LOWER MANHATTAN
CLIMATE RESILIENCE STUDY

May 2019

NYCEDC

NYC Mayor's Office of Recovery & Resiliency

Agenda

1. Overview of Lower Manhattan Coastal Resiliency (LMCR) and study findings
2. Overview of LMCR overall strategy and projects
3. Next steps on community engagement
4. Key questions for discussion

Lower Manhattan Coastal Resiliency (LMCR) is a comprehensive strategy to adapt Lower Manhattan to the impacts of climate change.

LM Climate Resilience Study

Developed **comprehensive climate risk assessment,** examining the full range of climate hazards and incorporating latest science

Tested/analyzed **engineering of coastal resiliency tools,** from flood walls to deployable barriers to raising streets and hardening buildings

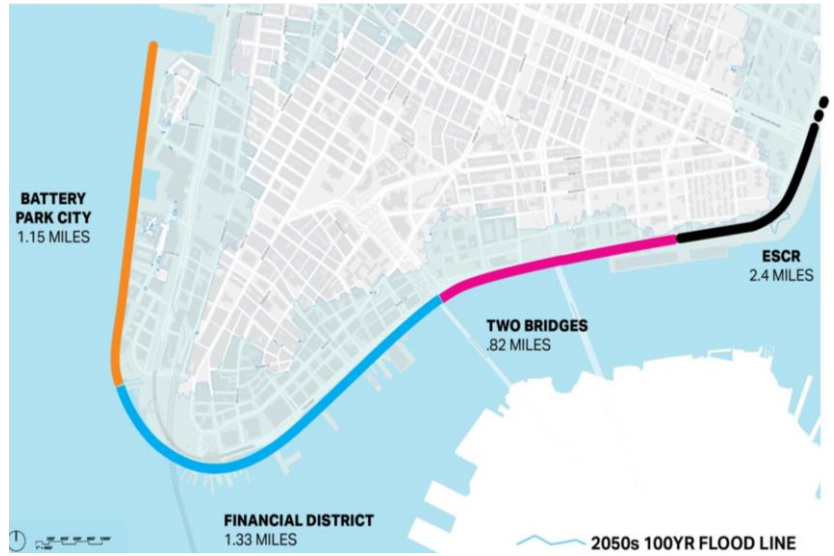
Capital Projects

Implementing approximately **$500M of on-land capital projects** to be **under construction before the end of administration**

Master Plan

Advancing **Climate Resilience Master Plan for Financial District and Seaport,** where on-land adaptation measures were not deemed viable

Core Project Goals: Reduced climate risks, viable implementation strategy, and integration of waterfront uses and urban co-benefits where possible



Study Areas

Not protecting Lower Manhattan would have devastating impacts on residents, jobs, and infrastructure.

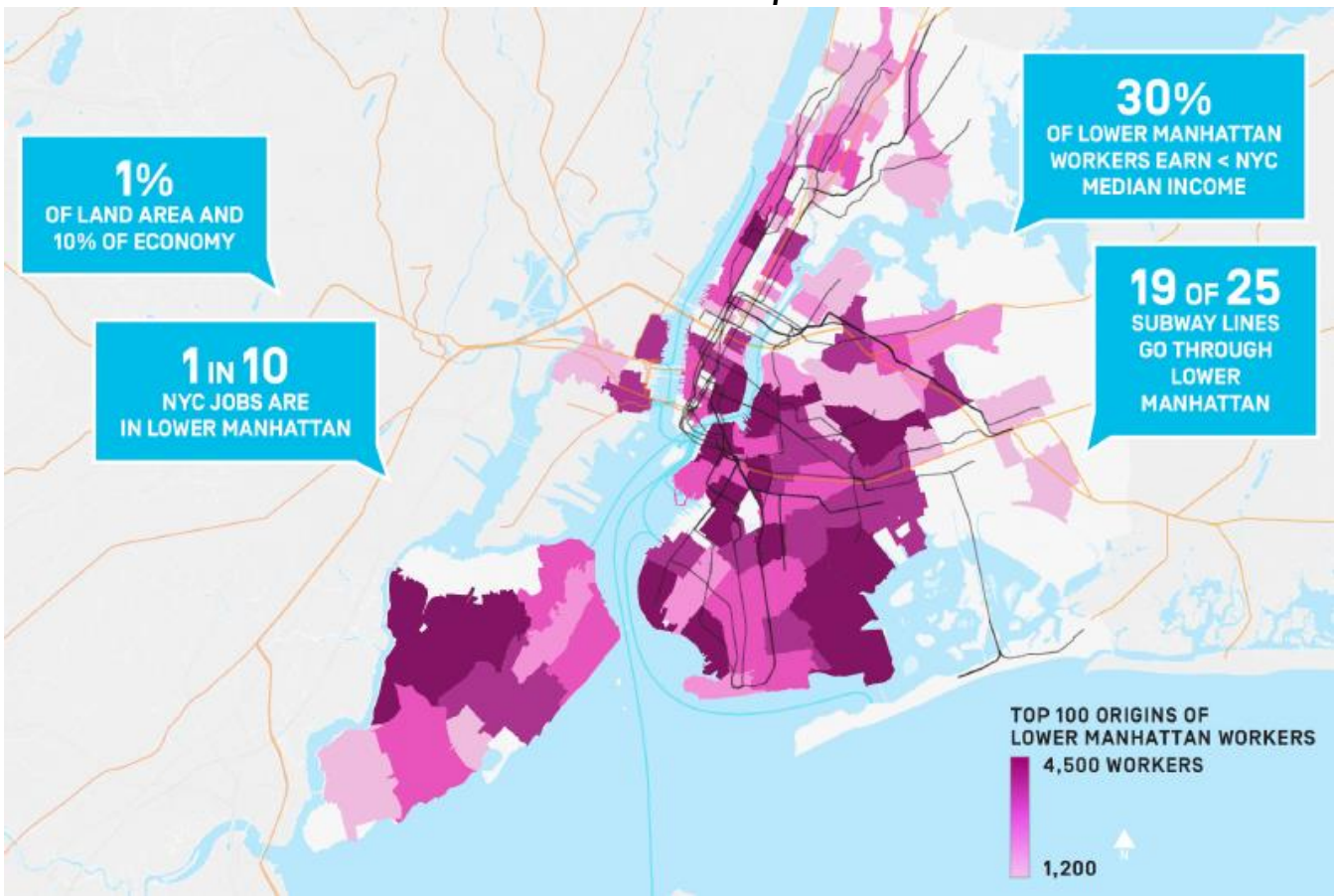
- Sandy flooded 17% of City's land, claimed 44 lives, and caused $19B in damages and lost economic activity
- Effects were devastating in LM, causing two deaths and damaging thousands of buildings, with estimated damages valued at $2.6 billion*
- Residents left without power or basic services

➢ **Event demonstrated how impacts of climate change to LM will be felt both locally and across the City/region**

Climate adaptation in LM is critical to protecting:

- **Major jobs center** with 10% of City's jobs (30% of workers earn less than $50K a year)
- **Homes of nearly 100,000 residents** and growing
- Critical infrastructure with **19 of the City's 25 subway lines** and 26 ferry lines passing through the area
- Vulnerable populations including low-income, elderly, and people with disabilities

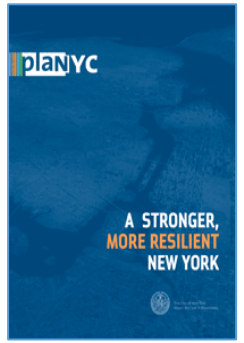
Lower Manhattan workers come from all parts of NYC



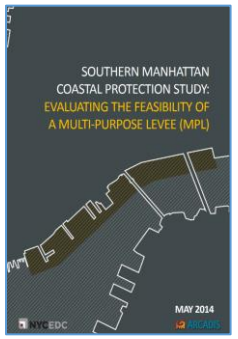
*Value includes Lower East Side

Since Hurricane Sandy, interagency City team has been working to find a solution for climate resilience for LM.

- Post-Sandy, *A Stronger, More Resilient New York* was released with initial idea for outboard development in LM
- *Southern Manhattan Coastal Protection Study* released in 2014 analyzed the ability for development to pay for outboard infrastructure to protect against storm surge
- Upon release of 2014 study, LM leaders and stakeholders called for a more comprehensive solution for the District and exploration of on-land alternatives
- 2014 *Big U* concept, integrating flood protection with community amenities in compartments, received funding through HUD Rebuild by Design competition
- First comprehensive climate risk assessment and strategy for Lower Manhattan, with engineering analysis of multiple on-land alternatives released in 2019 *Lower Manhattan Climate Resilience Study*
- 2019 Study has led to:
  - **On-land capital projects for 70% of the district** (including 45% of original Seaport City geography), advancing with $500M of funding; and
  - **Master Plan for Financial District and Seaport, where on-land solutions or technologies were not deemed viable.**
- **Additional and on-going community engagement needed** to advance capital projects and Master Plan

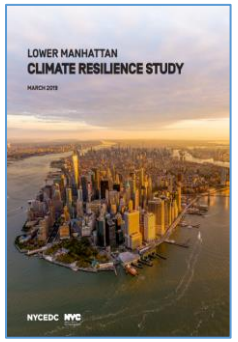


A Stronger, More Resilient New York (2012)



Southern Manhattan Coastal Protection Study (2014)

Rebuild By Design: The Big U (2014)

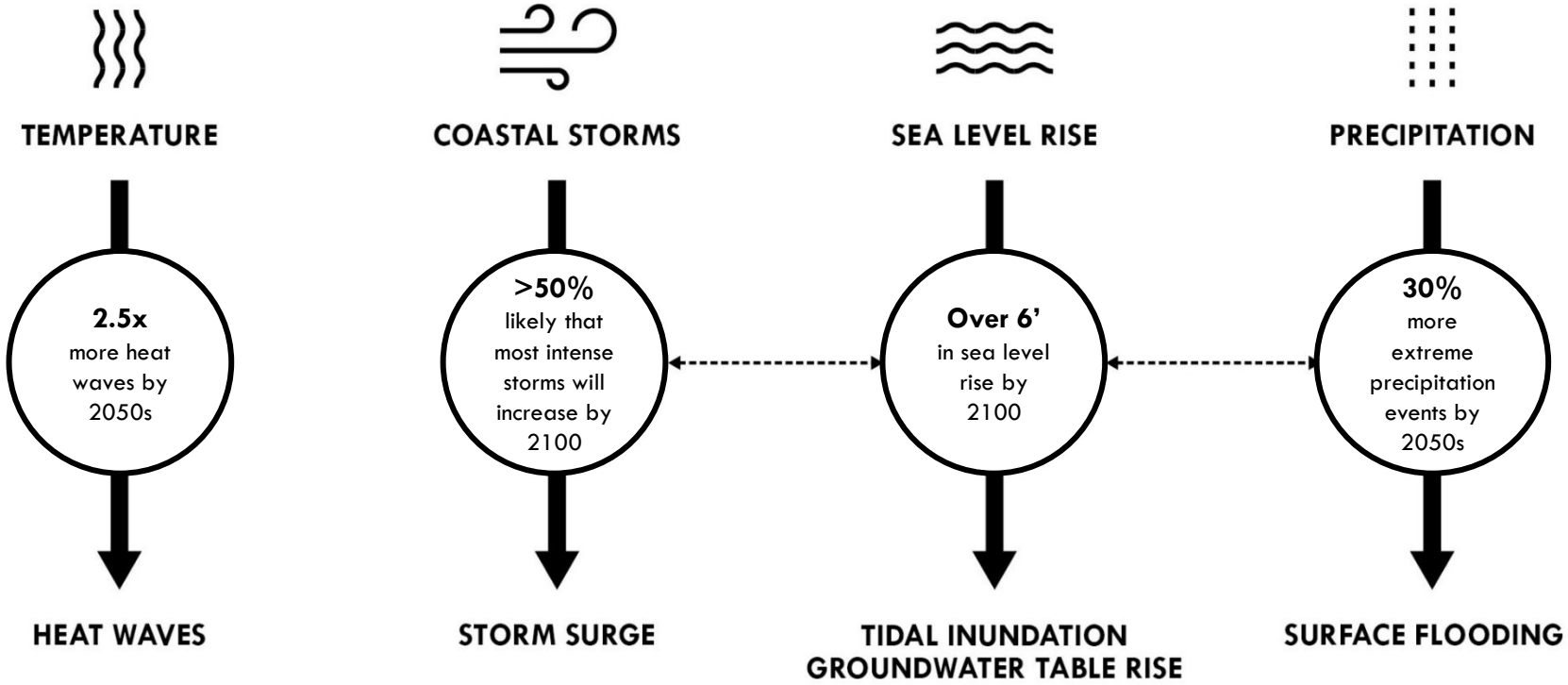


Lower Manhattan Climate Resilience Study (2019)

The City's understanding of climate science and risks has dramatically increased since Hurricane Sandy and post-Sandy plans.

We are experiencing climate change today and absent significant action, climate change will continue to produce devastating consequences faster than previously thought.

- New York Panel on Climate Change localizes climate science to NYC with a team of universities, climate scientists, impact specialists, and policy makers
- Sea levels have already risen in NYC by a foot since 1900, which is almost twice the global average



All analysis used 90th percentile projections from the 2015 New York Panel on Climate Change (NPCC), which are reaffirmed in the 2019 NPCC report. This represents the most conservative projections of the most up-to-date science that is specific to New York City. New Antarctic Rapid Ice Melt (ARIM) scenario released in 2019.

Lower Manhattan is at risk of both extreme events like Sandy and chronic conditions from sea level rise.

Hundreds of thousands of workers and residents, along with critical infrastructure, are acutely vulnerable to the impacts of climate change in LM

By the 2050s:

- 37% of properties at risk of flooding from 100-year storm surge
- Risk of street and basement flooding from increasingly frequent extreme rain events and 2.5 feet of projected sea level rise, overwhelming combined sewer system

By 2100: Potential for risks to impact LM's ability to function

- Daily tidal inundation, affecting 20% of streets and over 10% of buildings, due to over 6 feet of projected sea level rise
- 7% of buildings at risk of destabilization from projected groundwater table rise
- ~50% of properties (including 2/3 of historic or landmarked buildings) at risk of flooding from 100-year storm surge
- 39% of streets with underground utilities exposed to corrosion/water infiltration

➢ **There is no one-size-fits all solution for all of Lower Manhattan – strategy needs to be both comprehensive and tailored to each neighborhood**

Map. 2050s 100-year coastal storm flood.

100-year storm has a:

- 1% chance of occurring any given year
- 26% chance of occurring over a 30-year mortgage
- 45% chance of occurring over the 60-year life of a power substation

What happens if we do nothing?

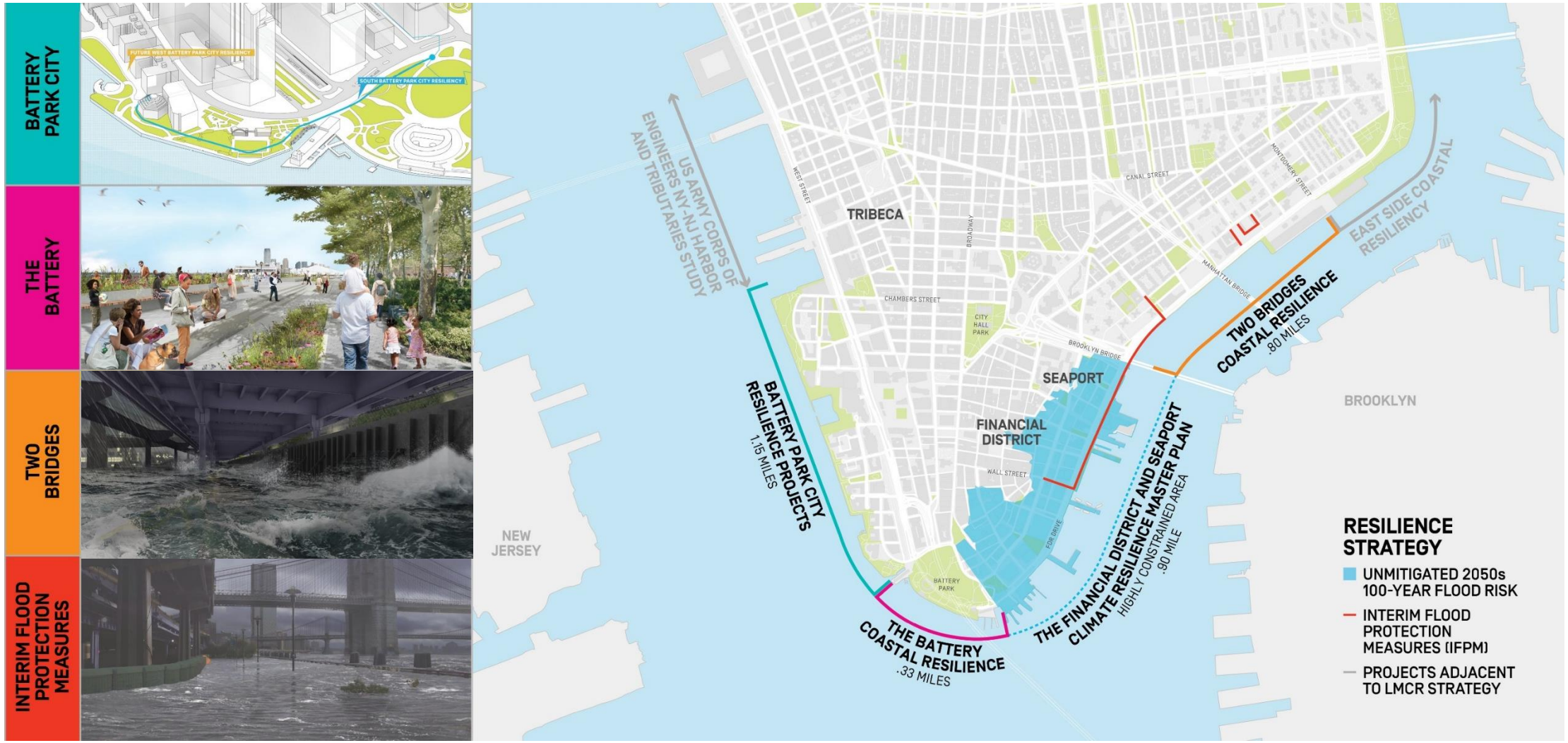
Impacts of climate change would affect not only LM workers and residents, but also people across the city

- By 2100 with daily tidal inundation, even retrofitted or hardened buildings could become inaccessible
- Today's thriving waterfront could be underwater on semi-permanent or permanent basis
- Jobs for New Yorkers from all parts of the city could be displaced
- Ferry terminals and other waterfront transportation hubs could become inaccessible
- Chronic water intrusion could damage subway tunnels that New Yorkers need to get to work
- Strain of flooding on drainage infrastructure could impact areas beyond LM

Manhattan post-Sandy

Coordinated interagency team is implementing $500M in on-land capital projects and advancing a Master Plan for FiDi-Seaport.

Capital projects to protect 70% of the shoreline of LM and Master Plan for remaining 30%



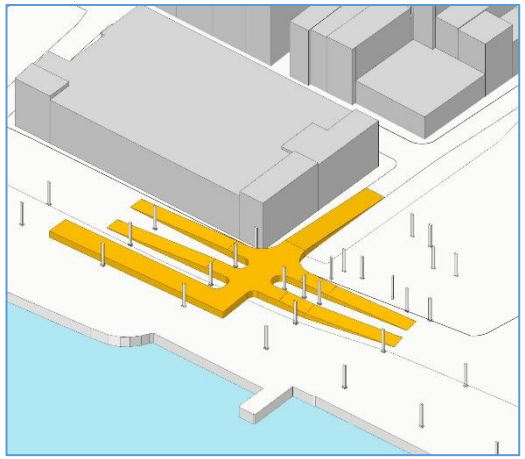
Study found on-land strategies for adaptation are not suitable for FiDi and the Seaport.

City studied a wide range of on-land adaptation measures and test-fitted them to existing conditions in FiDi-Seaport.

- **Deployable flood barriers,** including flip-up gates, stop logs, and roller gates
- **Passive flood barriers** to raise the coastal edge permanently
- **Building-level retrofits,** including dry and wet floodproofing, stabilization, and elevation
- **Elevation of public realm,** including regrading of streets and sidewalks
- **Seepage barrier** to address groundwater table rise
- **Upgrades to drainage capacity,** including additional pump capacity and stormwater storage tank

12-ft high posts to hold stop logs

12-15 ft flood walls grazing underside of FDR

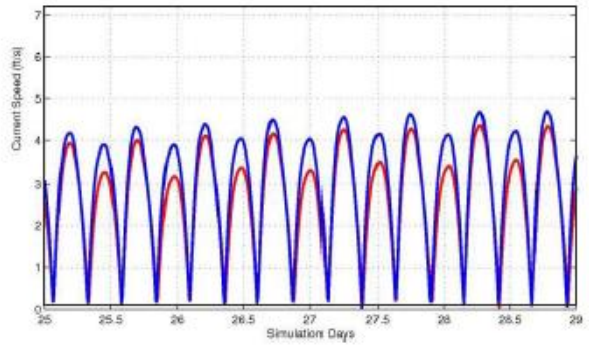


Passive street elevations over 5 ft

Analysis conducted as part of *Southern Manhattan Coastal Protection Study* showed no significant impacts to surrounding areas.

More analysis will be conducted to understand impacts of specific project options to areas surrounding FiDi-Seaport.

- 2014 study conducted hydrodynamic modeling of 500' shoreline extension scenario in present day (2014) and 2050 SLR conditions
- Found **no significant increase in water impacts to other neighborhoods** as a result of shoreline extension
- Found **no increase in water velocities of East River,** but some change in distribution of velocities (velocity decreased in some locations and increased in others)



Graph of East River velocities simulation, with (red) and without (blue) shoreline extension

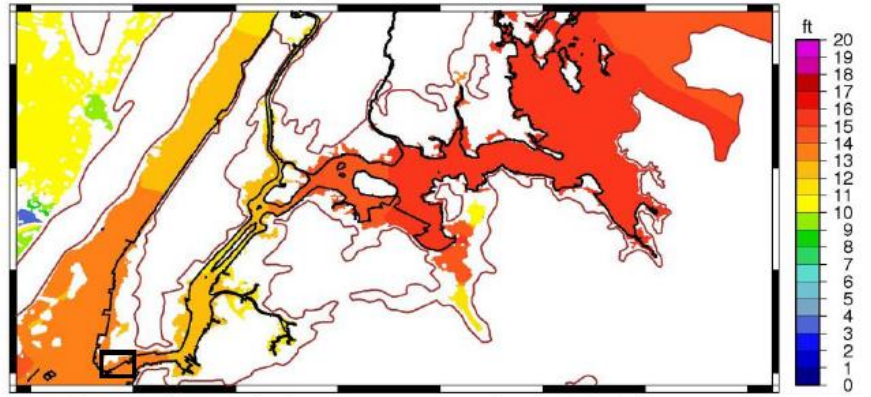


Figure 36: Maximum storm tide without MPL (year 2050). Approximate Study Area indicated by black polygon.

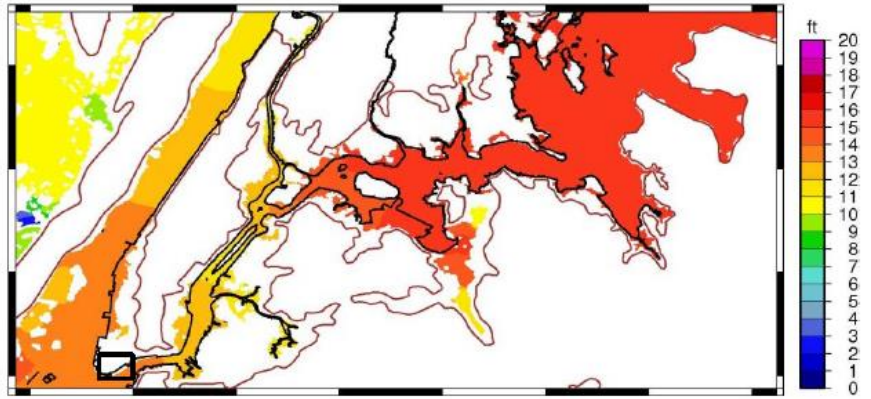


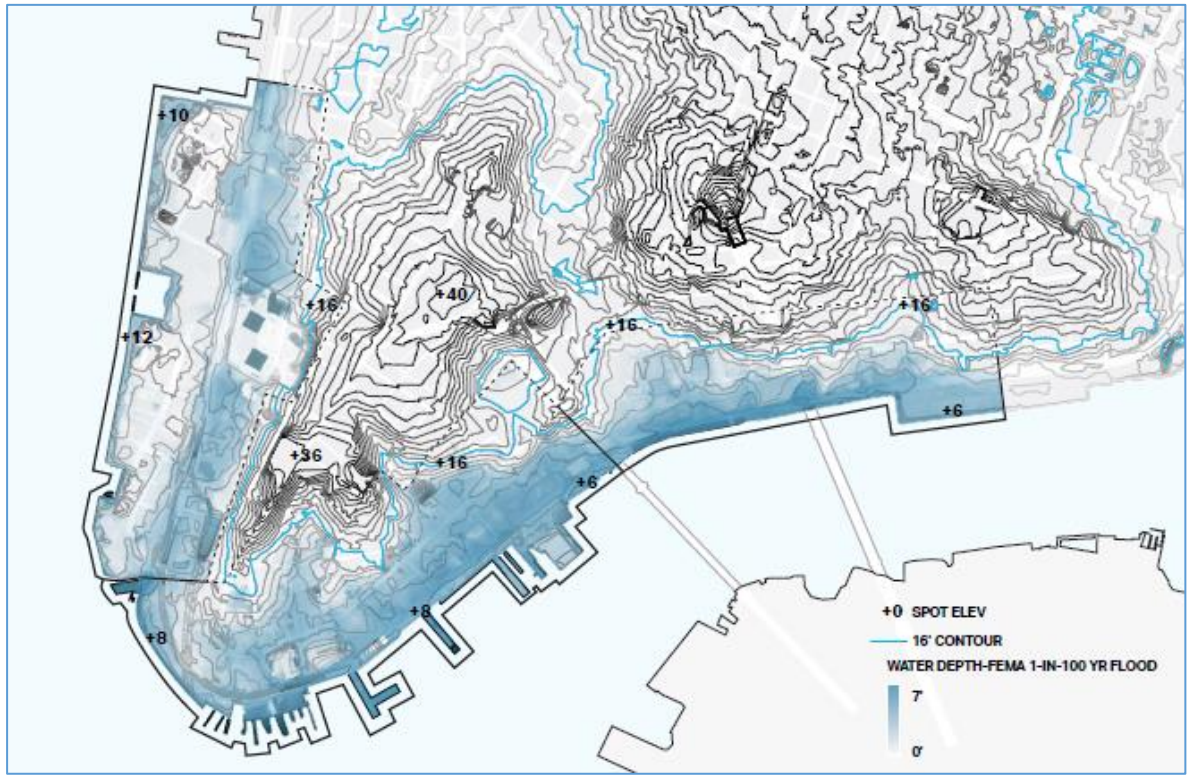
Figure 37: Maximum storm tide with MPL (year 2050). Approximate Study Area indicated by black polygon.

Image of Advanced CIRCulation model for with and without shoreline extension scenarios in 2050

Study found on-land strategies for adaptation are not suitable for FiDi and the Seaport.

Not any one constraint, but rather combination of all constraints that makes on-land options technically infeasible and undesirable

1. Acute climate risk
2. Not enough space for interventions because of above- and below-ground infrastructure
3. Narrow streets and limited waterfront open space makes raising elevations unsafe and disruptive
4. Any intervention would cause disruption 2-4 blocks inland for tying into high ground, due to low-lying topography
5. Concentration of historical buildings that are harder to floodproof
6. Technology for deployable flood barriers is untested at the height and scale that would be needed for FiDi and Seaport
7. No ability to accommodate increased demand on drainage infrastructure



Topography map of LM

➢ ***Shoreline extension deemed only viable option to protect LM***

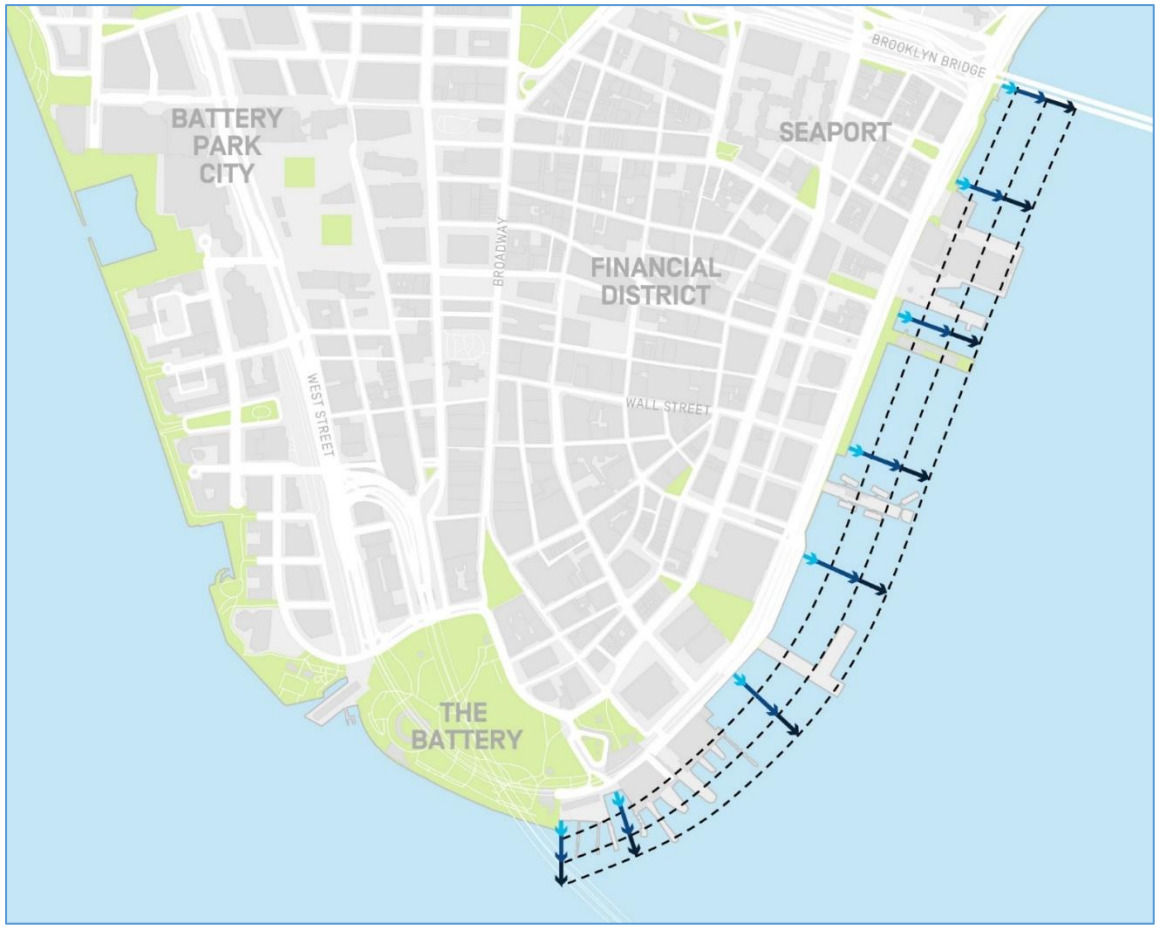
The Financial District-Seaport Climate Resilience Master Plan will develop a shoreline extension solution to increase resilience of LM.

In partnership with the community, the City will complete a Master Plan over the next two years

What can we achieve in two years?

- Determine extent of shoreline extension and topside programming
- Develop a comprehensive design and identify and first phase project
- Create a detailed implementation plan for financing, construction, and governance
- Advance permits with State and Federal agencies
- Create a drainage plan to upgrade sewer system in response to severe climate risks

Next step: RFQ responses due in early May; kick-off consultant team in Fall 2019 with ongoing community engagement



Location and extent of shoreline extension to be determined through community engagement and permitting

What have we heard so far?

Over 50 community and stakeholder briefings completed in the last two months

- Engagement process needs to be structured, deep, and transparent
- Different projects need to be coordinated across interagency team
- Want more clarity on difference between FiDi-Seaport Master Plan and *Southern Manhattan Coastal Protection Study*
- Appreciation for comprehensive approach and technical analysis
- Desire for additional information about why on-land adaptation projects are not viable for this geography
- Concerns around shoreline extension exacerbating flooding impacts to surrounding areas
- Questions around the do-nothing-and-retreat option and City's long-term plan for the whole city
- Questions about how this project will impact the environment

What does successful engagement look like for the Master Plan?

- Continued engagement on LMCR before Master Plan team kicks off
- Quarterly calls to ensure key stakeholders are kept up to date on Master Plan and overall LMCR Strategy
- Consistent public outreach events and ongoing meetings with individual stakeholders
- Outreach to the diverse range of people who use the area: residents, businesses, property owners, visitors, workers, youth and future generations
- Clear, accessible communication and education on complex climate issues
- Transparency on analysis and key decisions
- Use of innovative and creative engagement tools
- Language accessibility with Spanish and Mandarin
- Building capacity for long-term advocates for the implementation of the Master Plan

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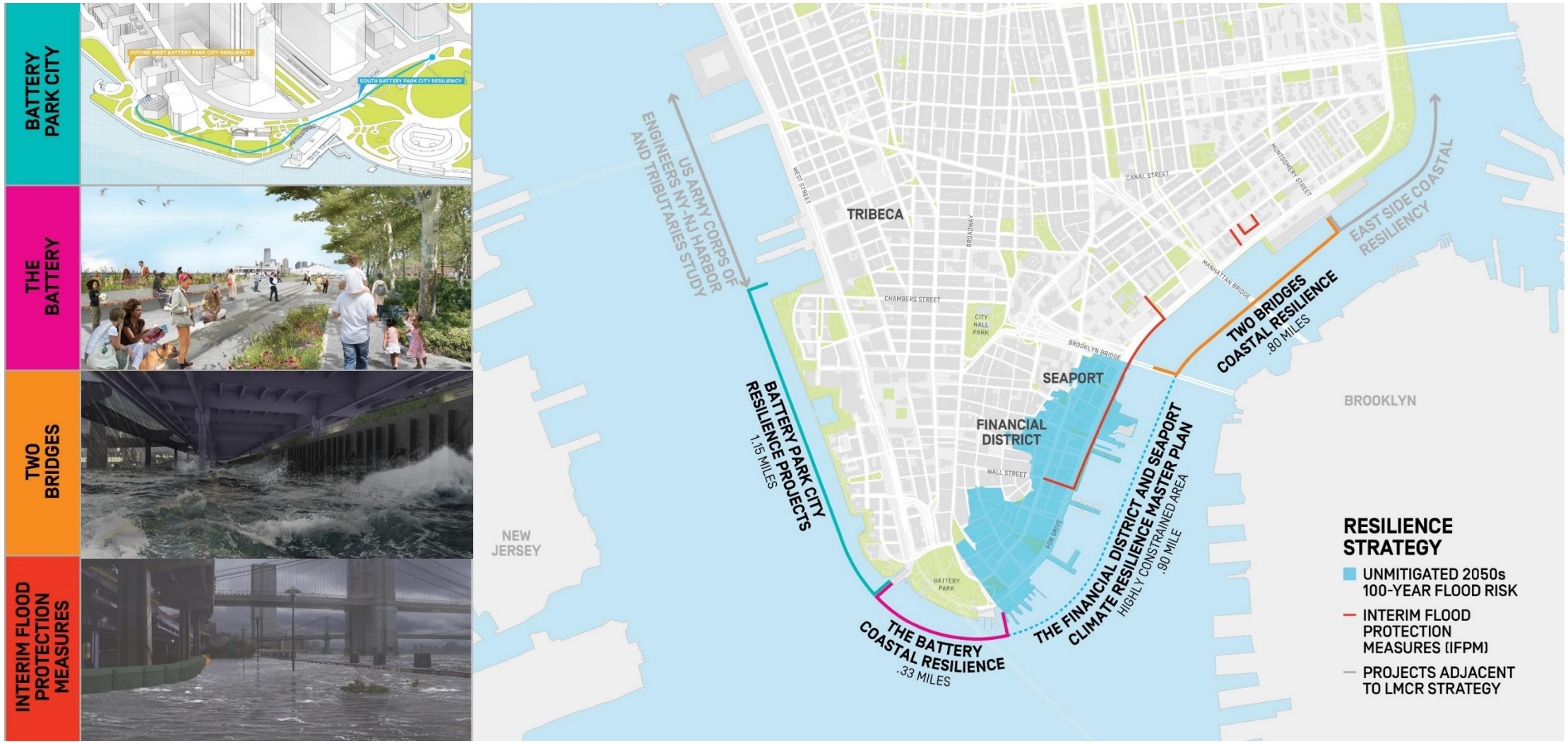
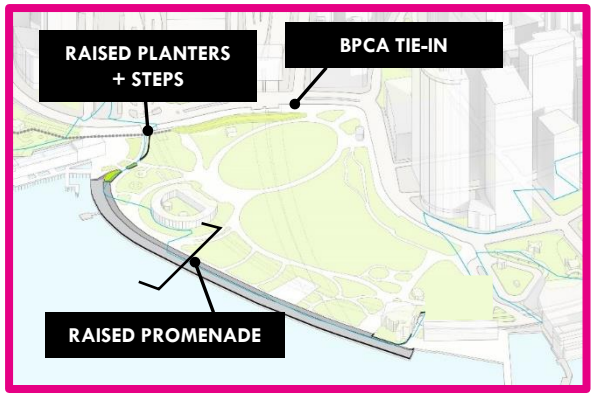


The Battery Coastal Resilience

Coastal protection to protect neighborhood while preserving the look and feel of the current park

- **Description:** Berm or other intervention at back of park to protect surrounding neighborhood from 2050s 100-year storm surge; reconstructed and raised wharf and esplanade to protect park against sea level rise in 2100. Final approach to be determined through continued design analysis and community engagement.
- **Timeline:**
  - EDC will lead design in coordination with Parks and will start construction in 2021
  - Battery Park City Authority is building tie-in for BPCA resilience work (design underway)
- **Next step**: Kick off design in Fall 2019

Conceptual rendering of waterfront esplanade raised to sea level rise

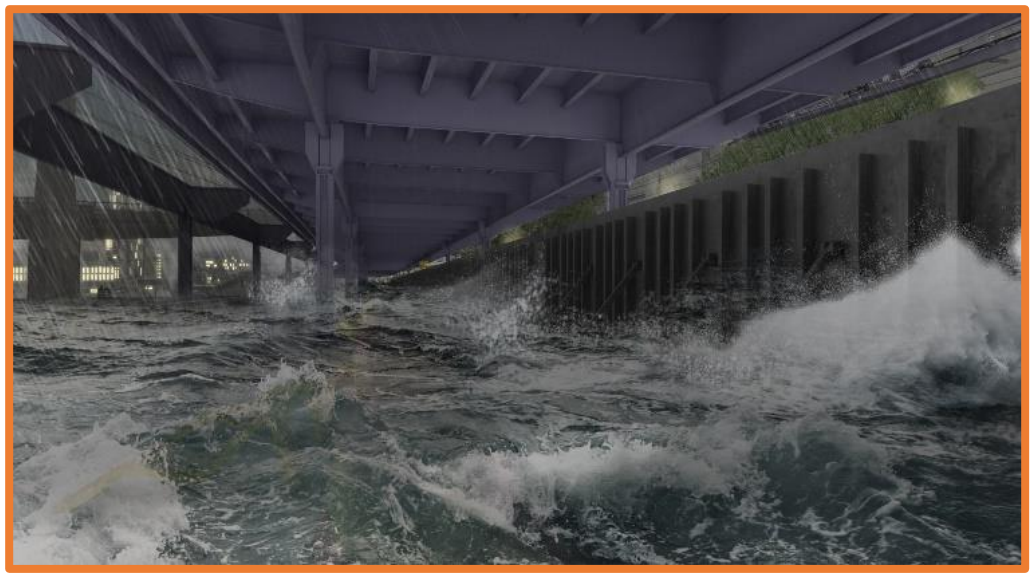


Conceptual alignment

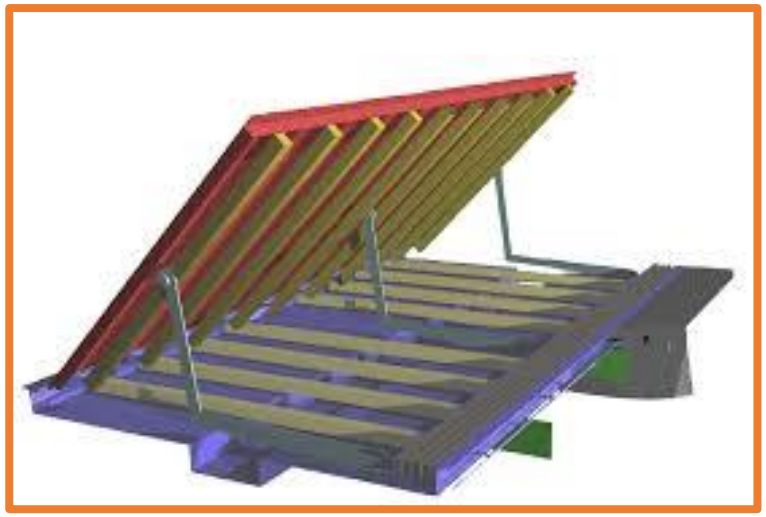
Two Bridges Coastal Resilience

Maximizes deployable protection to preserve public access to waterfront

- **Description:** Combination of flood walls and deployable flip-up barriers, with deployables maximized on view corridors; designed to 2050s 100-year storm
- **Timeline:**
  - Concept design shared with community summer 2018
  - EDC is doing final design, DDC will start construction in 2021
- **Next step:** Begin community engagement in Fall 2019



Deployables during storm



Deployable flip-up gate

Engagement will be coordinated and tailored to each individual project.

Project	External Affairs Lead(s)		Upcoming Public Milestone(s)
	Primary	Support	
Overall LMCR Strategy	MOR	EDC	Continue post-announcement briefings Schedule quarterly calls with CBs and elected officials
FiDi-Seaport Climate Resilience Master Plan	EDC	MOR	Ongoing community engagement; kick-off consultant team in Fall 2019
Two Bridges Coastal Resilience	EDC / DDC	MOR	Kick-off community engagement (Fall 2019)
The Battery Coastal Resilience	EDC / DPR	MOR	Kick-off design team (Fall 2019)
Interim Flood Protection Measures	EM	MOR	Implementation in June
Battery Park City – South **Battery Park City – North** **Battery Park City – West**	BPCA	MOR	BPC – S Public Meeting #3 (June)
			BPC – N Kick-off design team (Spring 2019)
			BPC – W Design RFP release (Fall 2019)

Key Questions for Discussion

- How do we **define "resilience"**?
- How do we think about the **relationship between resilience and the environment**?
- How do we **educate and communicate** complex and technical information to bring everyone along?
- Do you have ideas for tools and strategies for **broad public engagement**?
- How do we **define success** for us and the next generation?