

Flooding in New York City

30 October 2012

Breaking news

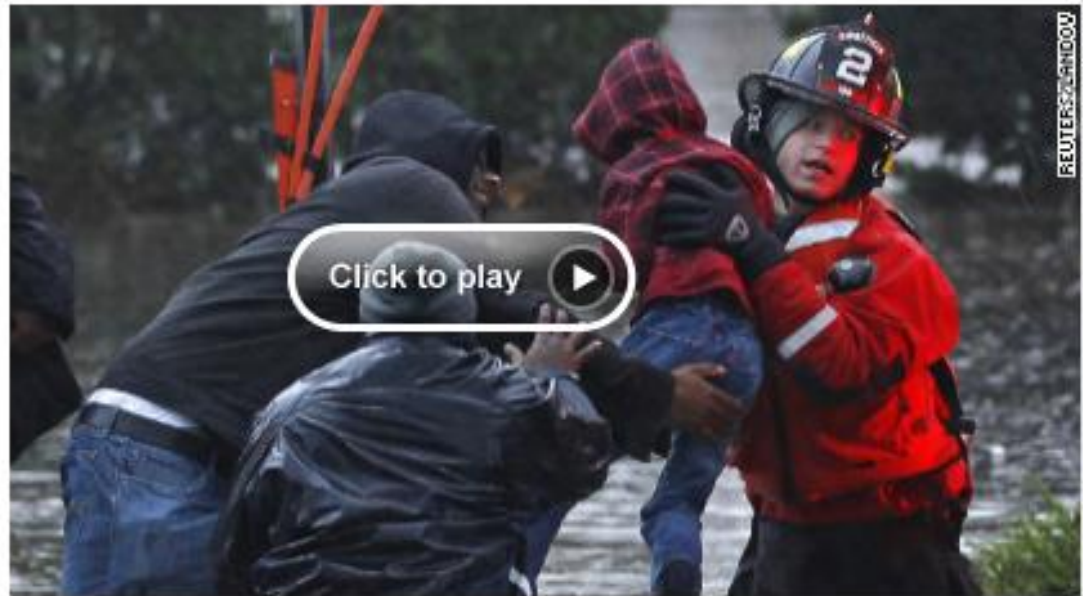
'Unthinkable devastation'

Sandy causes at least 26 U.S. deaths

- More than 7.5 million without electricity
- Bloomberg: NY's 'worst storm ever'
- Wall Street, NYC subways shut down
- More than 15,000 flights canceled

FULL STORY

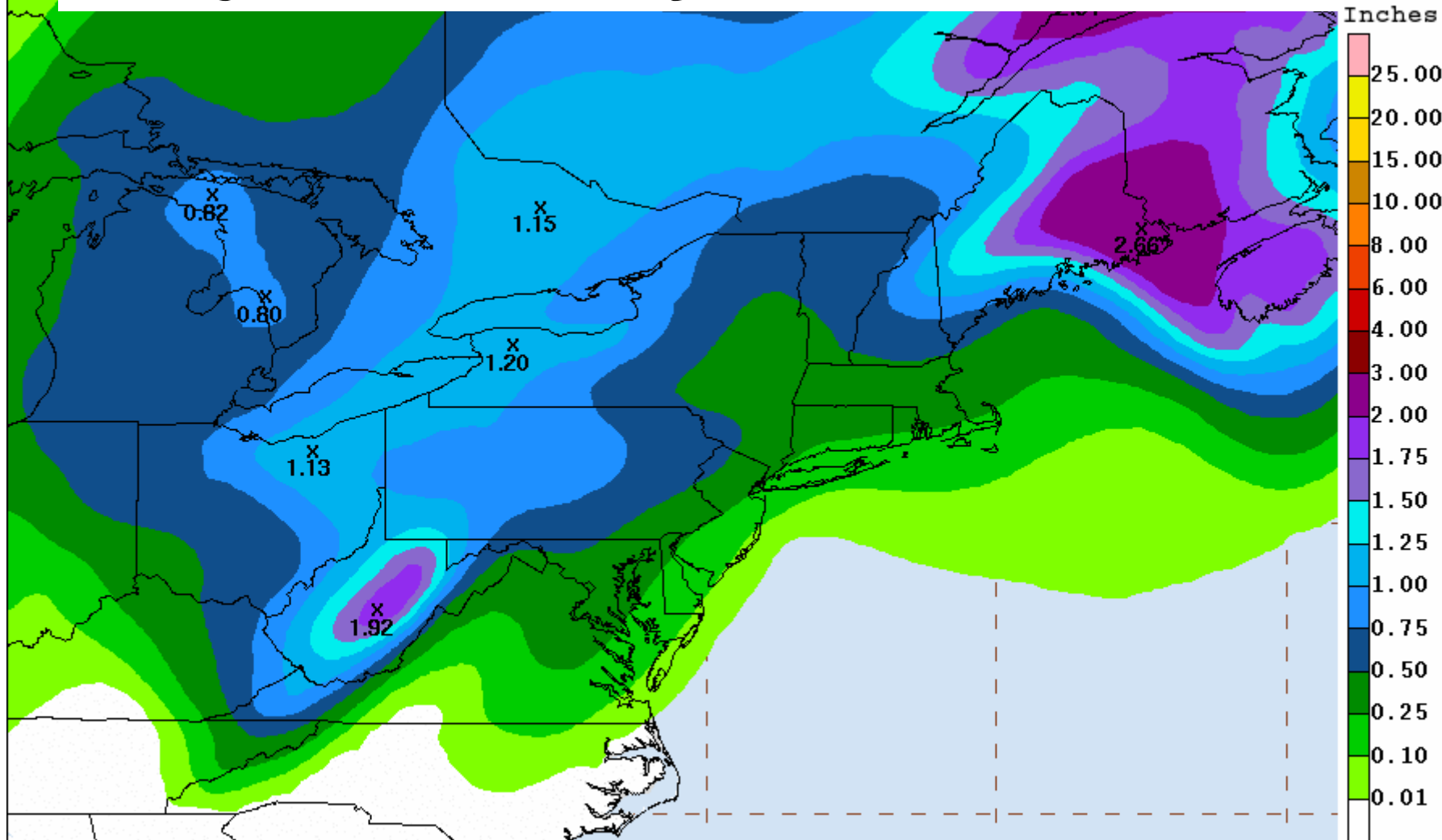
- Sandy's trail of destruction is not over
- Many trapped | State-by-state impact
- Sandy lashes states with snow 🇺🇸
- **LIVE:** See the radar 🇺🇸 | Storm Tracker
- Photos: The recovery | Map of damages



Current Conditions



Projected 5-day Rainfall from Sandy



Post-Tropical Cyclone Sandy
120-hour Day 1-5 Rainfall Forecast (inches)
Created 9:01 AM EDT Tue Oct 30 2012
Valid 8:00 AM EDT Tue Oct 30 2012
through 8:00 AM EDT Sun Nov 4 2012
NOAA/NWS/NCEP/HPC

Local point maximum rainfall may be higher than shown.
See the HPC public advisories for the latest tropical cyclone information.





**A STRONGER,
MORE RESILIENT
NEW YORK**

National Research Council

December 17, 2013



The City of New York
Mayor Michael R. Bloomberg

Recovery, Rebuilding, and Resiliency

In the aftermath of Sandy, Mayor Bloomberg set up the Special Initiative for Rebuilding and Resiliency (SIRR).



The goals of SIRR were to identify ways to

1. Rebuild neighborhoods not just as they were, but better; and
2. Strengthen critical infrastructure systems

by answering three key questions.

Question 1

What happened during Sandy and why?

Question 2

What could happen in the future?

Question 3

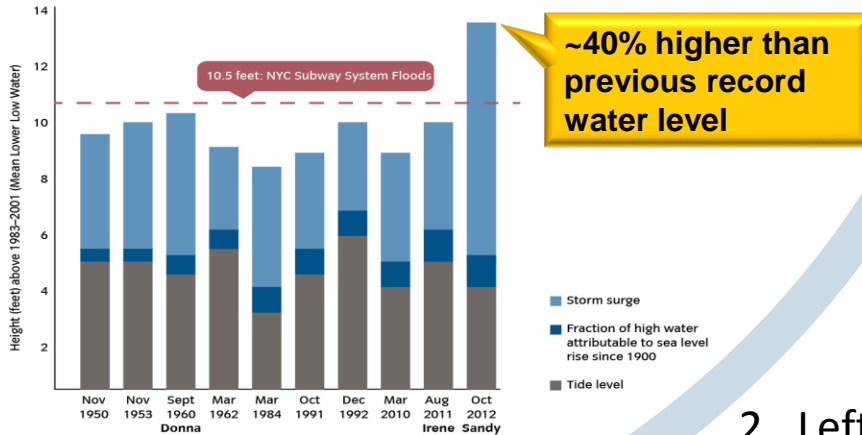
How do we rebuild post-Sandy and prepare for a future with climate change?

Agenda

- Sandy and the Risks of Climate Change
- PlaNYC: A Stronger, More Resilient New York
- Implementation

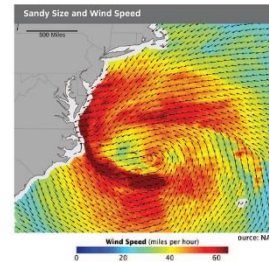
Sandy

An idiosyncratic surge event for NYC...



Why?

1. Wind Field



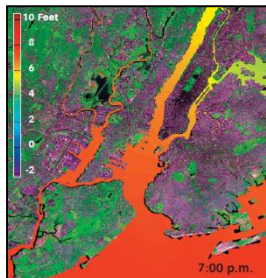
- 1,000 mile wind field pushed water into the NY Bight and caused record 32' waves off Rockaway coastline
- Wave action caused severe structural damage to buildings

2. Left Hook



- A rare “westward hook” put the city in the path of its onshore winds
- 3rd hurricane since 1878 to hit NJ

3. Tide



- Sandy’s storm surge largely coincided with a rising tide in the Upper Harbor
- Spring tide added to the peak water levels

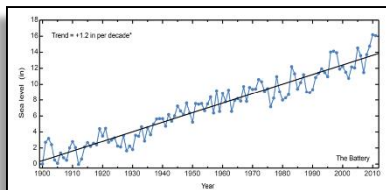
Result:

- 44 lives lost
- \$19 billion in damages
- Countless lives upended
- Major infrastructure disruptions

The Risks of Climate Change

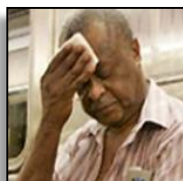
NYC faces a range of risks from climate change into the 2020s and 2050s.

NYC Panel on Climate Change (NPCC) projects increased chronic climate hazards...



- Increases in average temperature and precipitation
- Sea levels likely to rise 1-2 ft.; maybe by 2½ ft. by 2050s

...and increased impact from extreme weather events.



- Higher frequency and magnitude of coastal flooding
- More heat waves: number of days in NYC above 90° could triple

Analysis indicates a real cost of inaction...

- Similar likelihood event in the 2050s could be 5 times as costly
- Every \$1 invested now saves \$4 later through reduced damage

...and the Sandy supplemental funds provide a unique opportunity to invest now to reduce those future risks.

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A Stronger, **More Resilient** New York



A Stronger, More Resilient New York

- Analysis and recommendations built on best available science
- 257 initiatives to strengthen coastal defenses, improve buildings, protect infrastructure and make neighborhoods safer and more vibrant
- Accountability measures and a clear implementation plan

Four Principles of Resiliency

To address the risks of climate change, the City has developed a plan that adheres to four core principles.

- 1 Be ambitious, but seek achievability**
 - Can be significantly more resilient
 - Aim for the stars, but do not fail to launch
- 2 Acknowledge resource limits, but seek to stretch resources**
 - Maximize benefits per dollar (including non-monetary benefits, such as vulnerability of population)
 - Leverage existing resources to increase return on investment
- 3 Create multiple defensive layers (reduce impacts, while allowing faster recovery)**
 - First Layer: Coastal defenses (less flooding; less impact)
 - Second Layer: Buildings (less serious damage; faster rehabilitation)
 - Third Layer: Infrastructure and critical systems (fewer outages; faster restoration)
- 4 In impacted areas, do not abandon the waterfront (rebuild and, where possible, improve)**
 - Fight for coastal neighborhoods

Physical Resiliency

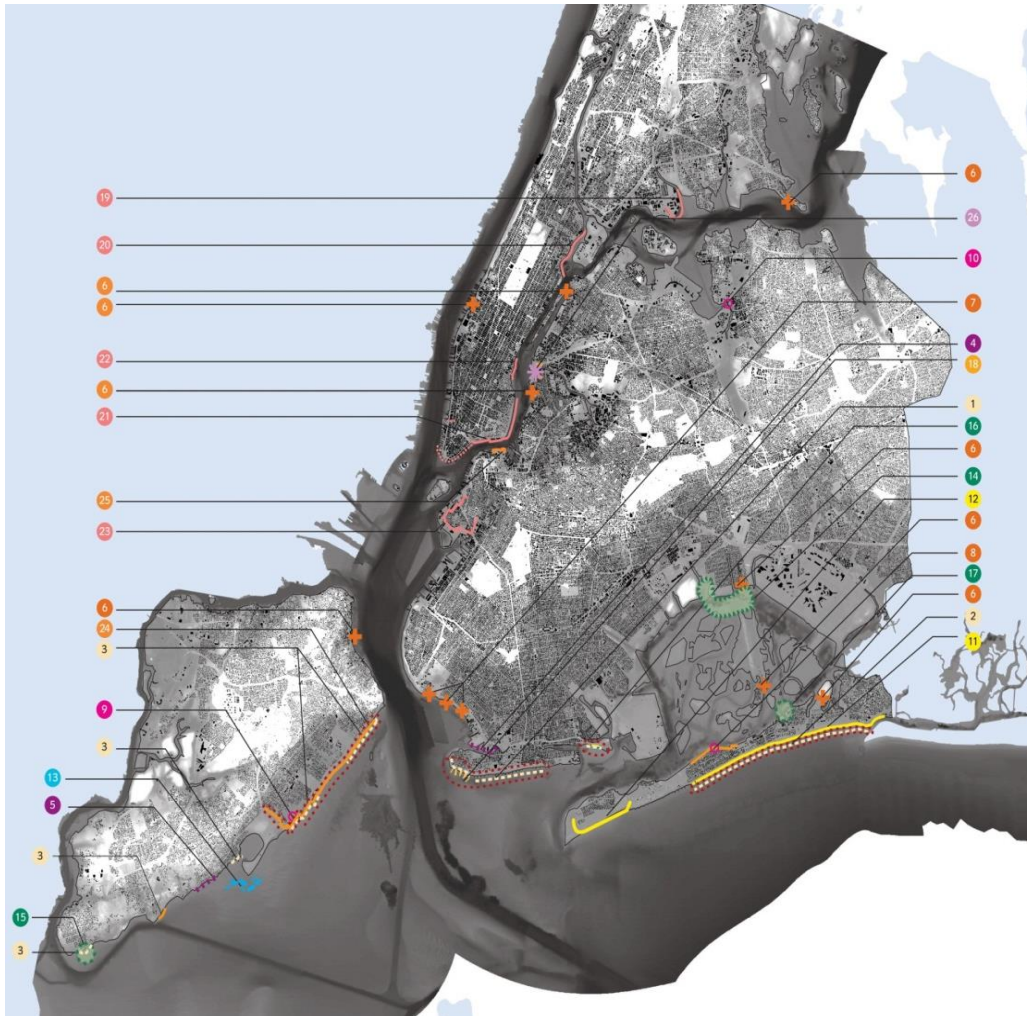
New infrastructure can help reduce the risk to our neighborhoods, critical services, businesses, and vulnerable populations.



Newtown Creek Local Storm Surge Barrier

Physical Resiliency

The City's plan includes detailed recommendations for a first line of defense on the coastline.



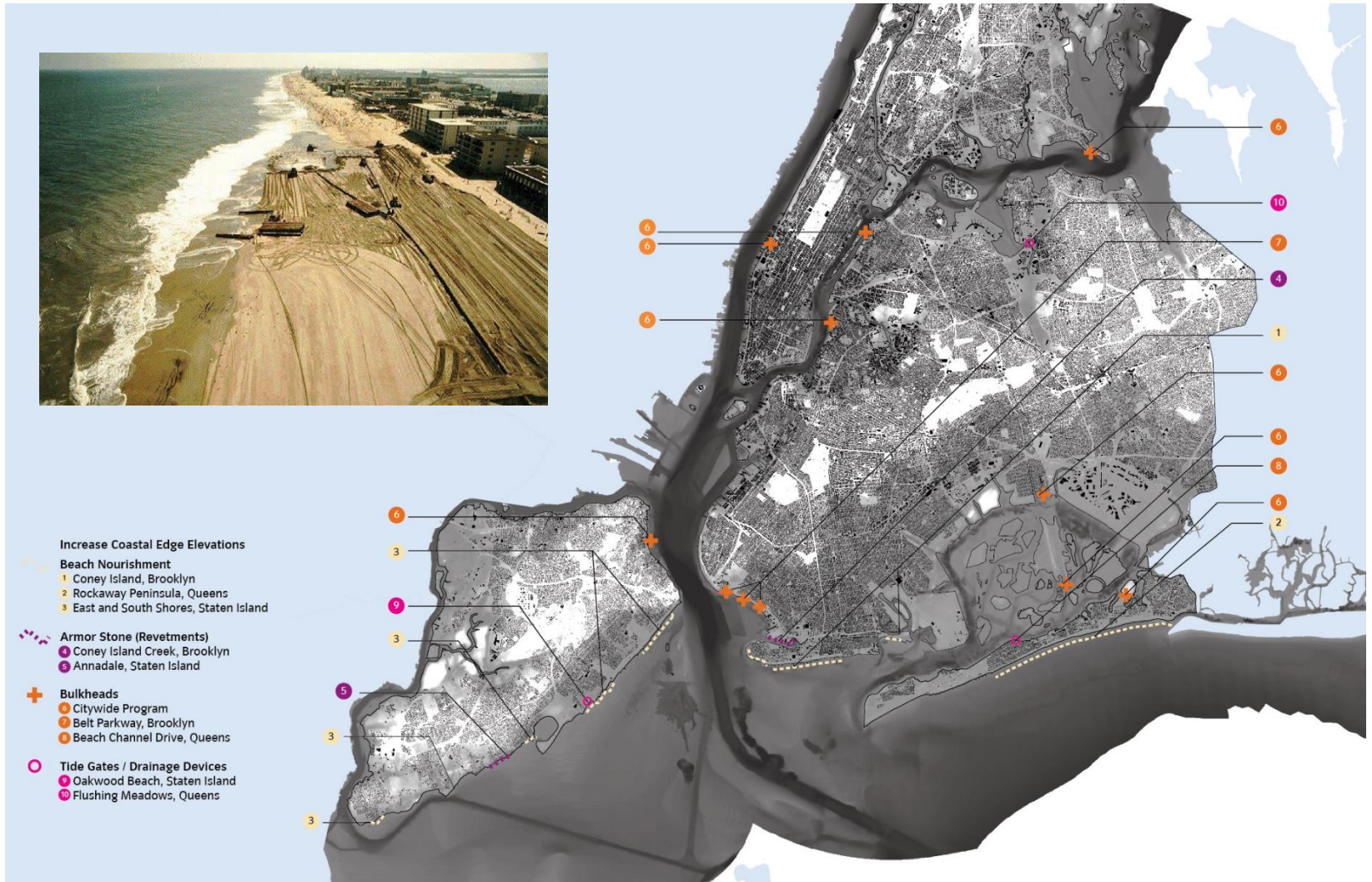
Proposals

The **1st phase** of the \$3.7 billion plan will include 37 initiatives to protect vulnerable areas from waves and inundation based on four key strategies:

1. Increase coastal edge elevations
2. Minimize upland wave zones
3. Protect against storm surge
4. Improve coastal design and governance

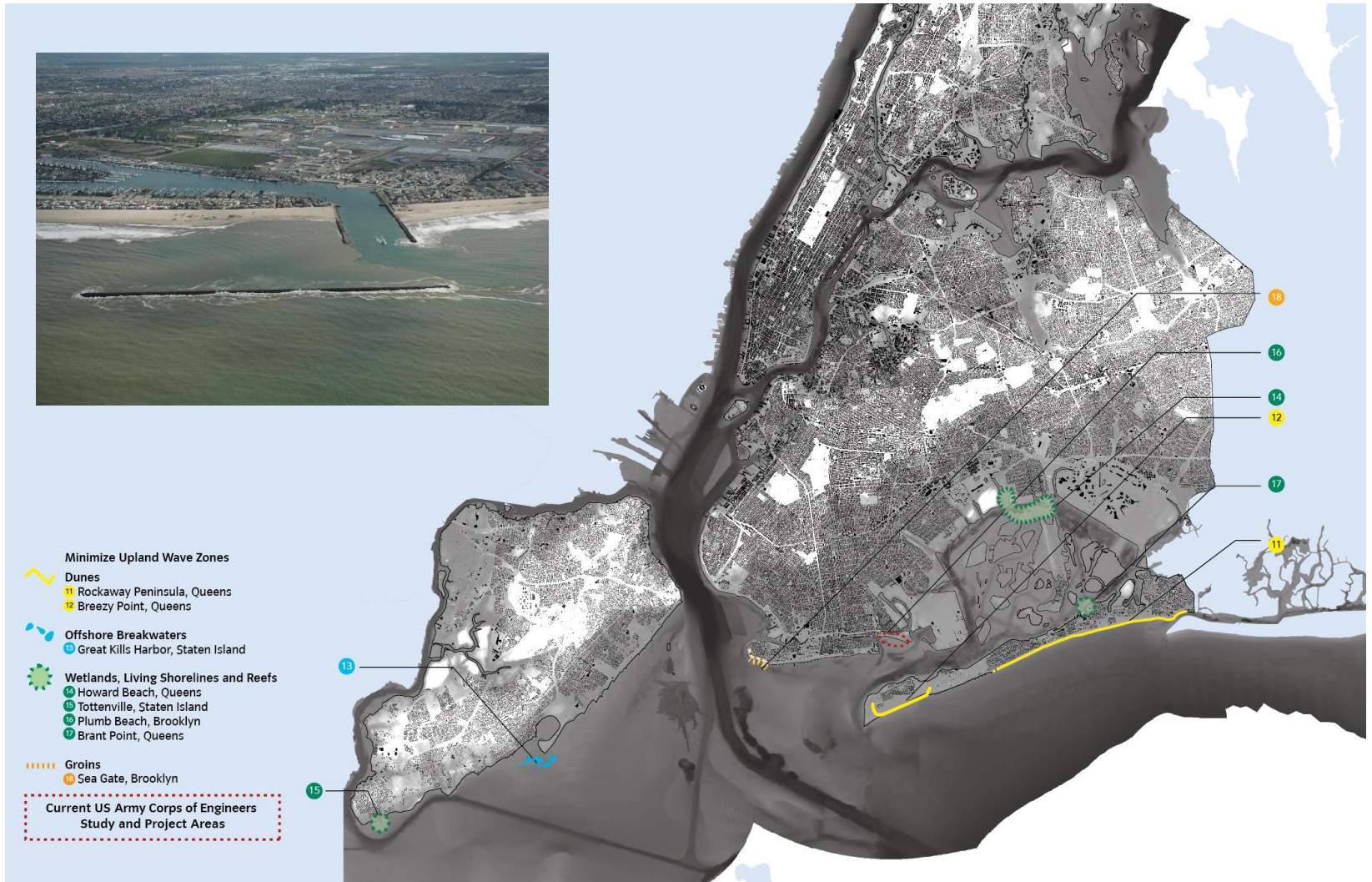
Physical Resiliency

The City will increase coastal edge elevations with beach nourishment, bulkheads, and revetments.



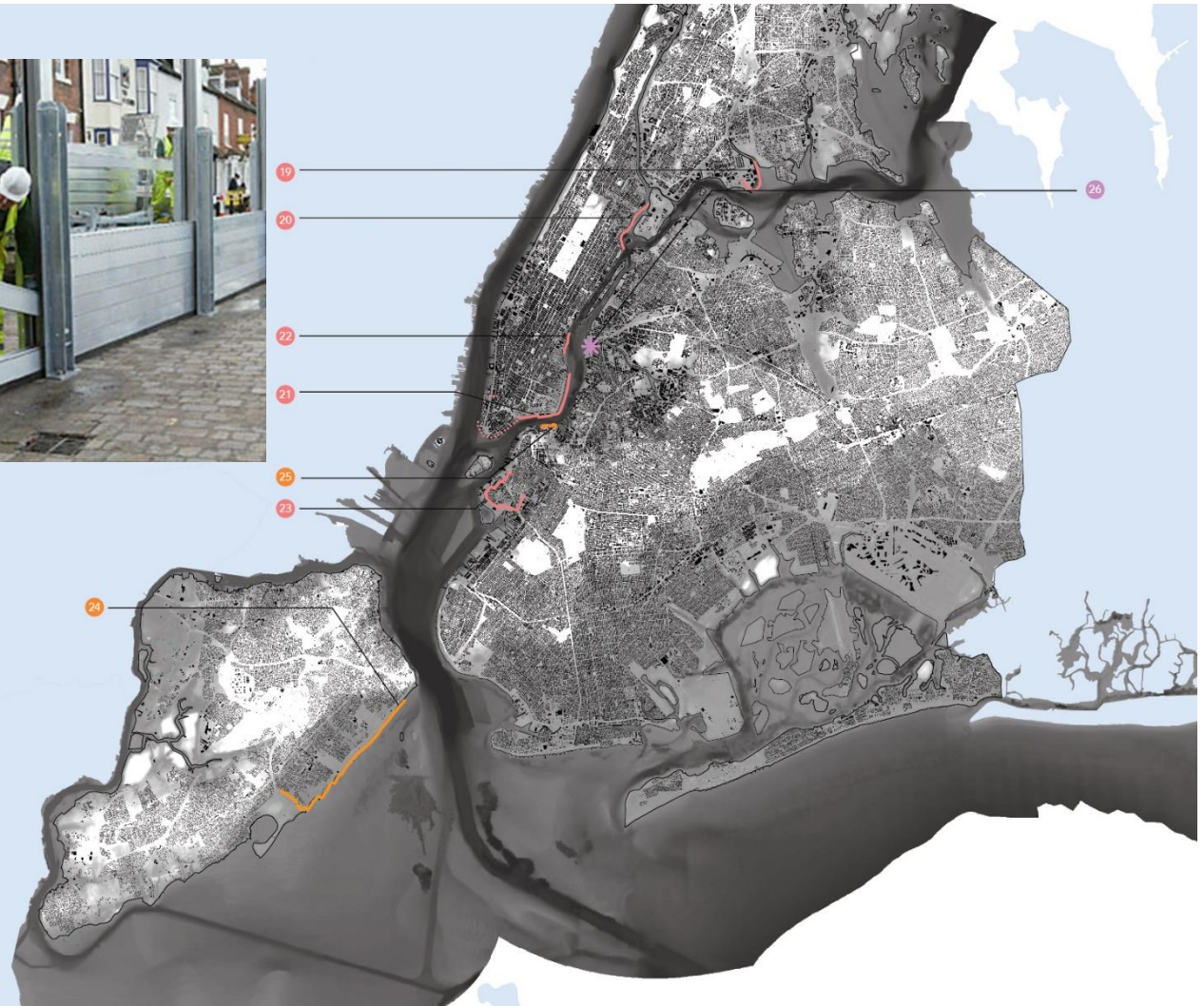
Physical Resiliency

The first phase will also work to minimize the impacts that waves have on vulnerable neighborhoods with wetlands, breakwaters, and dunes.



Physical Resiliency

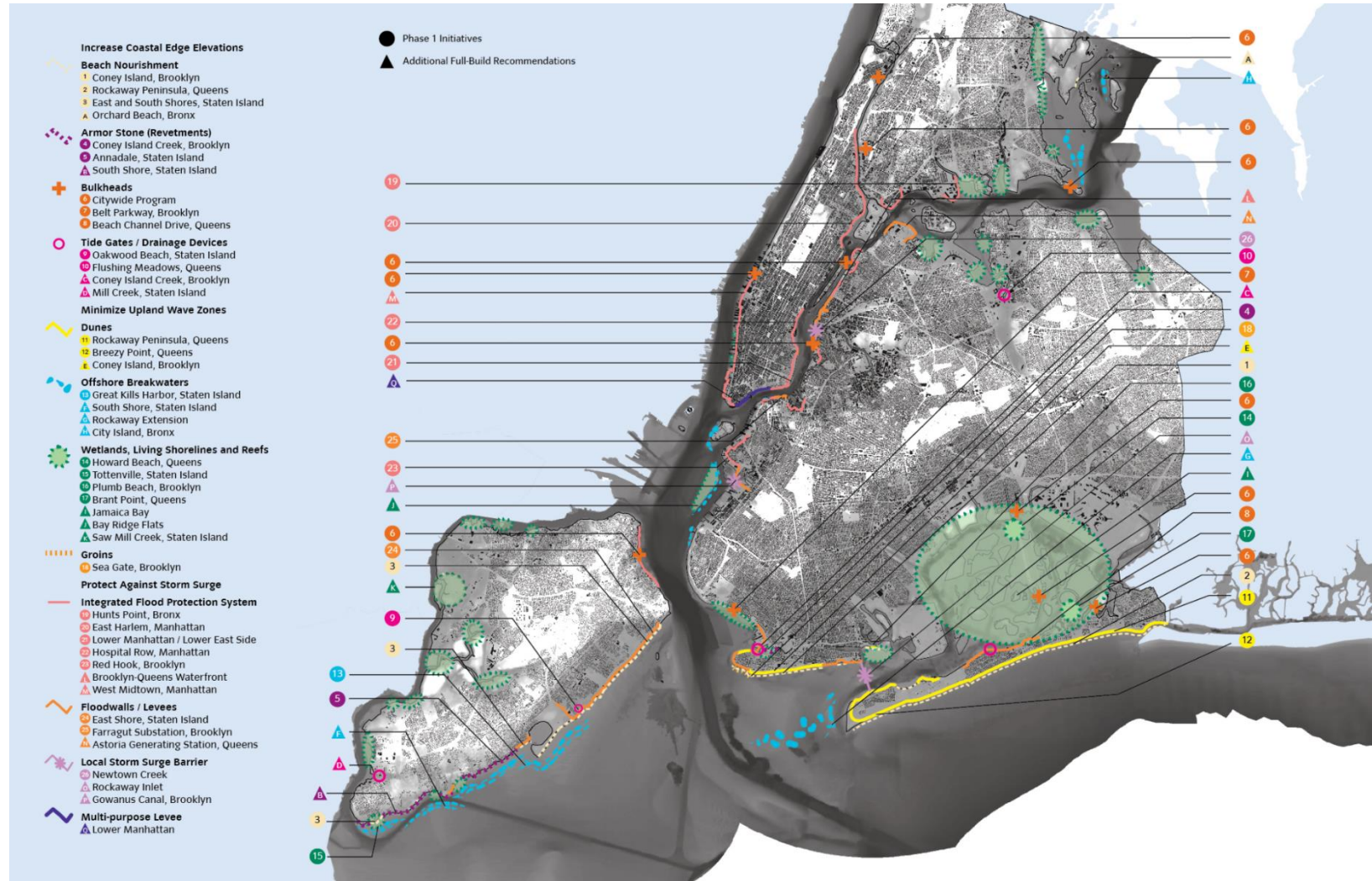
Finally, the first phase will work to minimize the impacts of inundation on vulnerable neighborhoods with levees, floodwalls, and local storm surge barriers.



- Protect Against Storm Surge**
- Integrated Flood Protection System**
 - 19 Hunts Point, Bronx
 - 20 East Harlem, Manhattan
 - 21 Lower Manhattan / Lower East Side
 - 22 Hospital Row, Manhattan
 - 23 Red Hook, Brooklyn
- Floodwalls / Levees**
 - 24 East Shore, Staten Island
 - 25 Farragut Substation, Brooklyn
- Local Storm Surge Barrier**
 - 26 Newtown Creek

Physical Resiliency

As additional resources are found, the City's plan calls for the completion of a full-build set of coastal protections that expand on its first phase strategies over time.



Resiliency Initiatives

The City's plan includes detailed recommendations for multiple lines of defense across the city coastline, neighborhoods, and other areas, including the following examples:

1

Strengthening Coastal Defenses



- Implement immediate beach and dune nourishment
- Execute existing and authorize new USACE projects
- Advance innovative and cost-effective solutions Citywide

2

Upgrading Buildings



- Strengthen the City's building code
- Upgrade existing public and private buildings

3

Protecting Critical Infrastructure and Services



- Harden critical electrical and liquid fuel infrastructure
- Invest in green infrastructure
- Improve telecom resiliency regulation

4

Making Neighborhoods Safer and More Vibrant



- Conduct detailed studies in vulnerable neighborhoods
- Advocate for affordability measures in NFIP
- Cooperate with State and Federal resiliency efforts

A Resilient Transformation

Bold thinking can transform neighborhoods and provide for enhanced safety, economic development, and stronger communities.



Coney Island Creek Tidal Barrier

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Implementation

And, while this is necessarily a long-term plan, the City has already taken steps, with many partners, to advance many of its key initiatives, including these highlights:

1

Strengthening Coastal Defenses



- Placed 1.2m cy of sand on City beaches
- Expanded dune grass production
- Launched feasibility study of Seaport City

2

Upgrading Buildings



- Passed 16 of 22 local laws to improve building resiliency
- Launching building resiliency incentive program

3

Protecting Critical Infrastructure and Services



- Supported ConEd's \$1 billion in resiliency investments
- Invested in expanded bluebelts
- Launching telecom resiliency office

4

Making Neighborhoods Safer and More Vibrant



- Launched Game Changer competition
- Advocated for affordability measures in NFIP
- Released Staten Island beach concession RFEI



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The City of New York
Mayor Michael R. Bloomberg