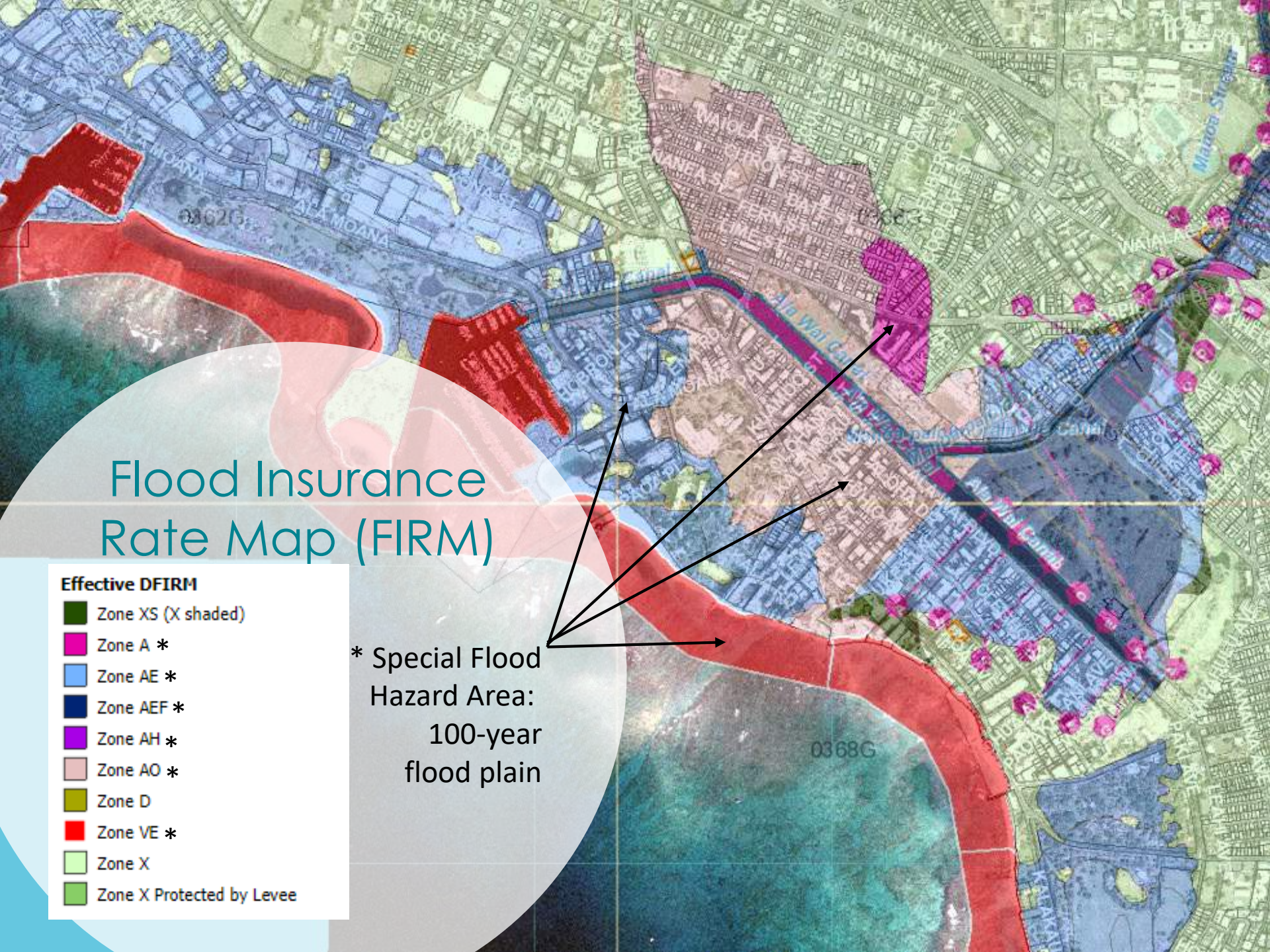

Courtesy of OCCSR

End-of-Century Sea Level Rise Could be Greater



Source: Habel et al. 2017

Flood Insurance Rate Map (FIRM)



Miami

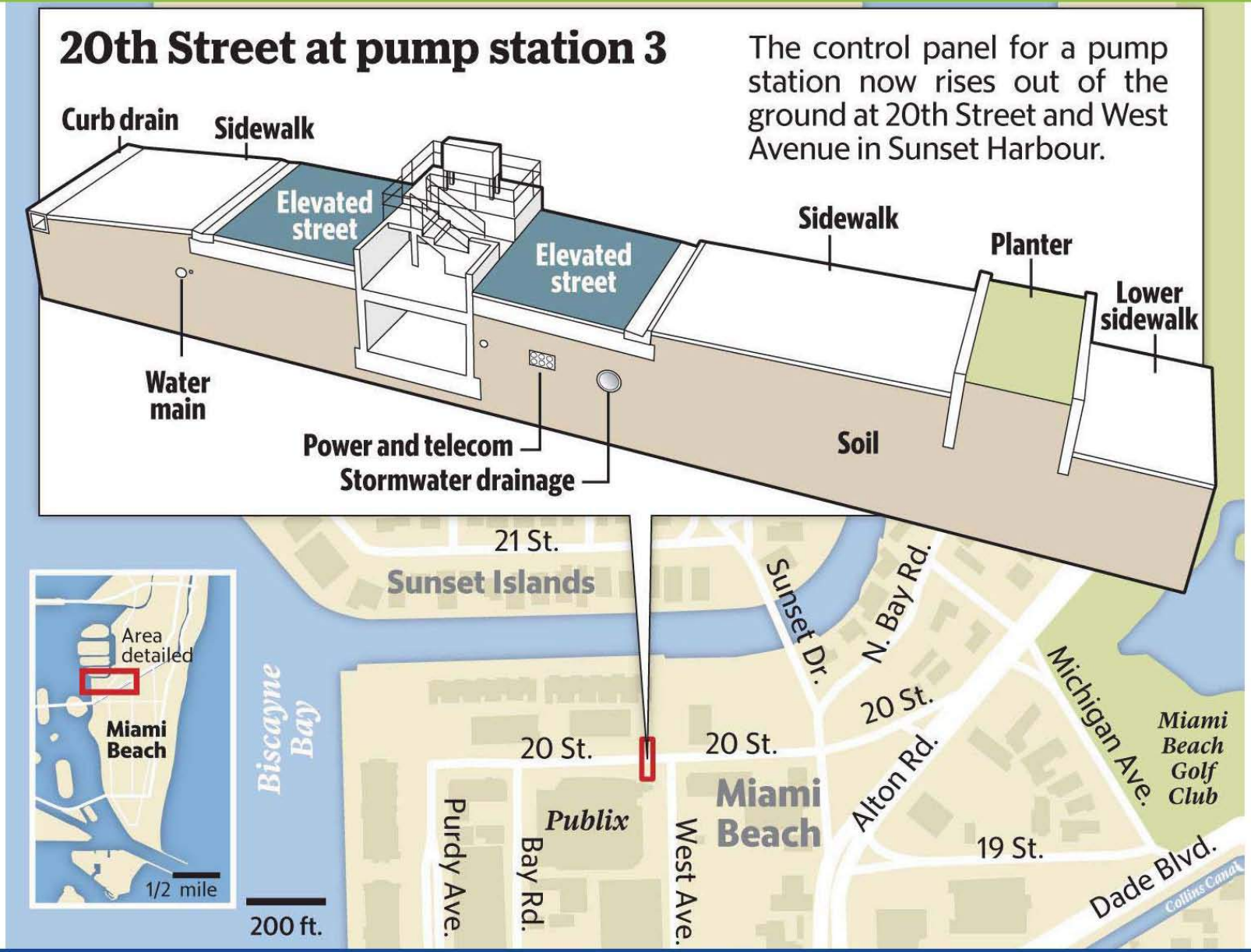
STORMWATER MANAGEMENT MASTER PLAN

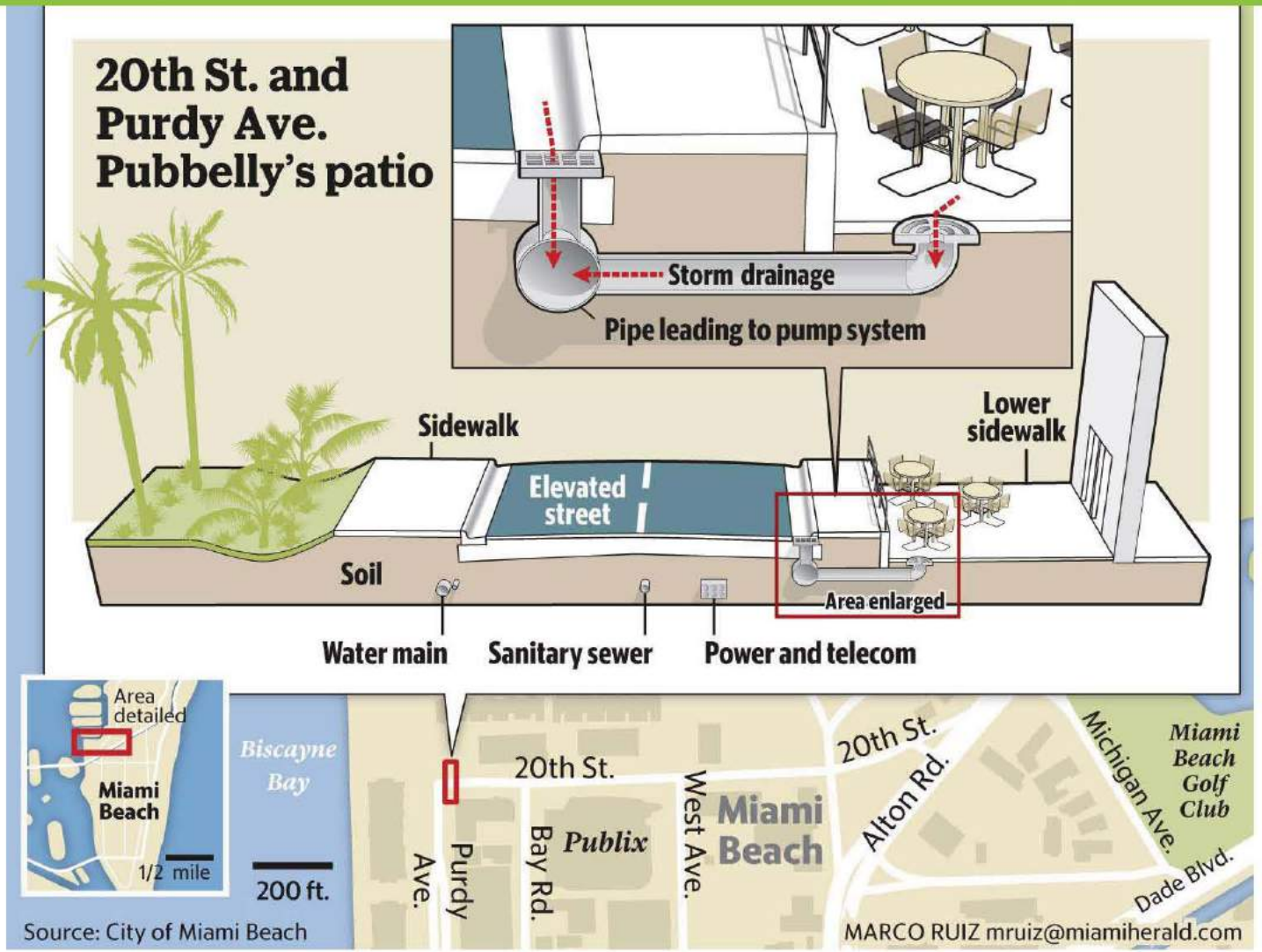
Impacts of Sea Level Rise

- Higher groundwater
- Higher tides
- Increased flooding
- Decreased effectiveness of the existing stormwater system

INFRASTRUCTURE RESILIENCY

- Elevating Public & Private Infrastructure
- Stormwater Retrofits
- Updating/Replacing Utilities
- Green Infrastructure

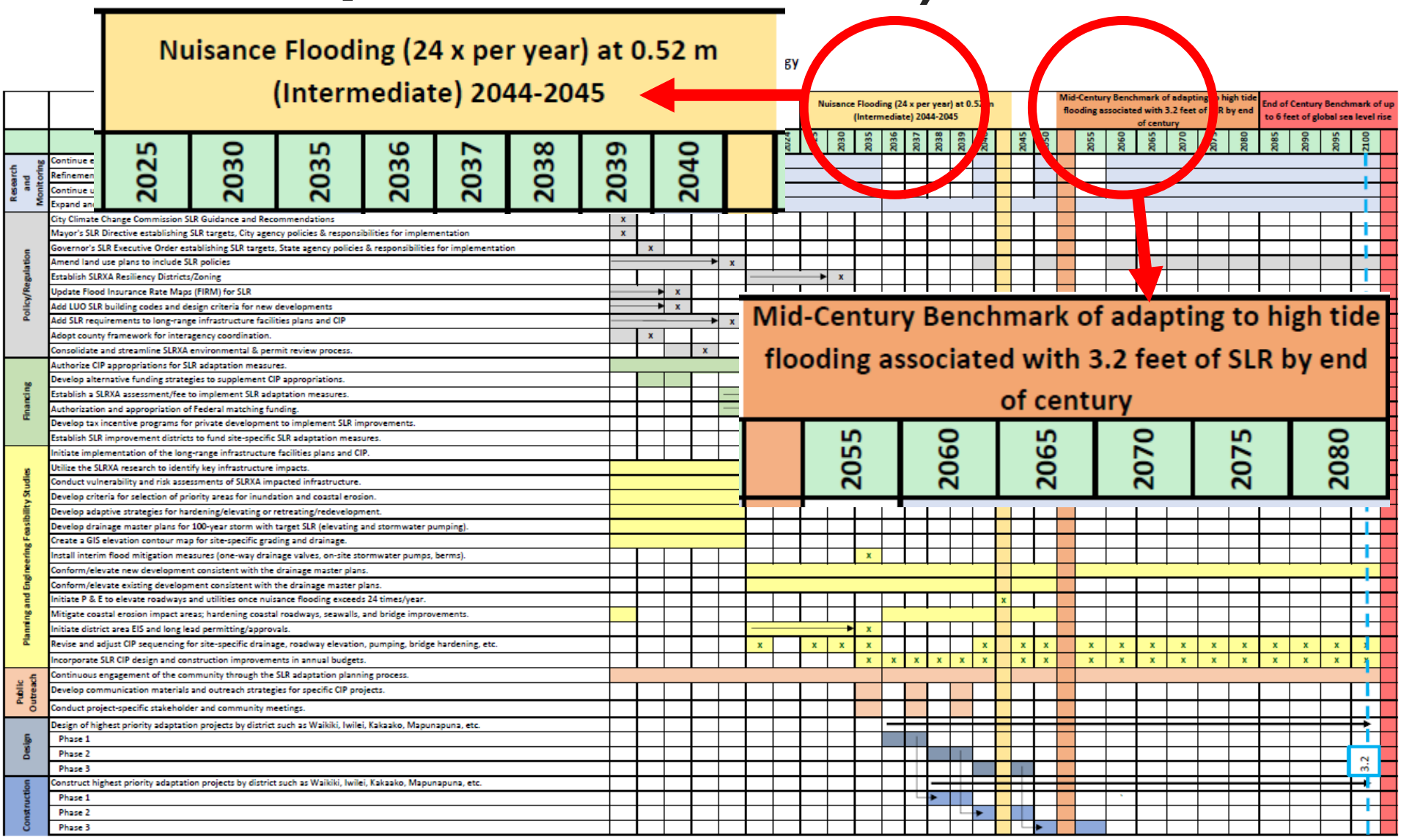

20th Street at pump station 3
The control panel for a pump station now rises out of the ground at 20th Street and West Avenue in Sunset Harbour.
Curb drain
Sidewalk
Elevated street
Elevated street
Sidewalk
Planter
Lower sidewalk
Water main
Power and telecom
Stormwater drainage
Soil
Area detailed
Miami Beach
1/2 mile
200 ft.
Biscayne Bay
21 St.
Sunset Islands
Sunset Dr.
N. Bay Rd.
20 St.
Michigan Ave.
Miami Beach Golf Club
20 St.
20 St.
Alton Rd.
Purdy Ave.
Bay Rd.
Publix
West Ave.
Miami Beach
19 St.
Dade Blvd.
Collins Canal



This rendering shows the elevated roadway at 20th Street and Purdy Avenue, in front of Pubbelly restaurant. To the right, the patio in front of Pubbelly is about two feet lower than the street. Floor drains down there feed into the same pipes that connect to the curb drains on the road, which routes water to the pump station.

Sunset Harbour
20 Street & Purdy Avenue

Draft Adaptation Framework/Action Plan



WRF Study Identified Two Candidate Pilot Areas for Sea Level Rise Adaptation

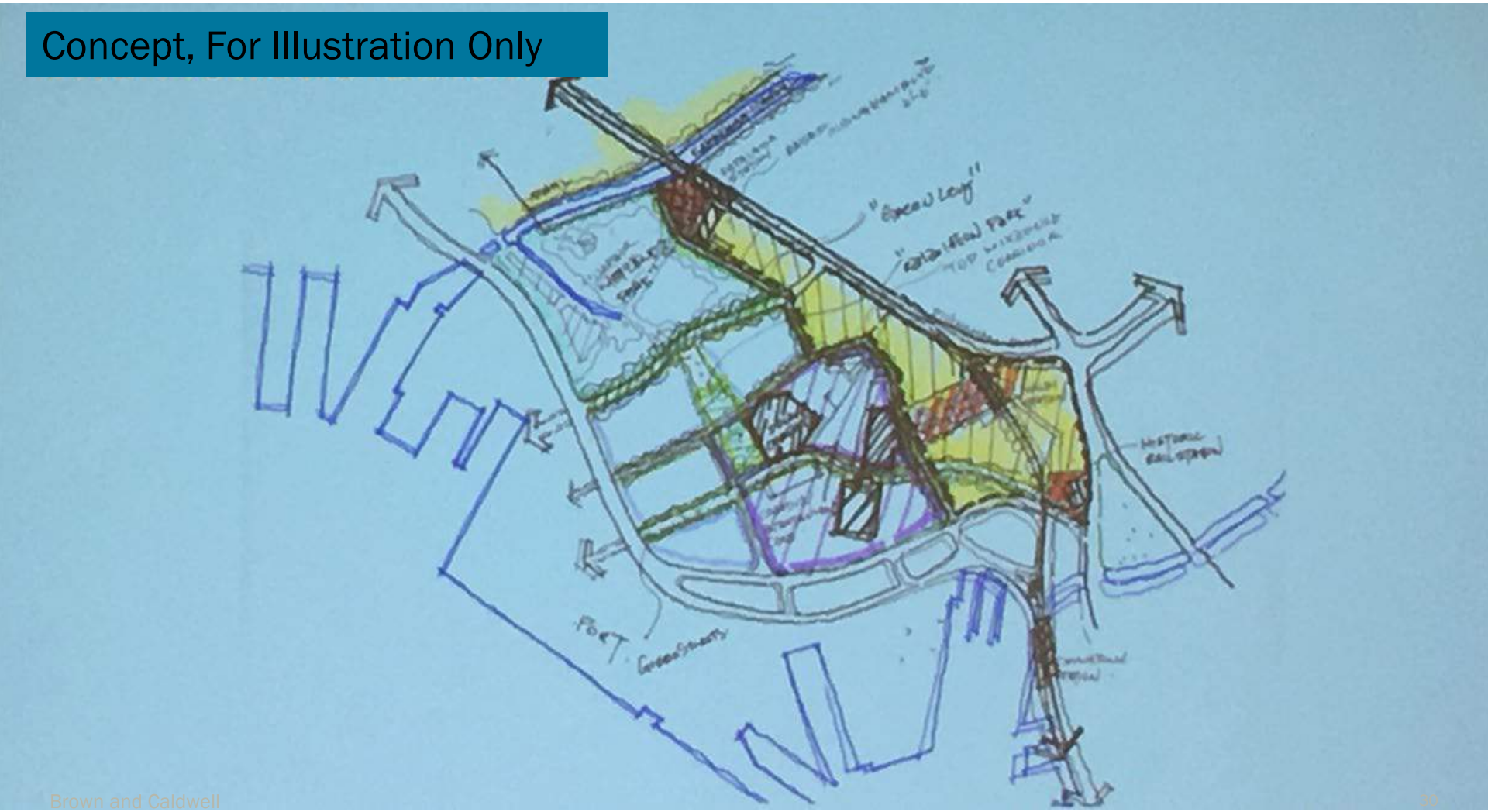
West Waikiki

Iwilei

Possible Selection & Prioritization Criteria:

- Potential severity of social, economic, or environmental impacts
  - Taxable real estate; flood impacts to pedestrians, commercial and recreation activities, tourism, transportation and infrastructure.
- Opportunity to add SLR adaptation measures with proposed improvements
  - Ala Wai Flood Mitigation Project
  - Iwilei Transit Oriented Development Plan

Iwilei Redevelopment Concept to Live with Water



The One Water Cycle

Brown AND Caldwell

Acknowledgements

Research Team

Principal Investigators

- Dean Nakano,
- Lynn Stephens, P.E.
- Jon Turk, P.G.

Project Team

- Susan Mukai
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Brown AND Caldwell

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Project Advisory Committee

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- David Yates, National Center for Atmospheric Research
- Kenan Ozekin, Water Research Foundation