

Innovations in Urban Redesign

Letting the Water In

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ARCADIS

Imagine the result



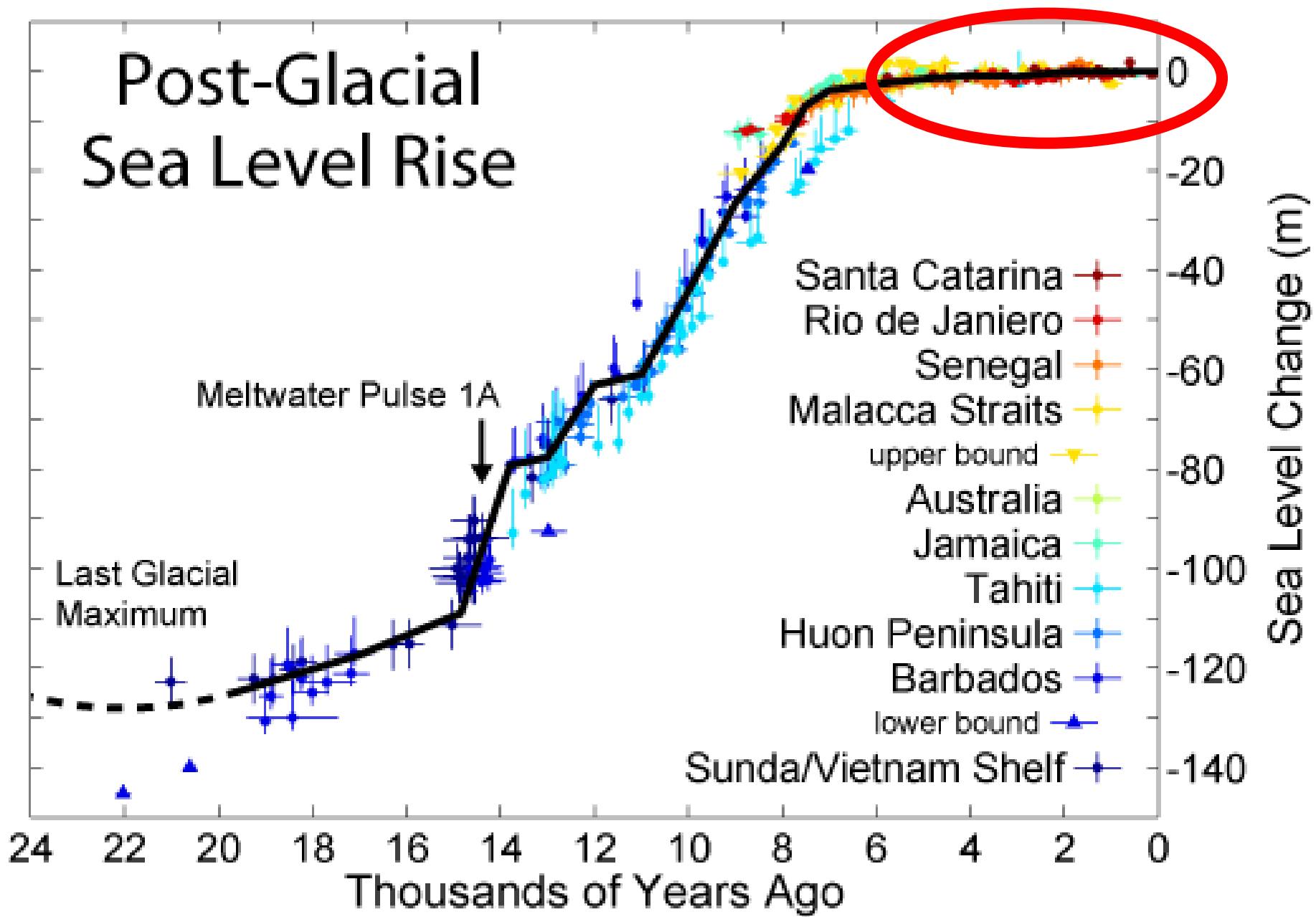
Outline

- Sea level rise in perspective
- Adaptive measures
- Urban redesign
- Implications for water agencies

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Post-Glacial Sea Level Rise

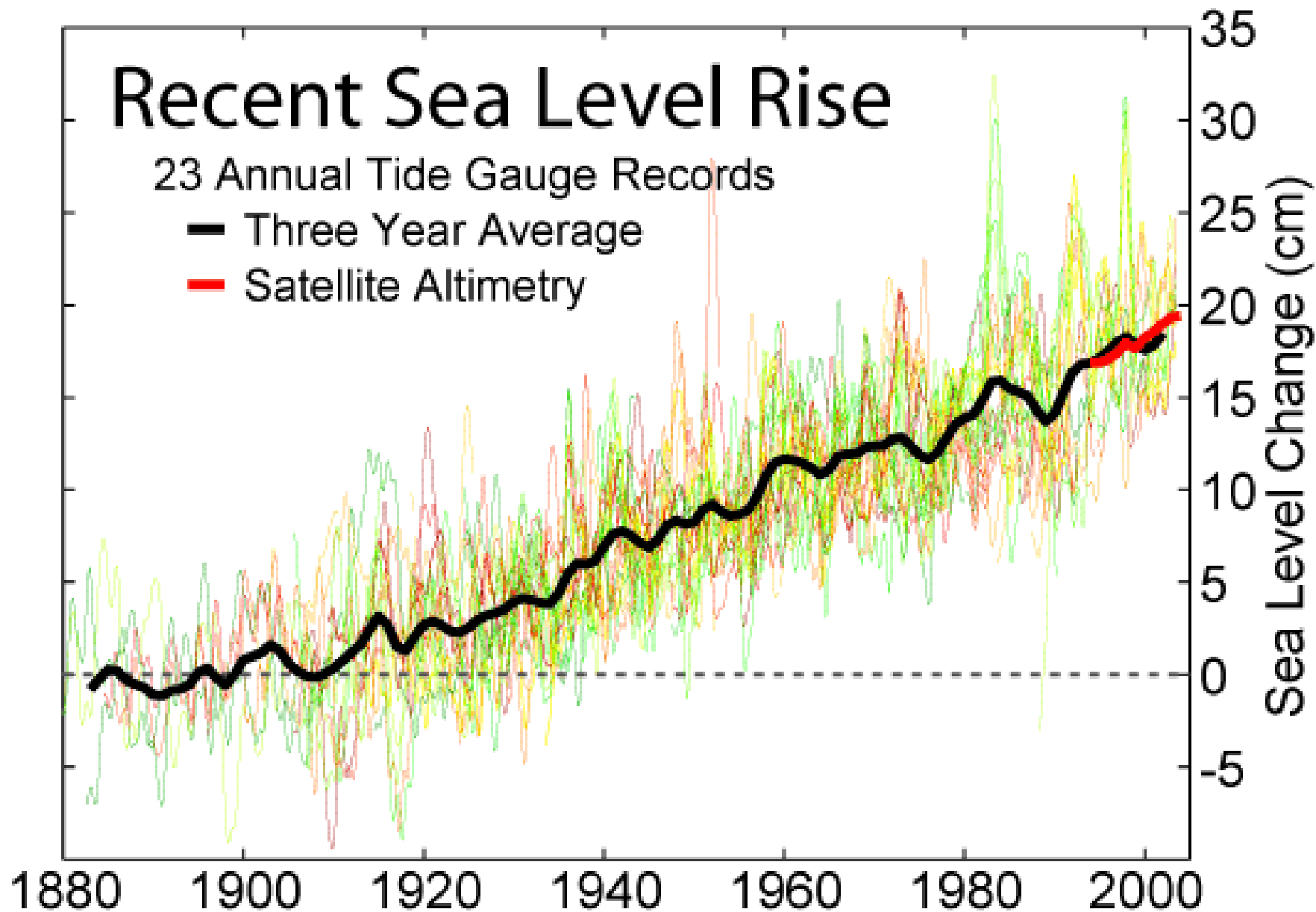


Recent Sea Level Rise

23 Annual Tide Gauge Records

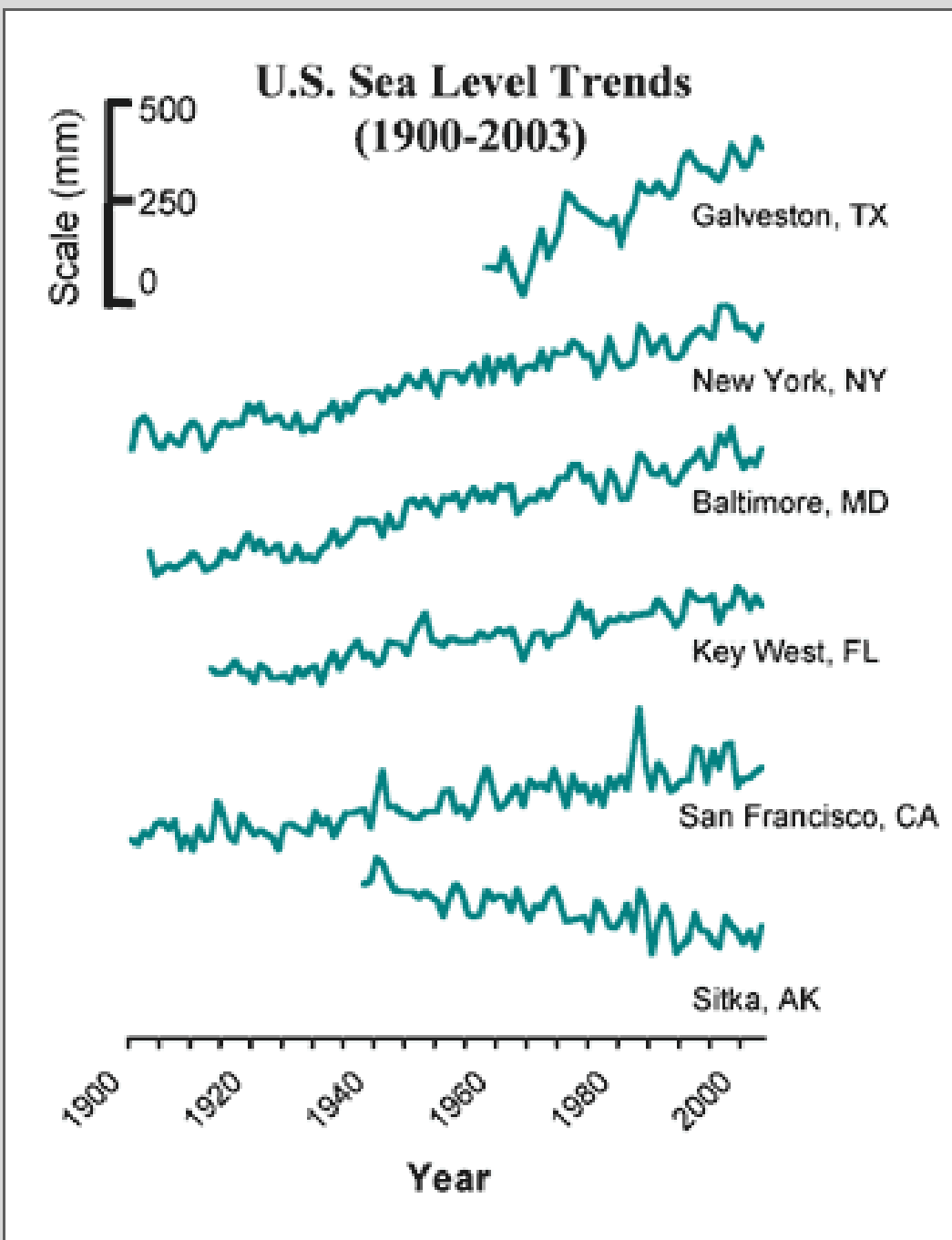
— Three Year Average

— Satellite Altimetry



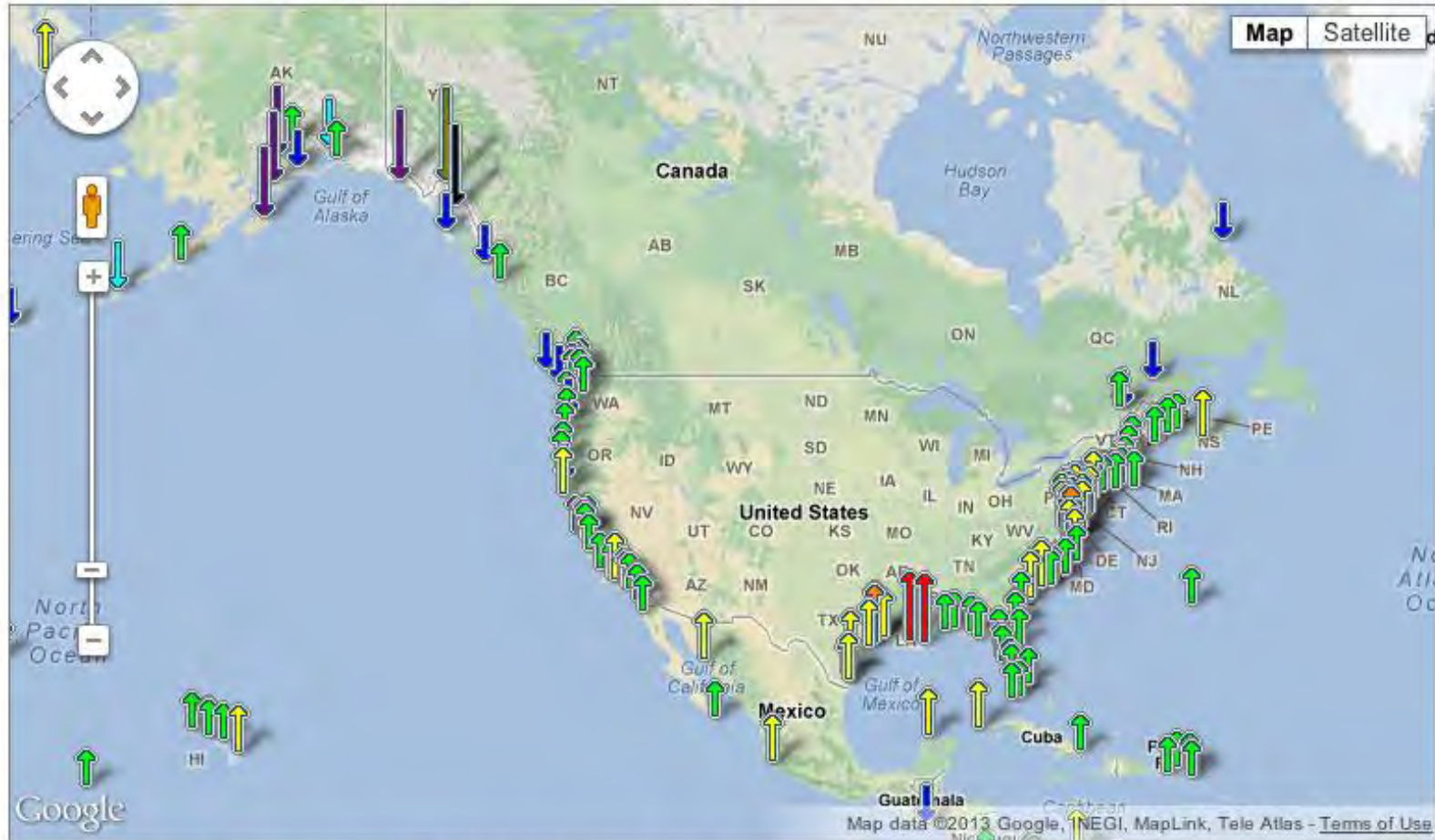
Douglas (1997)

Sea Level Rise is Not One Size Fits All



Source: NOAA National Ocean Service

Sea Level Trends



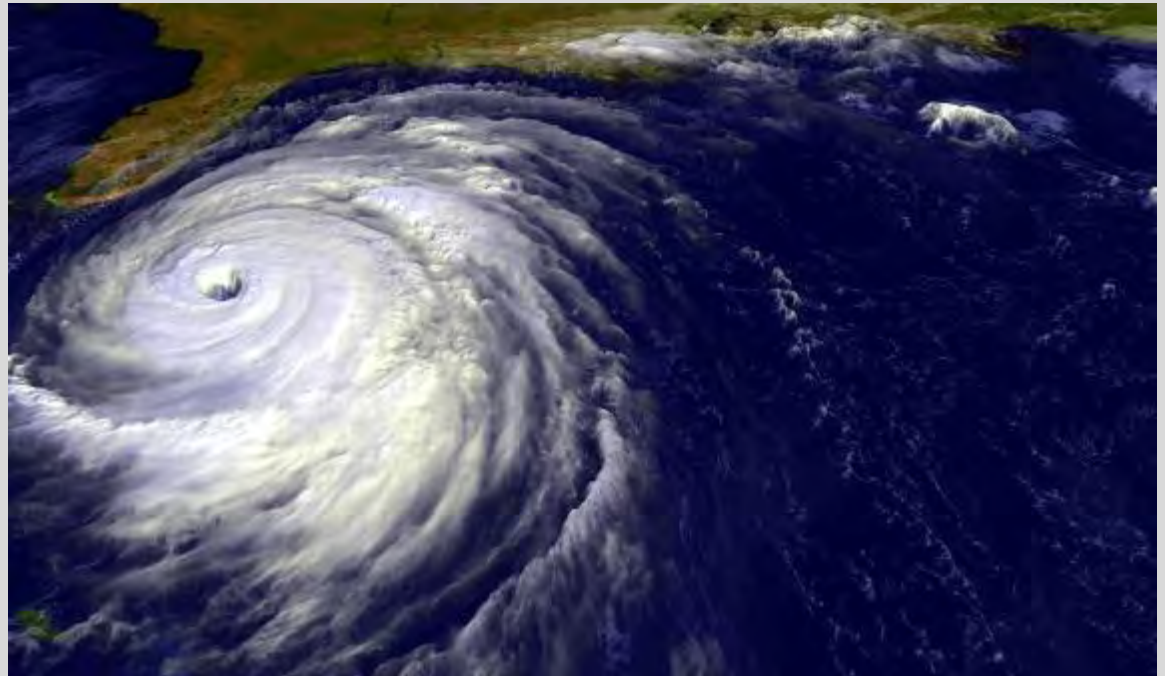
The map above illustrates regional trends in sea level, with arrows representing the direction and magnitude of change. Click on an arrow to access additional information about that station.



<http://tidesandcurrents.noaa.gov/sltrends/>

Changing Storm Risk Compounds SLR Impacts

- Storm surge, inundation, and waves
- Increase is greater than adding to SLR
- Research indicates there is amplification due to local topography
- Future storm characteristics are unknown



Superstorm Sandy



Tuckerton, NJ



Atlantic City



USA Today: **Scientists warn sea levels could swamp coasts:** October 8, 2014

“It doesn't take a storm to cause destructive flooding.”



“In the next 15 years or so, many towns and cities could see a tripling in the number of high-tide floods each year. In 30 years, a whopping tenfold increase is possible.”

What are the effects?

- Municipal drainage no longer works during high tide
- Increasing frequency of flood events
- Inundated roads



What are the effects?

- Rivers and aquifers becoming more saline
- Plant and tree mortality (ghost forests)
- Lowland fields no longer suitable for agriculture



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Engineered solutions



Natural solutions



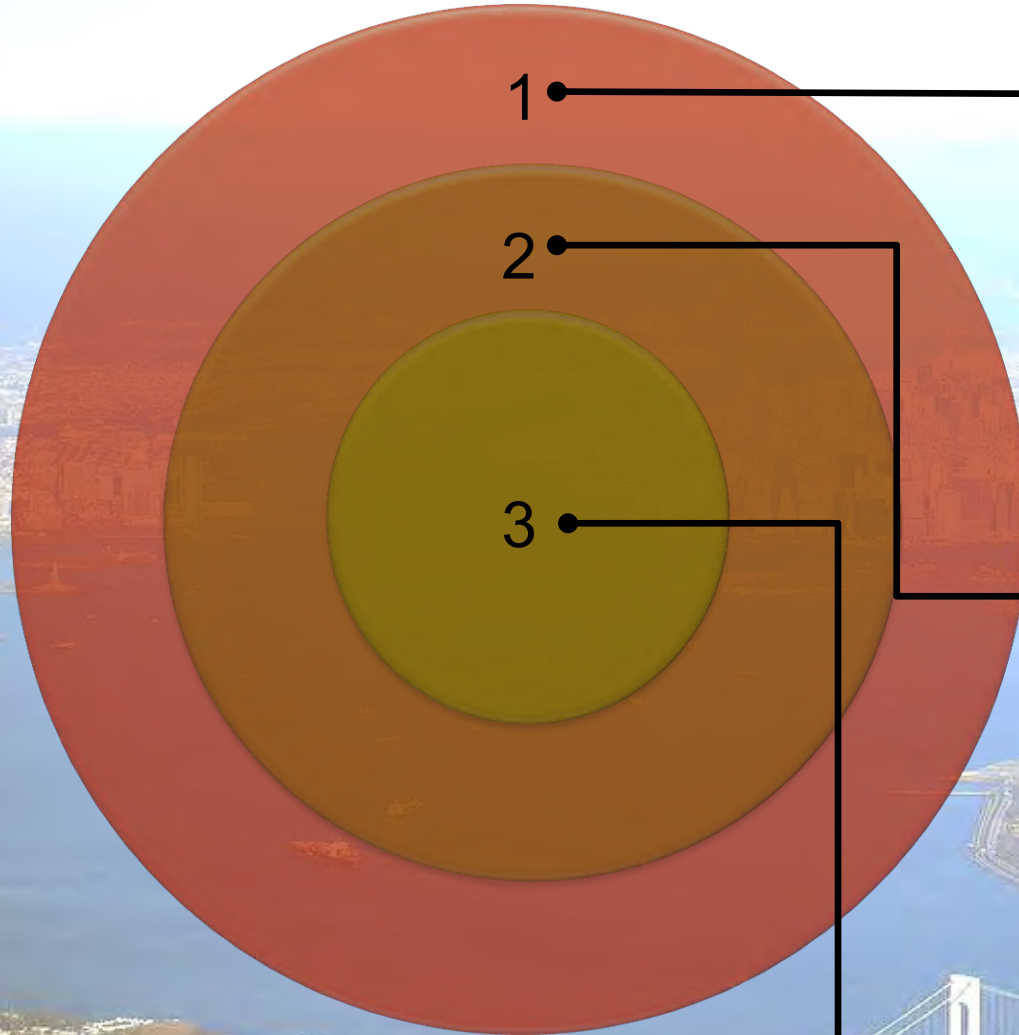
Inner city solutions



Multiple Lines of Defense



Outer Layer of Defense
(Regional) – Larger, engineered solutions



Middle Layer of Defense
- Connecting “transition” zone)



Inner Layer of Defense (Local)
- Smaller-scale solutions, green infrastructure

Flood Protection New Orleans

Protection 100-yr Flood Construction □ 2006 – 2011 □ Investment: \$14.5 B



Lake Borgne Storm Surge Barrier



Seabrook Sector Gate



West Closure – Pump Station

Storm Surge Barriers from Around the World



Middle Layer of Defense

Building with Nature, Scheveningen (NL) - Sand Engine



“Seed” sand formation



Utilize Natural Processes



Create Marshlands

Middle Layer of Defense

Beach Fortification: Scheveningen

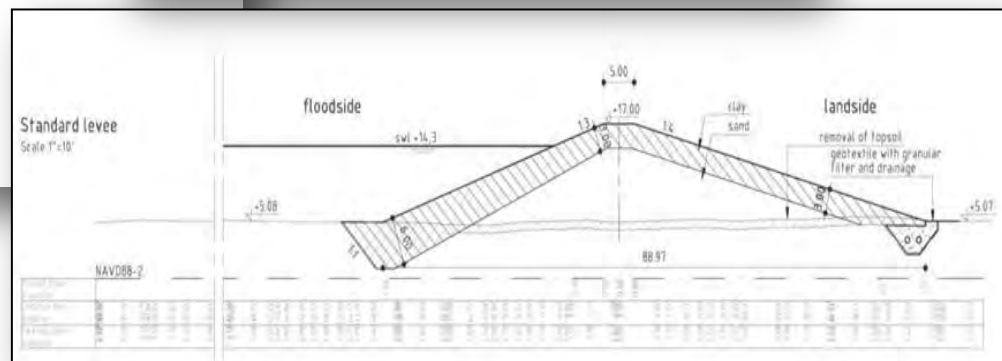
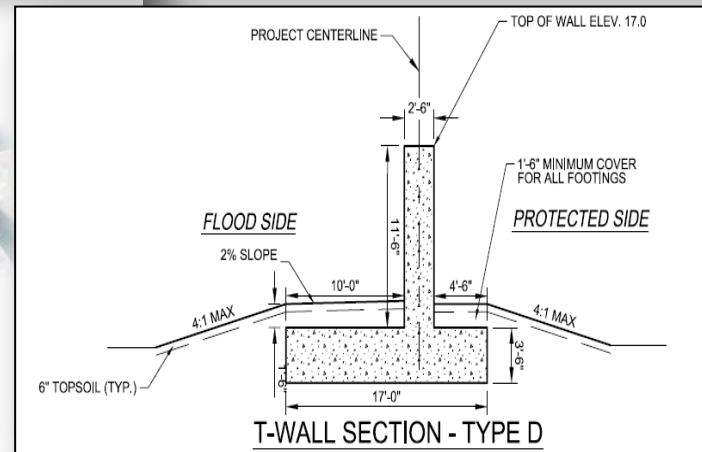
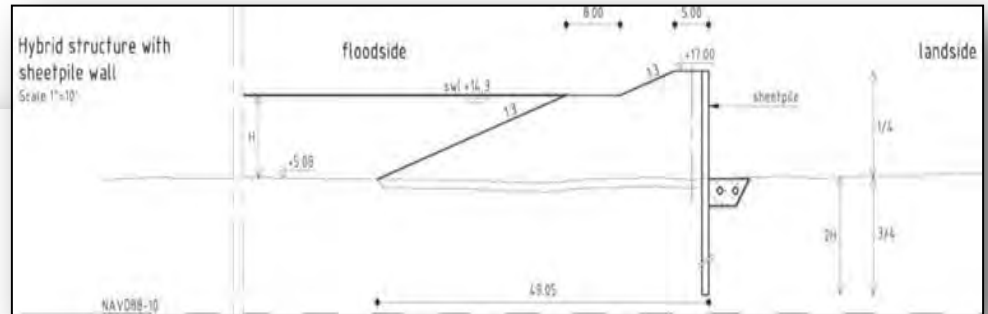
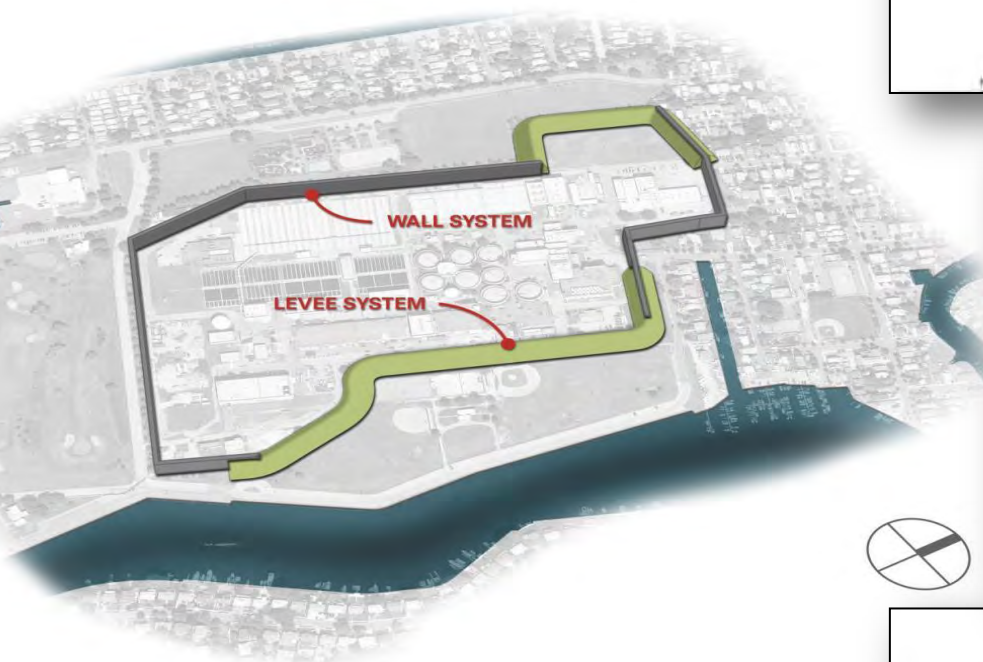


Inner Layer of Defense

Bay Park Treatment Plant: – Hurricane Sandy



Bay Park Water Treatment Plant



PERSPECTIVES

PARK VIEW - CURRENT



PERSPECTIVES

PARK VIEW - FINAL



PERSPECTIVES

PARK VIEW – CURRENT



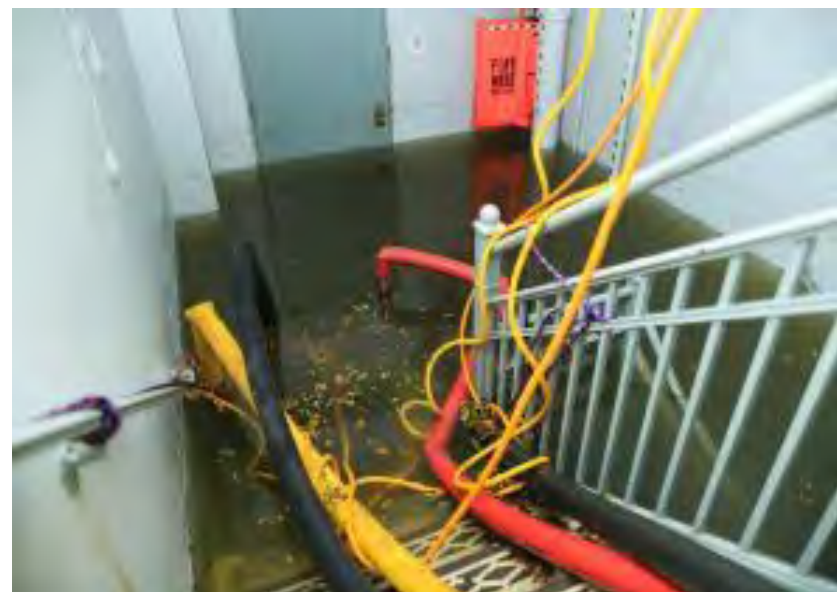
Bay Park Treatment Plant



Inner Layer of Defense

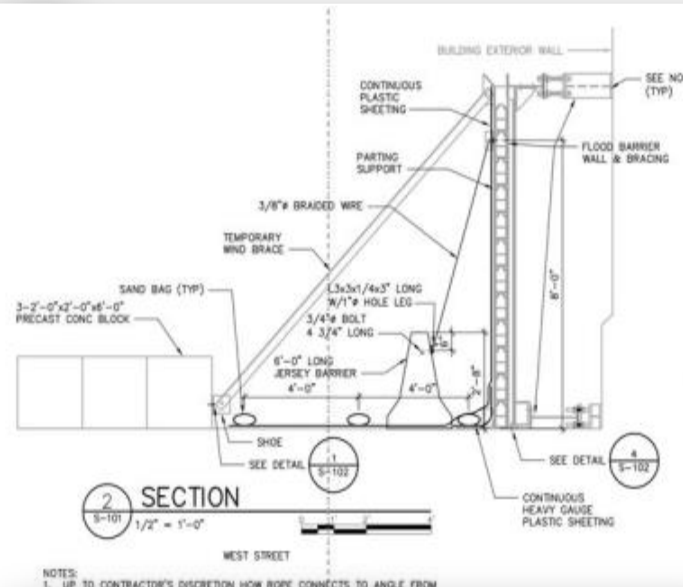
Comprehensive Flood Mitigation Plan

West Street and 104 Broad Street
Telecommunications



Inner Layer of Defense

Protection of New York's Critical Assets - Telecommunication Centers



Images: deployment of removable flood wall - flood wall design – underground utilities and conduit plugs

Outline

- Climate in perspective
- Adaptive measures
- **Urban redesign**
- Implications for water agencies

Battery Park City



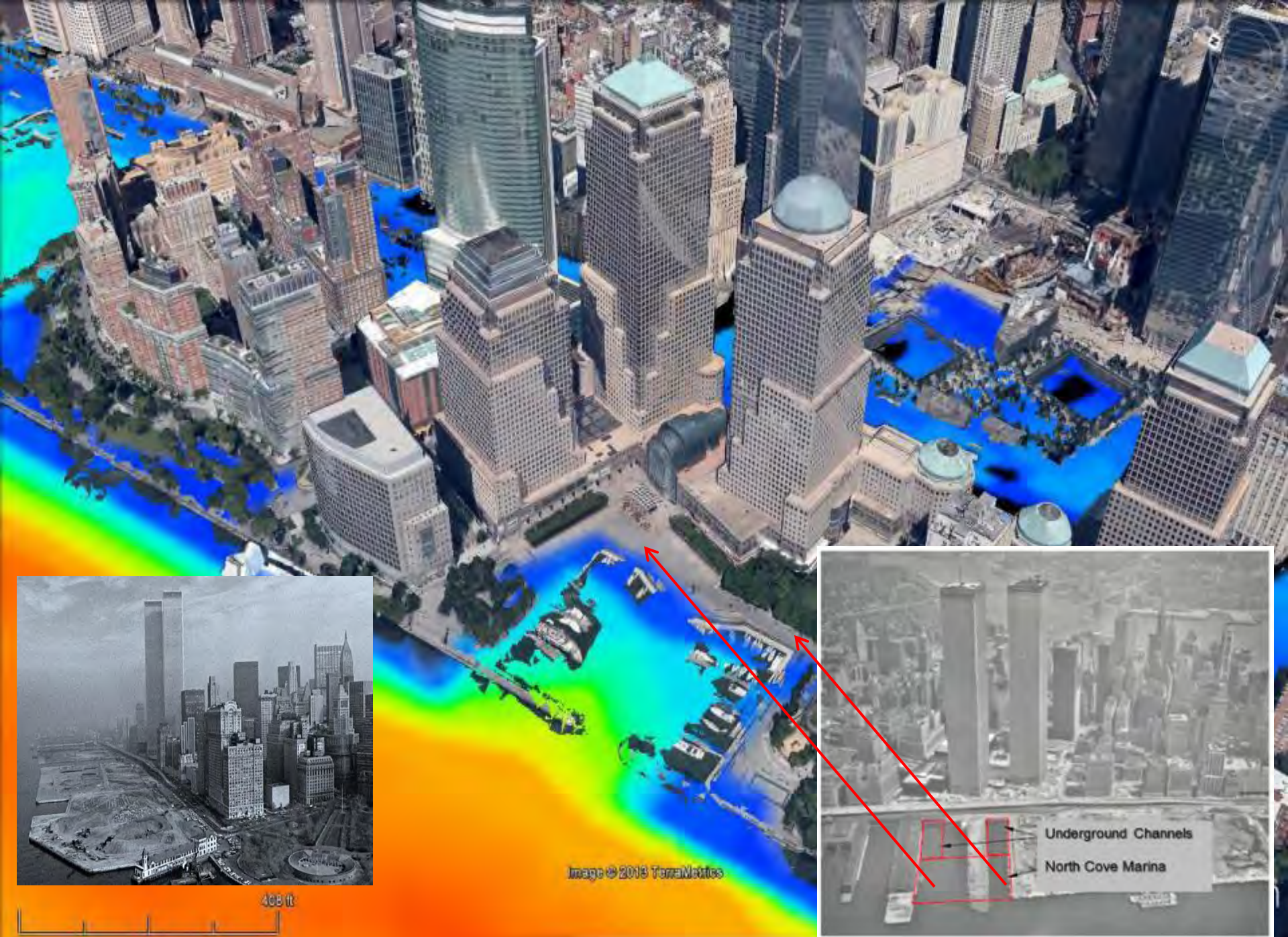
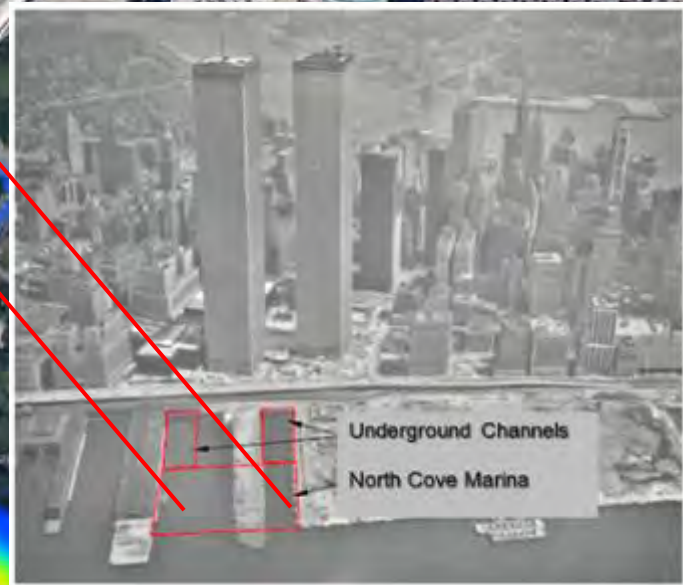


Image © 2014 TerraMetrics



Underground Channels
North Cove Marina

40°42'48.03" N 74°00'56.30" W elev. 25 ft eye alt. 1590 ft

FLOW-3D MODEL FLOOD DEPTH

SUPERSTORM SANDY 10/29/12, 9:10 PM ET

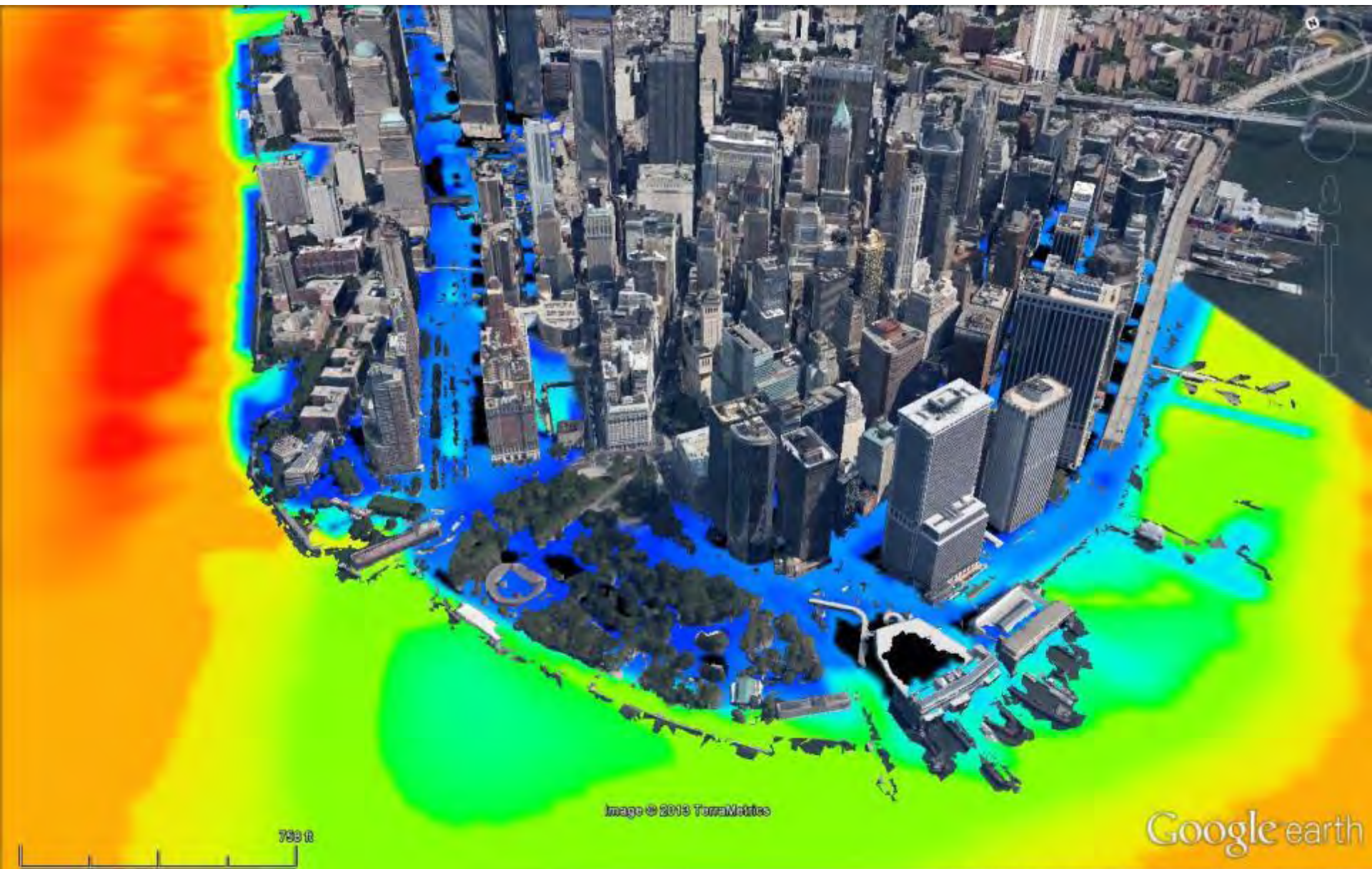


Image © 2014 TerraMetrics

Google earth

40°42'14.87" N 74°00'50.60" W elev 150 ft eye alt 2859 ft

Mayor Pledges to Rebuild and Fortify Coast

By DAVID W. CHEN
and MICHAEL M. GRYNBAUM

New York City, still reeling from the impact of Hurricane Sandy, will expand its evacuation zones, tighten building codes and look for ways to fortify critical infrastructure like transportation and electrical networks from future natural disasters, Mayor Michael R. Bloomberg said Thursday.

But while the mayor said he would aggressively pursue a rebuilding of the damaged waterfront, he warned that “there are no panaceas or magic bullets” to protect the city fully. And while he did, for the first time, specifically suggest dunes or levees as pro-

tective measures worth exploring, he again dismissed the use of expensive experiments like sea gates stretching across New York Harbor.

It was Mr. Bloomberg’s first major address on what the city should do in a post-hurricane world that, after the end of 2013, will also be a post-Bloomberg world. And the speech, which was televised live from a Lower Manhattan hotel that had been closed for two weeks because of the storm, had the bearing of a future-oriented State of the City event, with accompanying slides and even a surprise guest: former Vice President Al Gore.

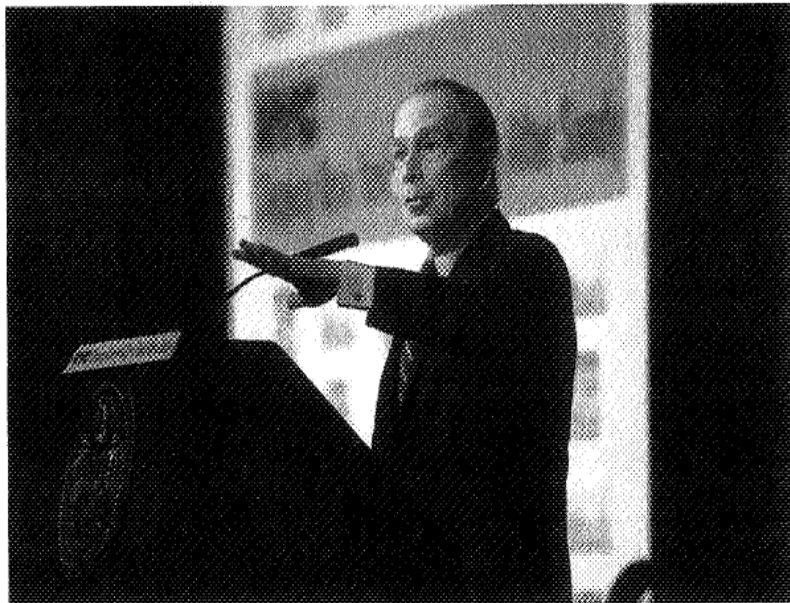
Mr. Gore, now an environmental activist, repeatedly lavished praise on

the mayor for his work on responding to climate change, saying he does not “know of anybody who has done more.” Mr. Gore, a Democrat, even gently chided the Obama administration: “We cannot have four more years of mentioning this occasionally,” he said.

Mr. Bloomberg, an independent, offered a much kinder assessment, saying the federal government had been very responsive to the damage wrought by Hurricane Sandy. But he also repeatedly sought to temper expectations of a quick solution, at one point stating bluntly, “Saying we’re going to spend whatever it takes just is not realistic.”

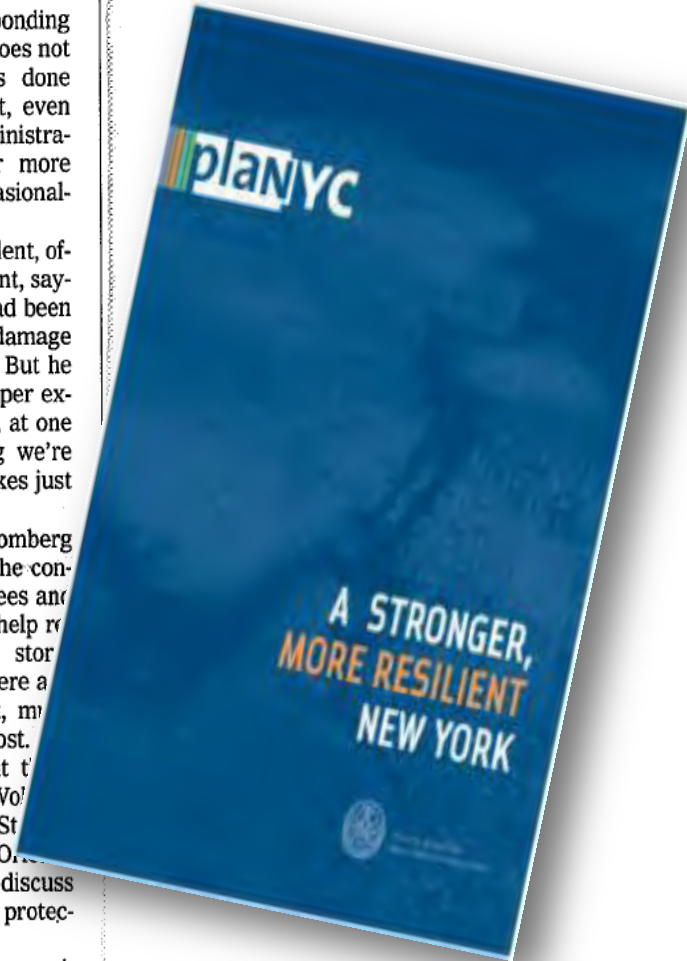
Among other ideas, Mr. Bloomberg said the city would consider the construction of dunes, jetties, levees and berms along coastal areas to help reduce damage from future storm surges. He did not specify where such barriers would be built, much less how much these would cost. City aides to the mayor said that the deputy mayors — Howard Wechsler, Linda I. Gibbs and Robert K. Storch — had recently traveled to New Orleans and met with officials there to discuss recovery, rebuilding and flood protection measures and lessons.

Height restrictions on some residential homes would be relaxed, Mr. Bloomberg said, so owners can elevate their houses above the flood plain. He also said the city would update its building code to require more stringent protection against floods. In particular, Bloomberg officials said that residential buildings — including



HIROKO MASUIKE/THE NEW YORK TIMES

Mayor Michael R. Bloomberg gave his first major speech on post-hurricane reconstruction Thursday in Lower Manhattan. Al Gore attended.



Continued on Page A32

SOUTHERN MANHATTAN
COASTAL PROTECTION STUDY:
EVALUATING THE FEASIBILITY OF
A MULTI-PURPOSE LEVEE (MPL)



MAY 2014

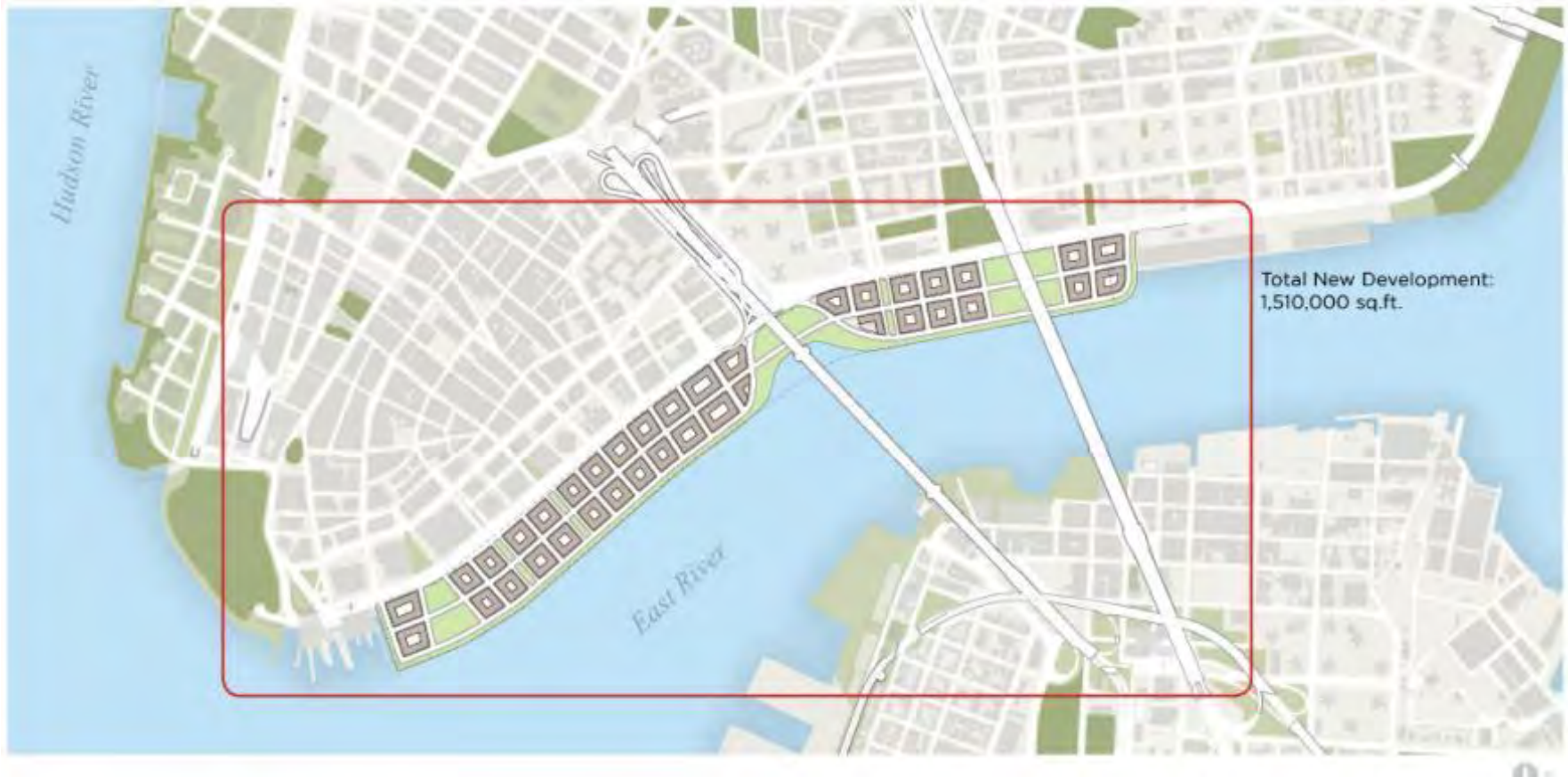
Seaport City

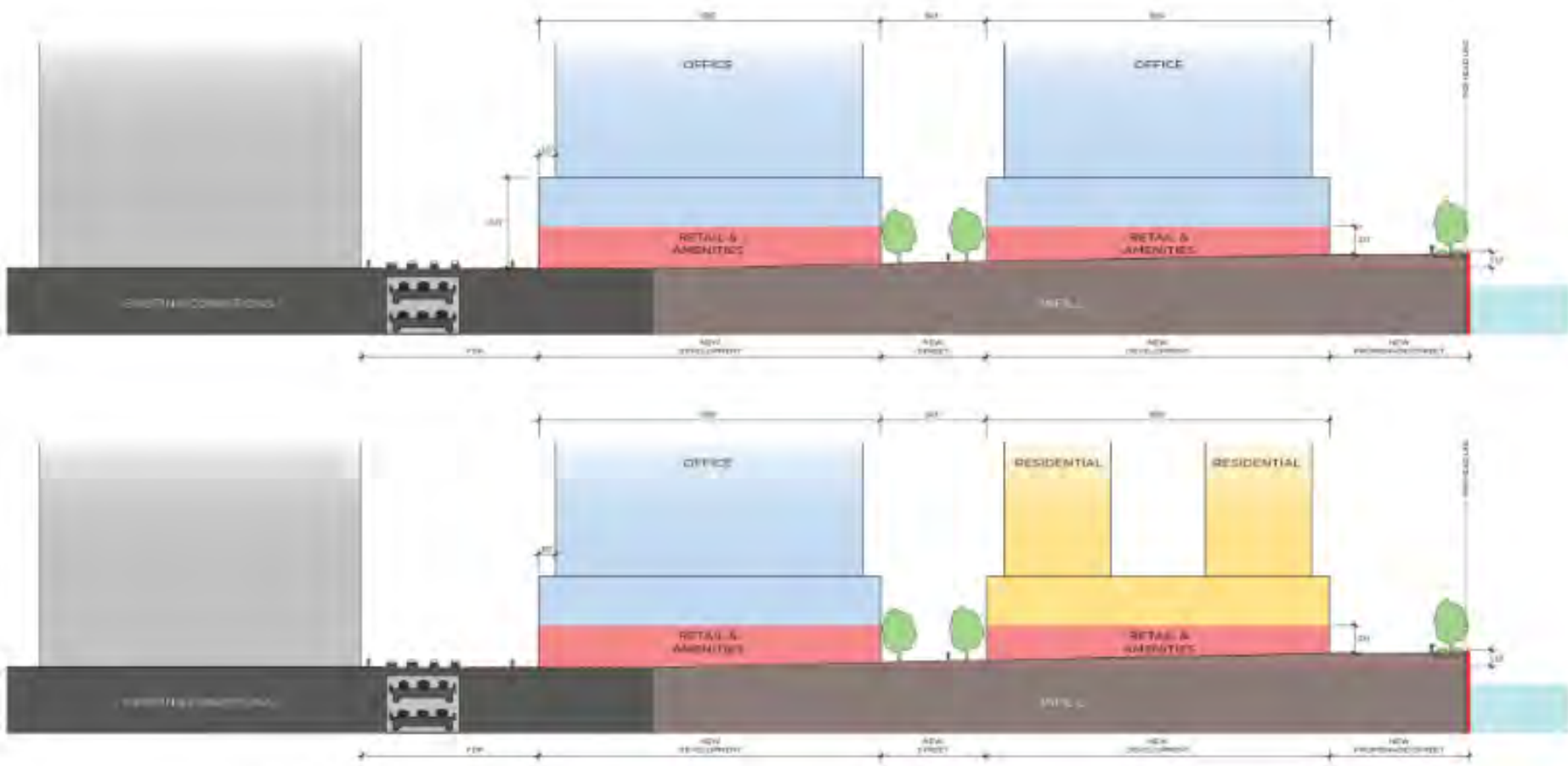


Seaport City



Seaport City





OPTION 3A: FULL BUILD-OUT
SEAPORT CITY | NYC

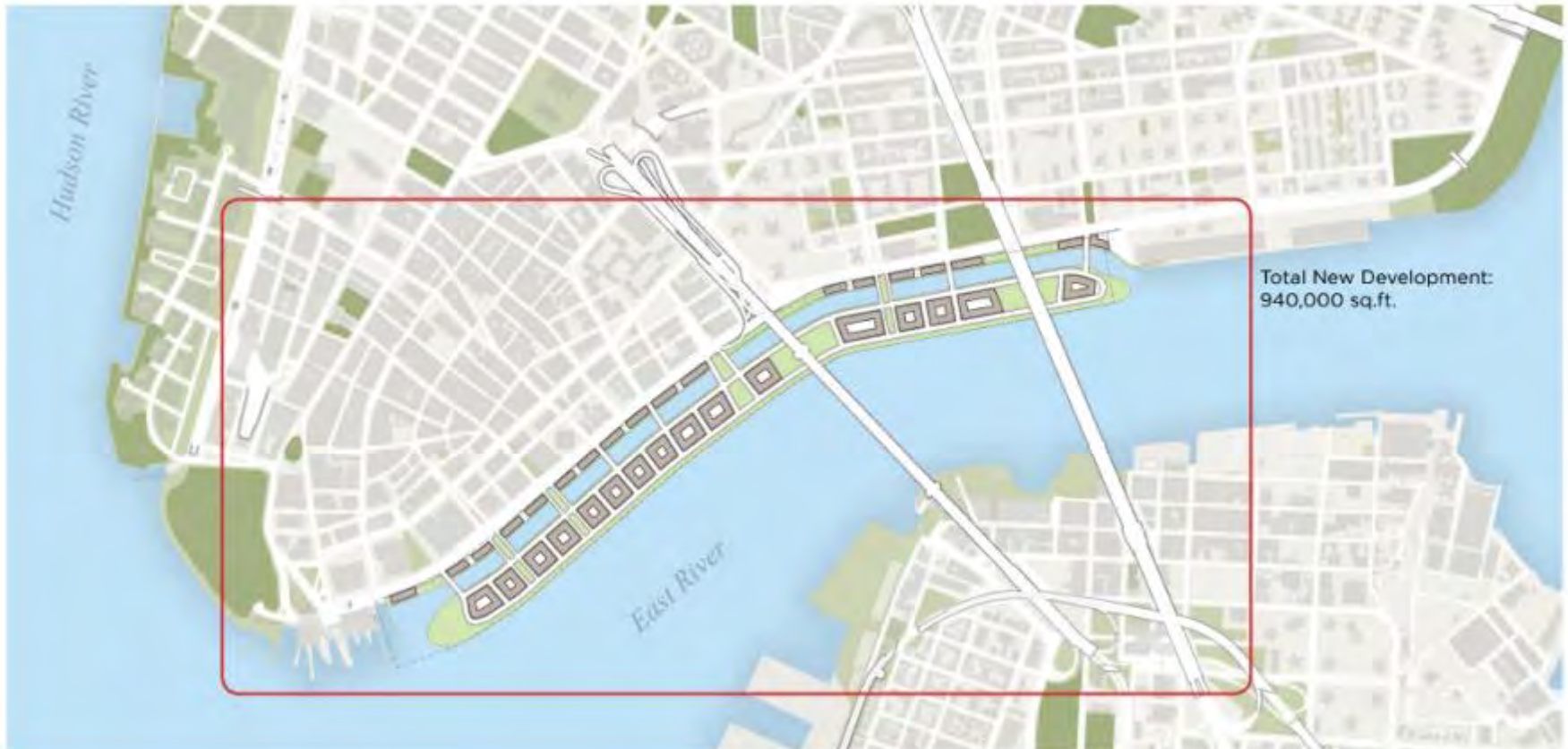
24 October 2013

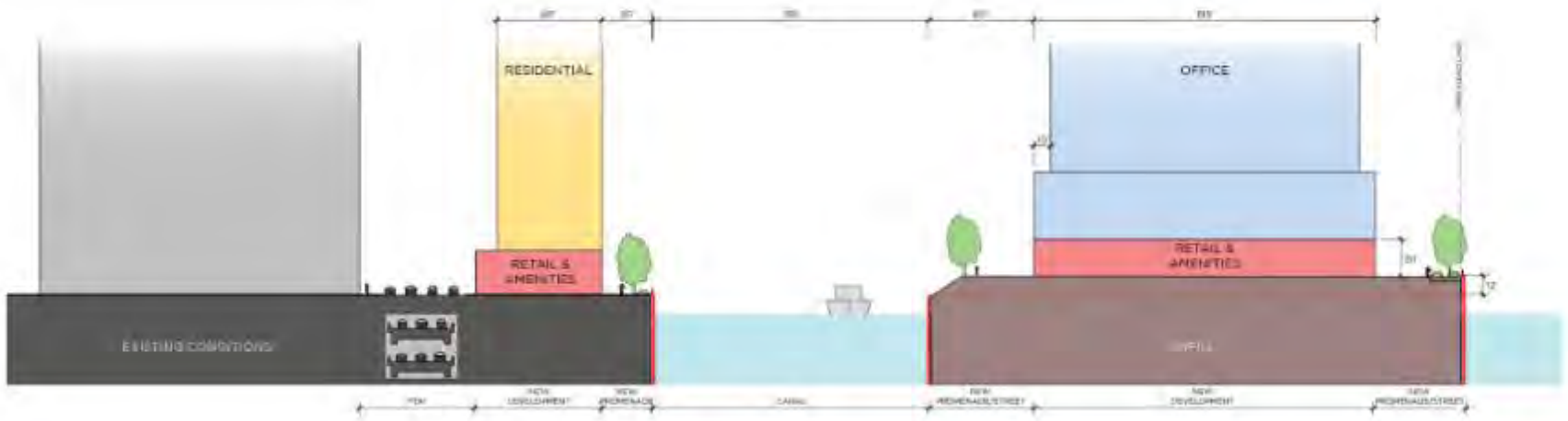


ARCADIS HOKA OGC|COWI FXFOWLE WXY AKRF SP&R J. KEENAN **A14**



Seaport City





NYCEDC **OPTION 3B: CANAL**
SEAPORT CITY | NYC

24 October 2013

A20

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REBUILD BY DESIGN

Promoting Resilience
Post-Sandy
Through Innovative
Planning and Design

An Initiative Of
The President's
Hurricane Sandy
Rebuilding Task Force

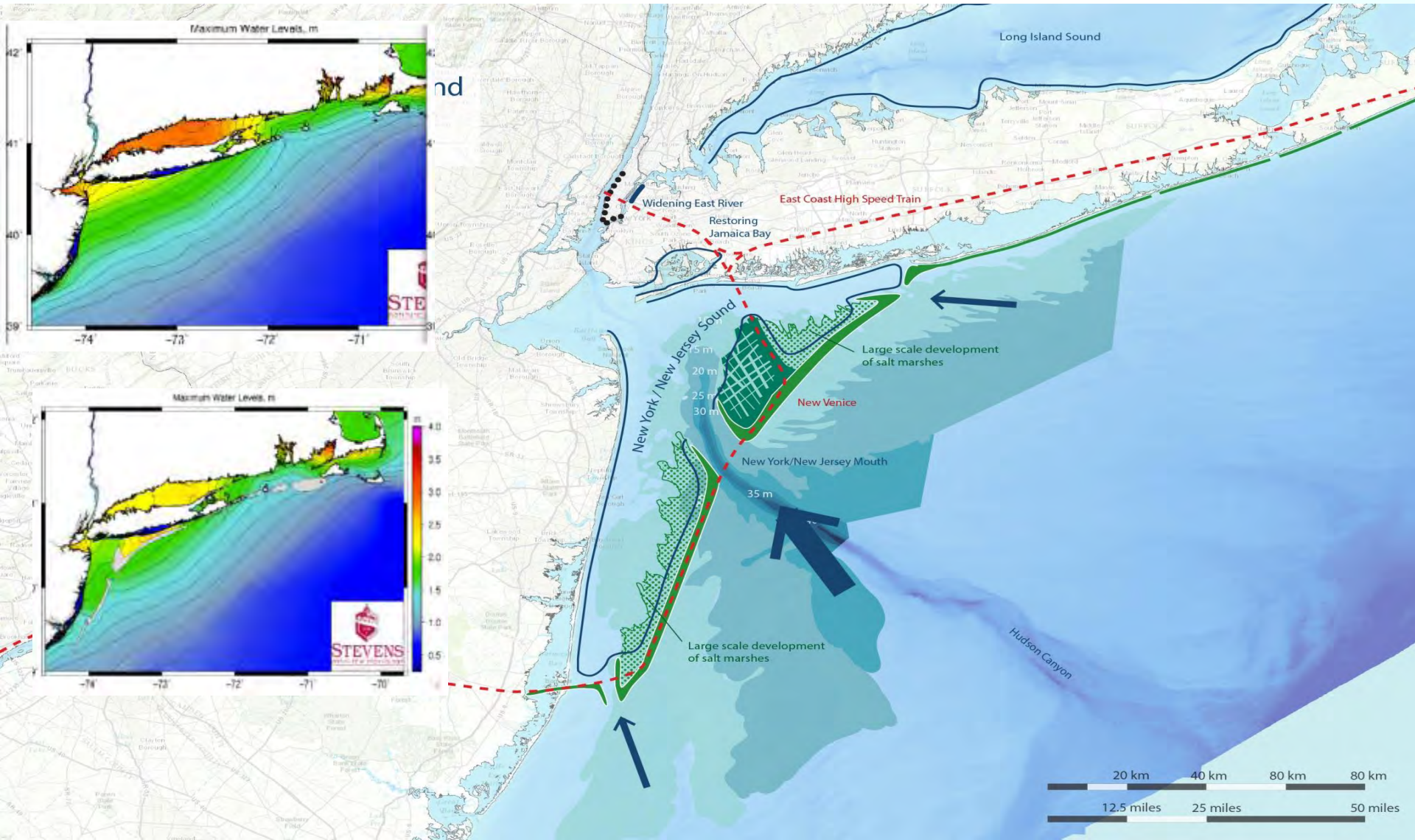
Rebuild By Design

In Collaboration With
Institute for Public Knowledge, NYU
Municipal Art Society
Regional Plan Association
Van Alen Institute

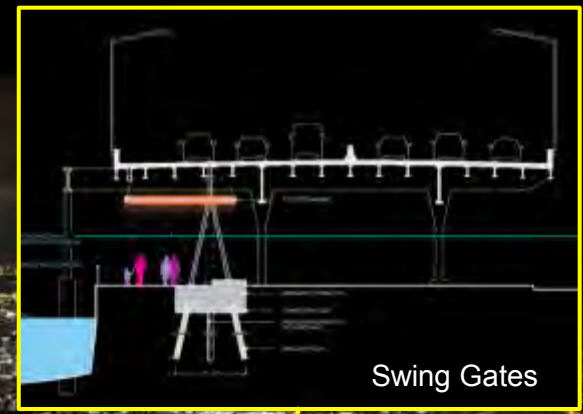
Lead Supporter
The Rockefeller Foundation

With Additional Support From
Deutsche Bank Americas Foundation
Hearst Foundation
JPB Foundation
Surdna Foundation
The New Jersey Recovery Fund

HUD Rebuild by Design



BIG U – Manhattan



Swing Gates



Elevated Landscapes

● Critical Facilities

Short Term Perspective – Hudson River

Short Term Solutions, 1 to 5 years

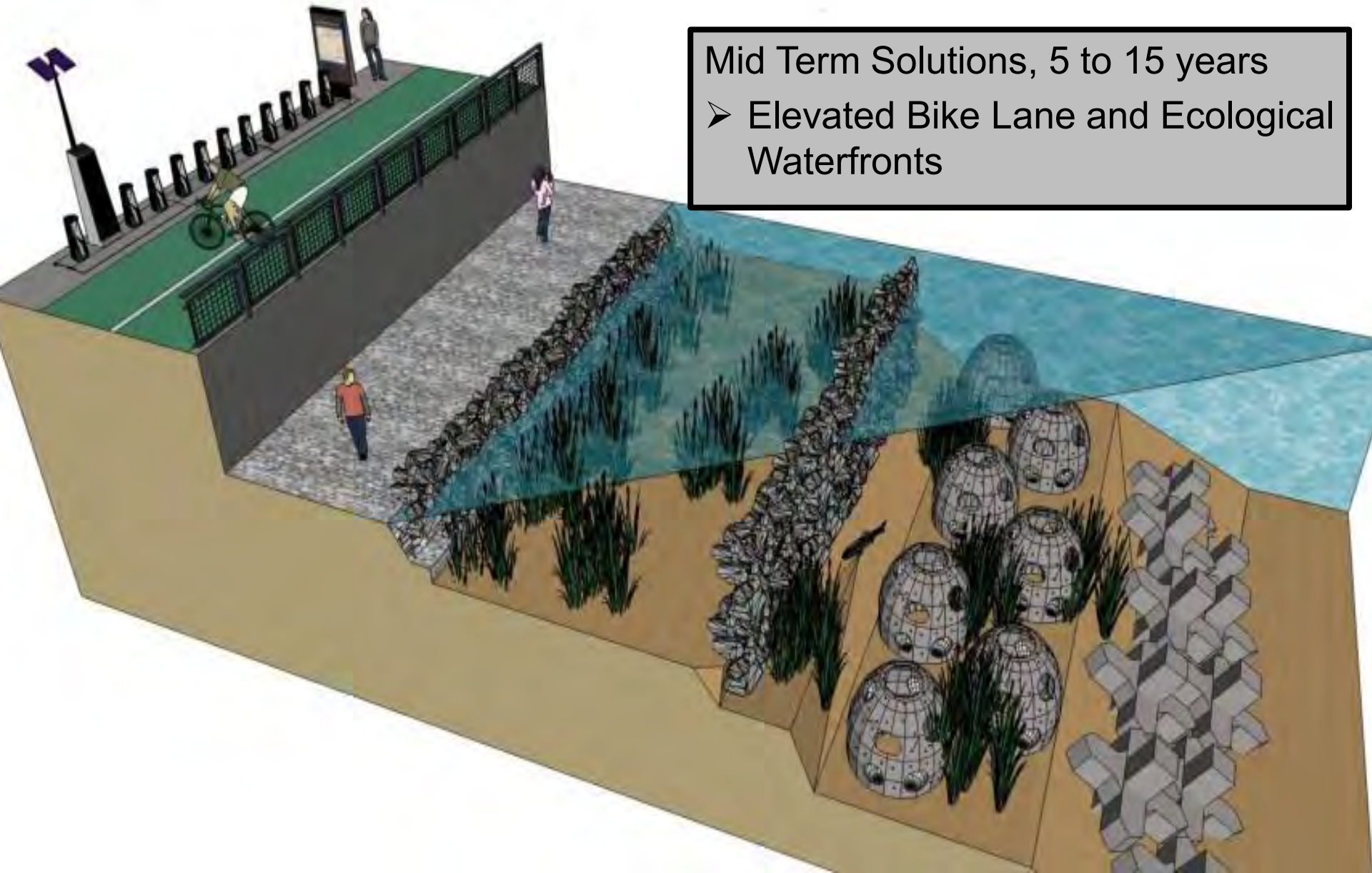
- Improve Landscaping and Flood Wall Solutions



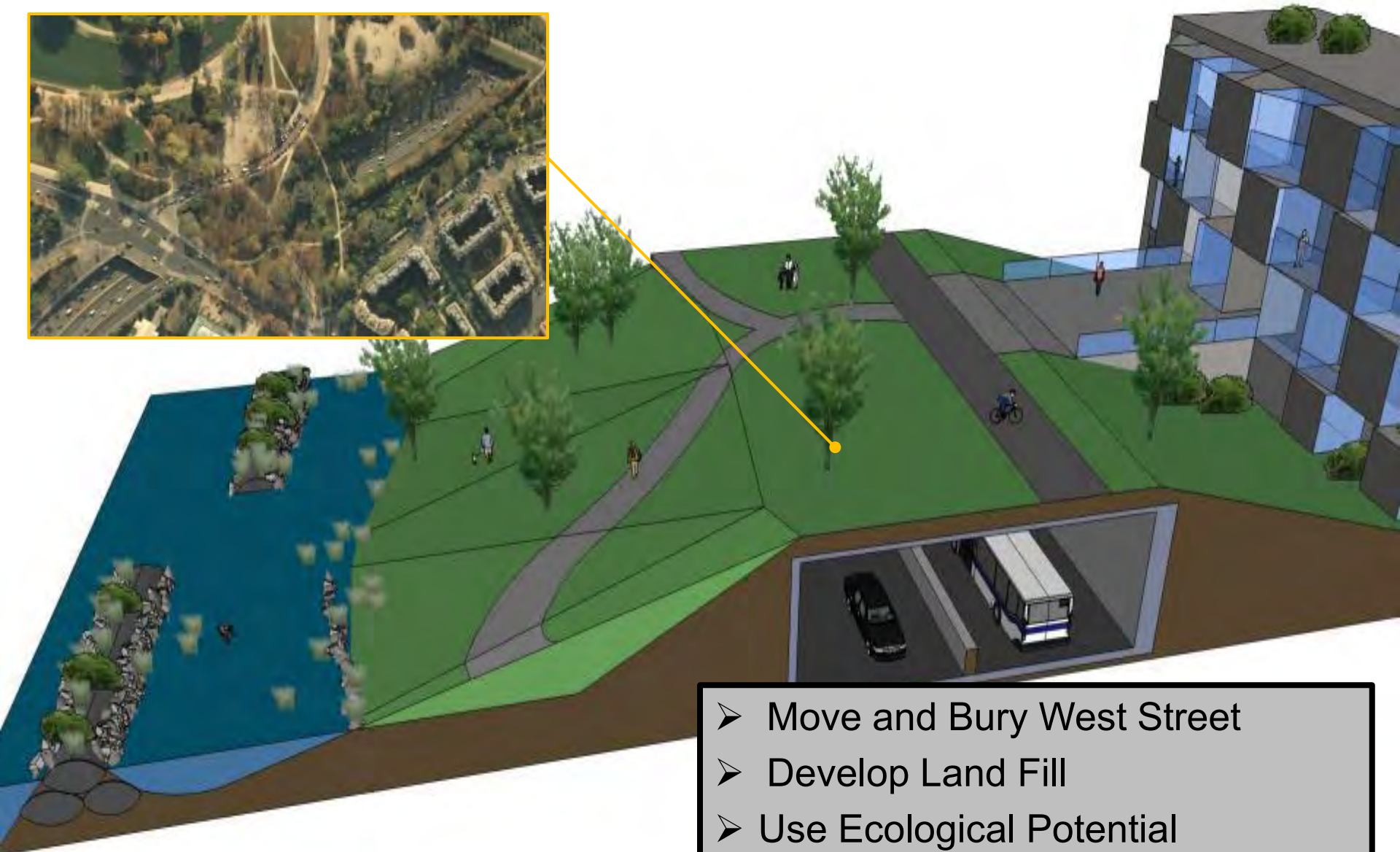
Mid Term Perspective – FDR Drive

Mid Term Solutions, 5 to 15 years

- Elevated Bike Lane and Ecological Waterfronts



Long Term Perspective – West Street



- Move and Bury West Street
- Develop Land Fill
- Use Ecological Potential

NYC Health and Hospitals Corporation



Coler Hospital – Roosevelt Island



Metropolitan Hospital



Bellevue Hospital



Coney Island Hospital

NYC Health and Hospitals Corporation



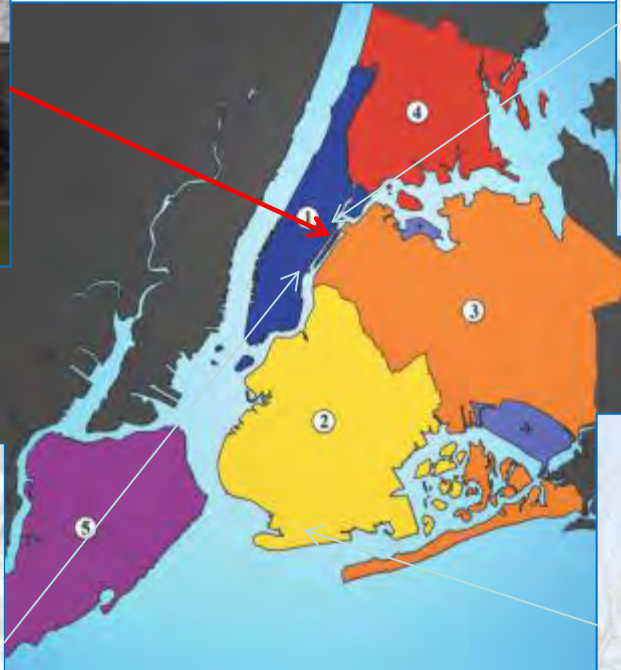
Coler Hospital – Roosevelt Island



Metropolitan Hospital



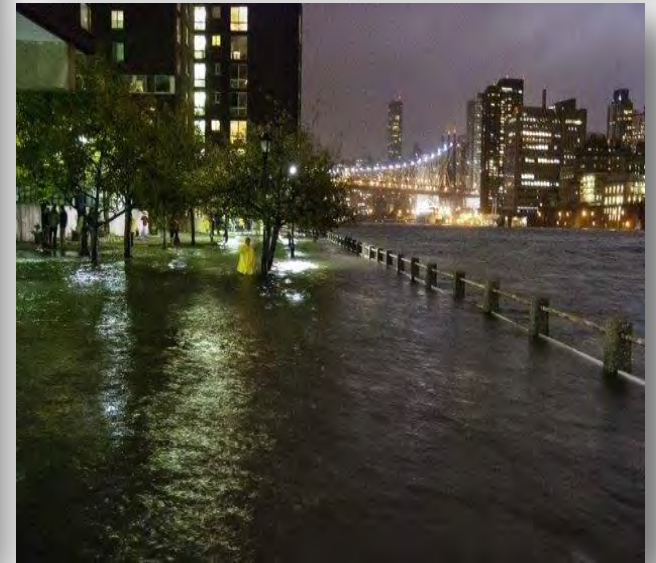
Bellevue Hospital



Coney Island Hospital

Coler Specialty Hospital and Nursing Facility

- Roosevelt Island

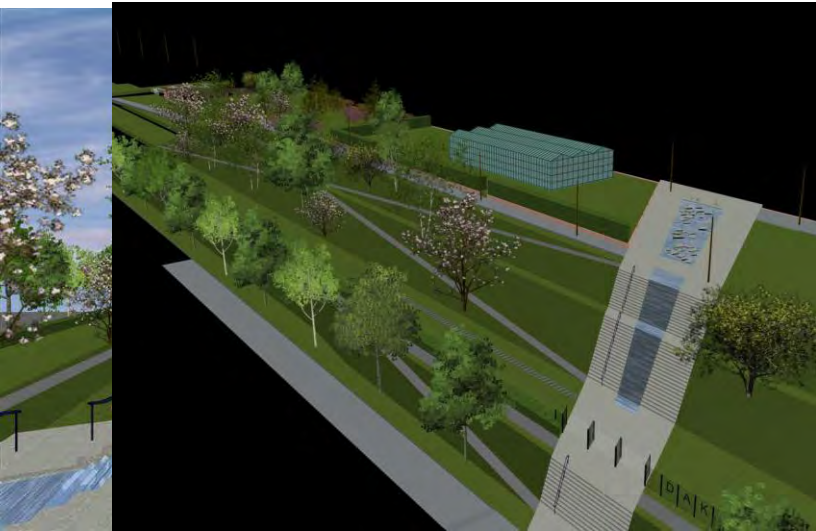


Coler Specialty Hospital and Nursing Facility

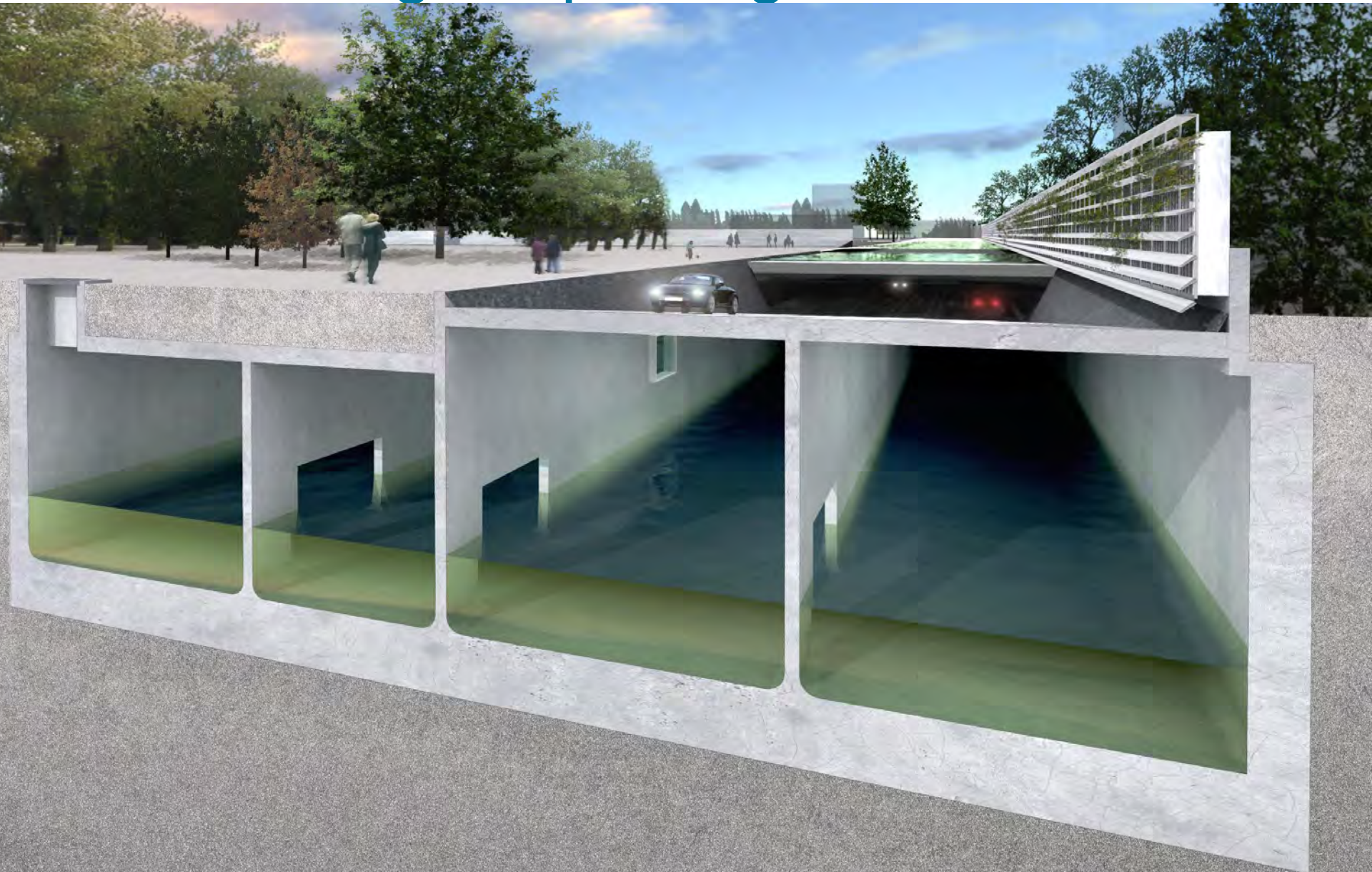
- Preferred Long Term Resiliency Strategy



Flood Protection: multifunctional urban levees



Water storage in parking facilities



Water Plazas



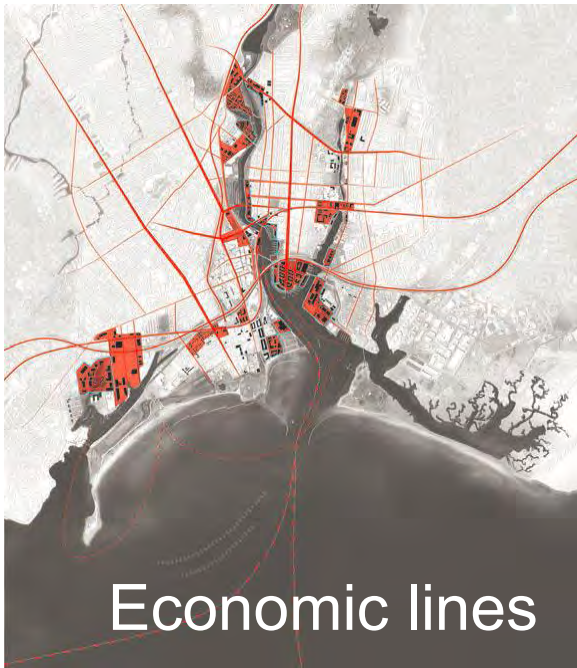
Bloemhofplein tijdens een
extreme stortbui

URBAN FLOODPLAIN

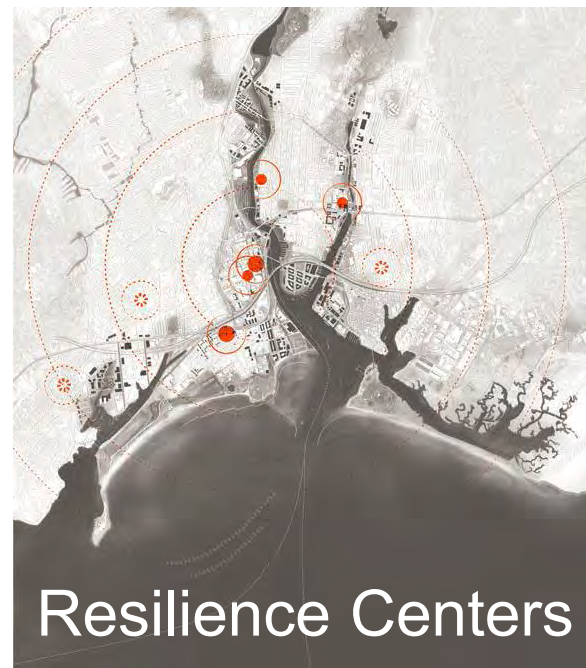




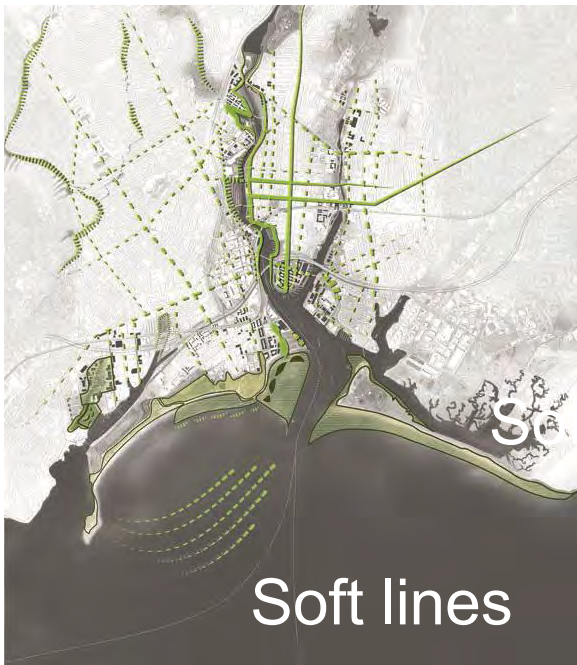
RESILIENT BRIDGEPORT
CLAIM THE EDGE, CONNECT THE CENTER



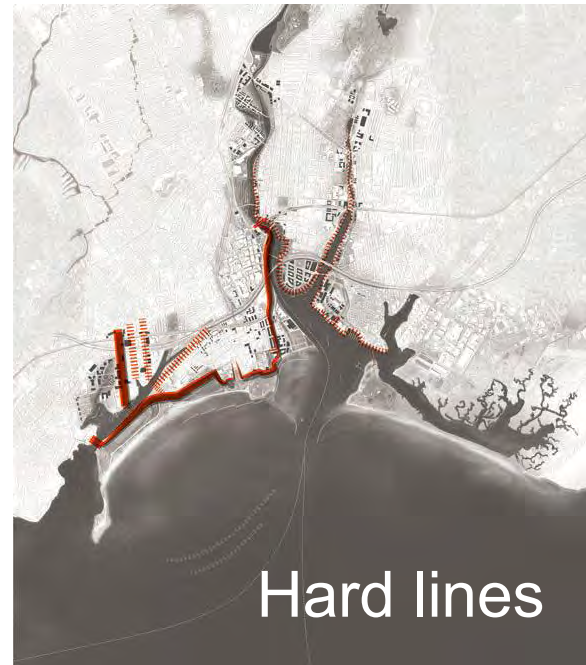
Economic lines



Resilience Centers



Soft lines



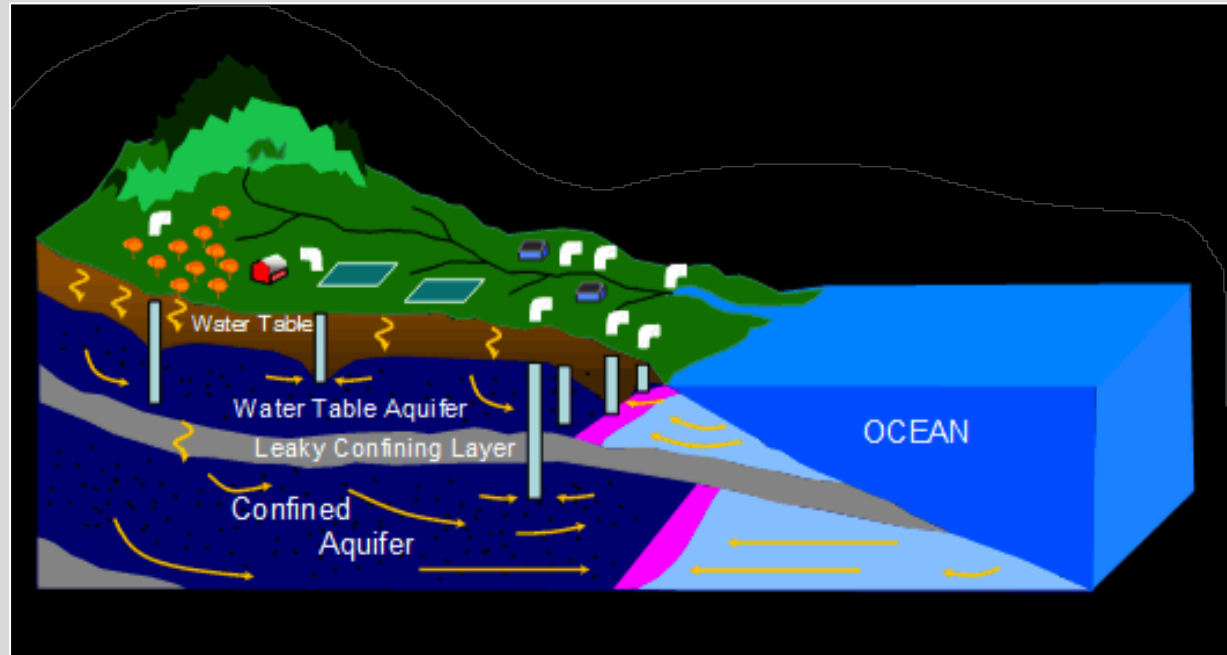
Hard lines

REBUILD BY DESIGN: RESILIENT BRIDGEPORT
BRIDGEPORT IN CONTEXT: HIGH-GROUND

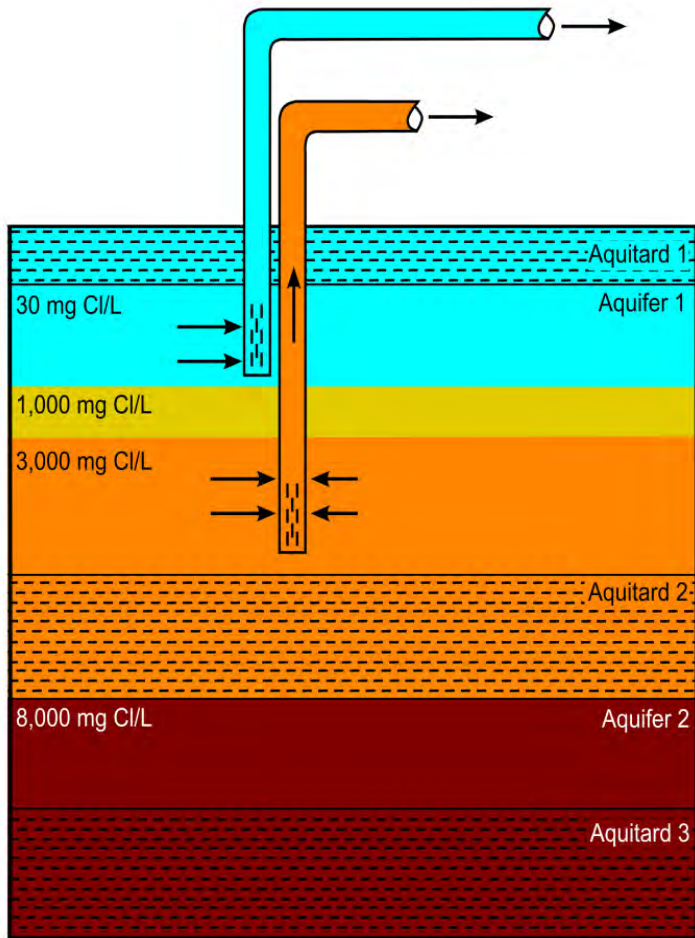


Revisiting effects for water agencies

- Salt-water intrusion
- Water quality impacts for drinking water wells

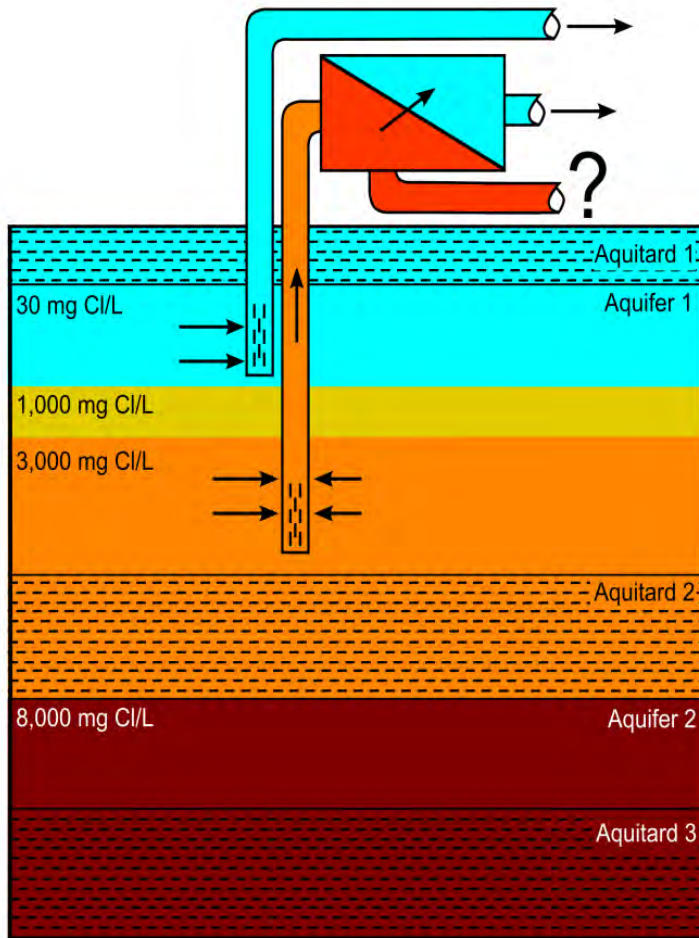


What can be done about groundwater salinization?



1. Pump (intercept) brackish water ('Fresh keeper')

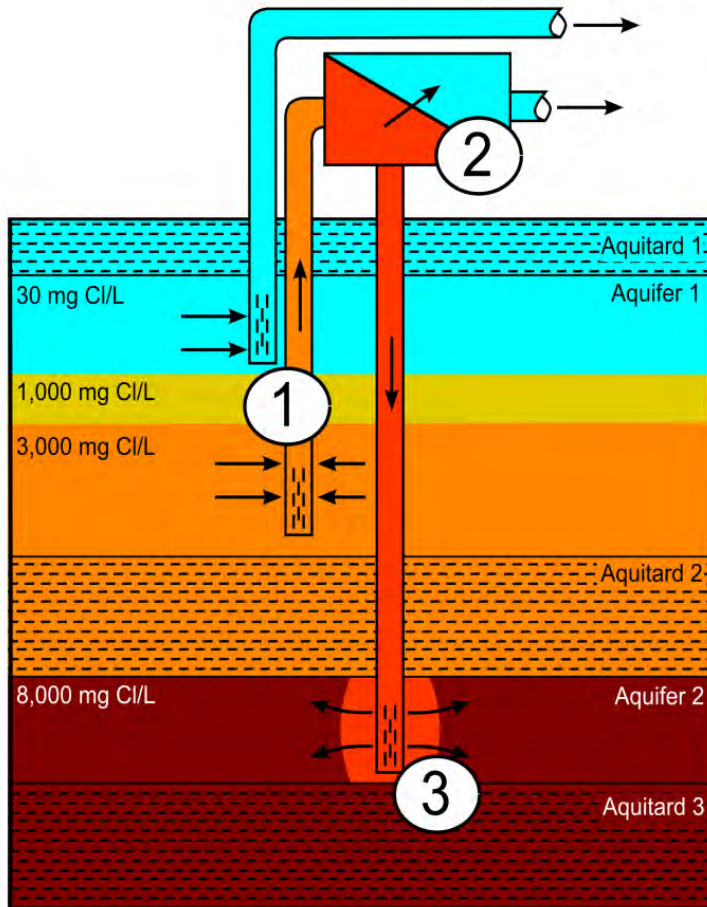
One solution: 3 phase approach



1. Pump (intercept) brackish water ('Fresh keeper')

2. Use brackish water as additional drinking water source (BWRO)

One solution: 3 phase approach



1. Pump (intercept) brackish water ('Fresh keeper')
2. Use brackish water as additional drinking water source (BWRO)
3. Dispose BWRO concentrate through deep well injection

Freshkeeper Projects in Florida



TOWN OF BELLEAIR



Take Away Messages

- Resiliency has the attention of the federal government with a focus on large urban areas
- Urban planning for flood protection is taking on a new dimension
- Water agencies need to be a part of the dialogue – water is a major part of economy driven development
- Vulnerable assets in flood plains need to be evident to stakeholder groups during dialogue
- Groundwater resources need innovative solutions for protection

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