CB1 PUBLIC WORKSHOP
MAY18TH, 2017

OneNYC: RESILIENCY

Following Hurricane Sandy, a global conversation on resiliency emerged. Here's what it means to us in New York City.

Our Resilient City

Our neighborhoods, economy, and public services will be ready to withstand and emerge stronger from the impacts of climate change and other 21st century threats

OneNYC: SUSTAINABILITY

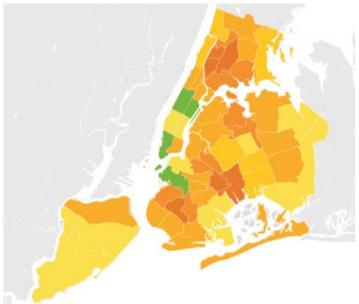
Our Sustainable City

New York City will be the most sustainable big city in the world and a global leader in the fight against climate change

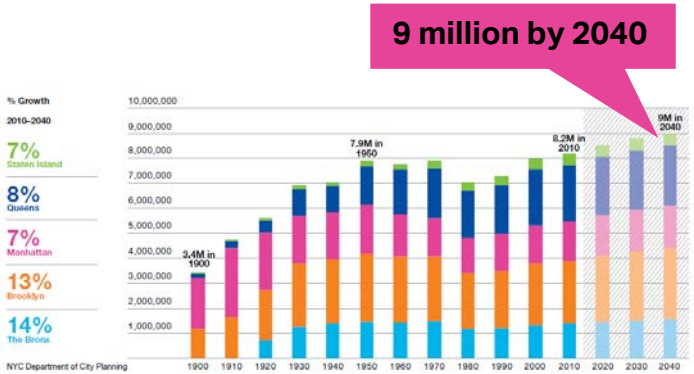
CLIMATE CHANGE / 21ST CENTURY THREATS

…But we know that Sandy is not the only risk we face. As we look towards the future, we must take stock of our current challenges…

Hurricane Sandy



Increasing Inequality



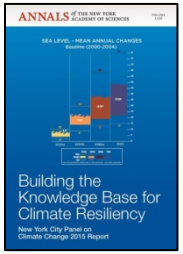
A Growing Population

Aging Infrastructure

CLIMATE CHANGE / 21ST CENTURY THREATS

…And grapple with the impacts of climate change on our city.

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



By the 2050s*:*
+ 4.1°F to 5.7°F increase in average temperature
+ 4% to 11% increase in average annual precipitation
+ Sea levels likely to rise 1-2 ft.; maybe 2½ ft.

By 2100:
+ High-end projections *may* reach 6 ft.

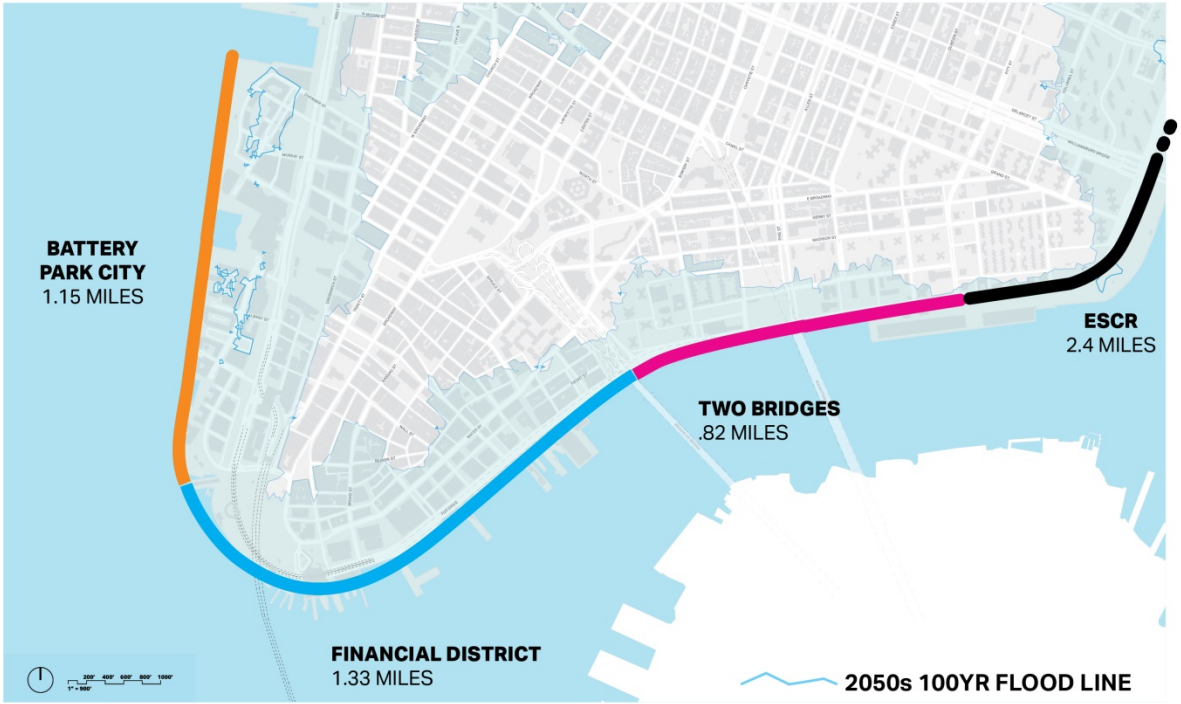
…and increased impact from extreme weather events.

By the 2050s:
+ Number of days in NYC above 90º could triple
+ Number of most intense hurricanes and associated extreme winds may increase

Even today:
+ Flooding is more intense

PURPOSE OF CURRENT STUDY

1. Develop long-term strategy and feasible concept design for all of Lower Manhattan
2. Prioritize project concepts toward implementation and conduct advanced planning when possible
3. Engage with community on core design principles and priorities

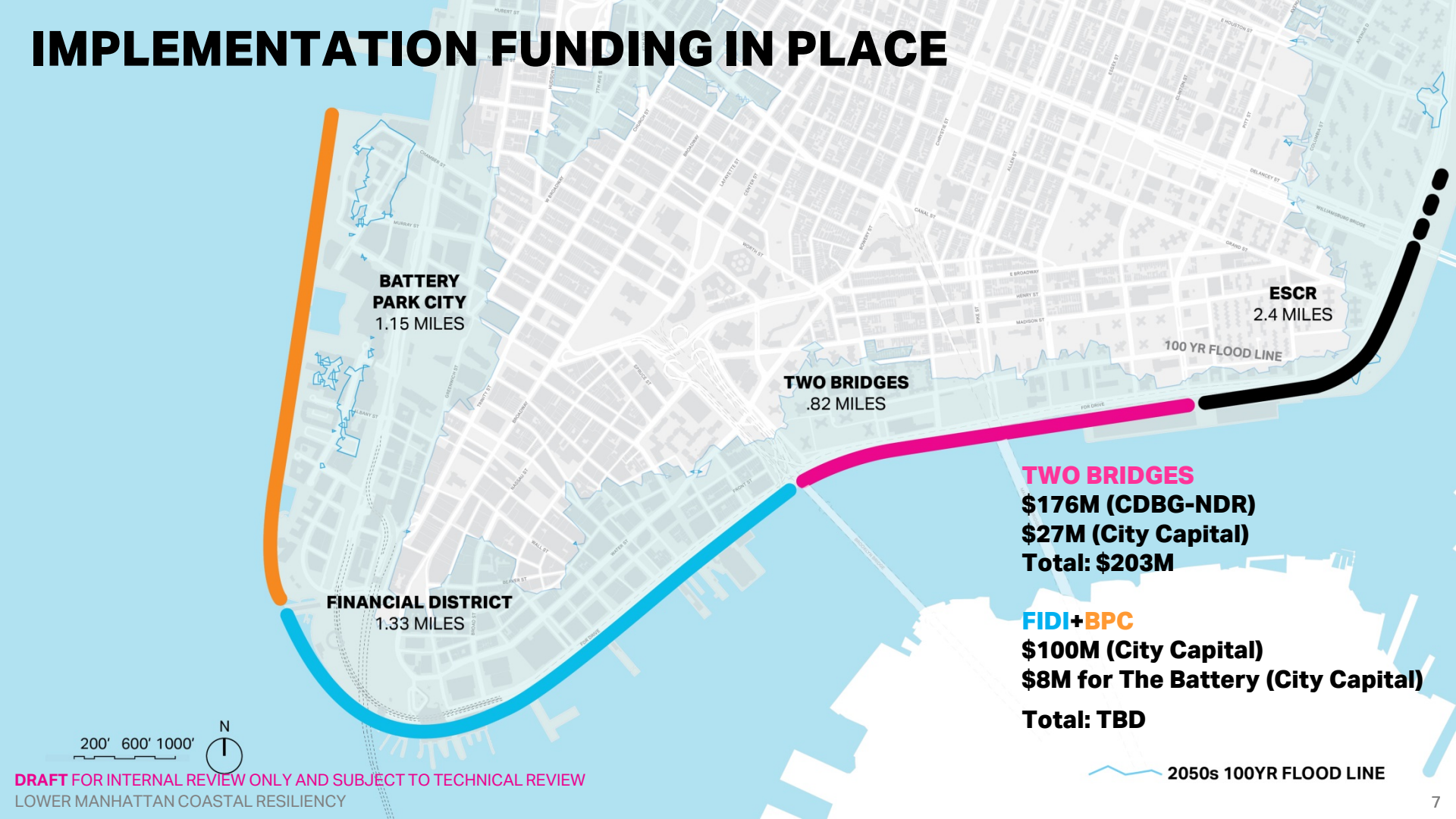


Study Funding:

\+ $7.25M CDBG-DR

($3.75M GOSR; $3.5M NYC)

IMPLEMENTATION FUNDING IN PLACE



TWO BRIDGES
$176M (CDBG-NDR)
$27M (City Capital)
Total: $203M

FIDI+BPC
$100M (City Capital)
$8M for The Battery (City Capital)

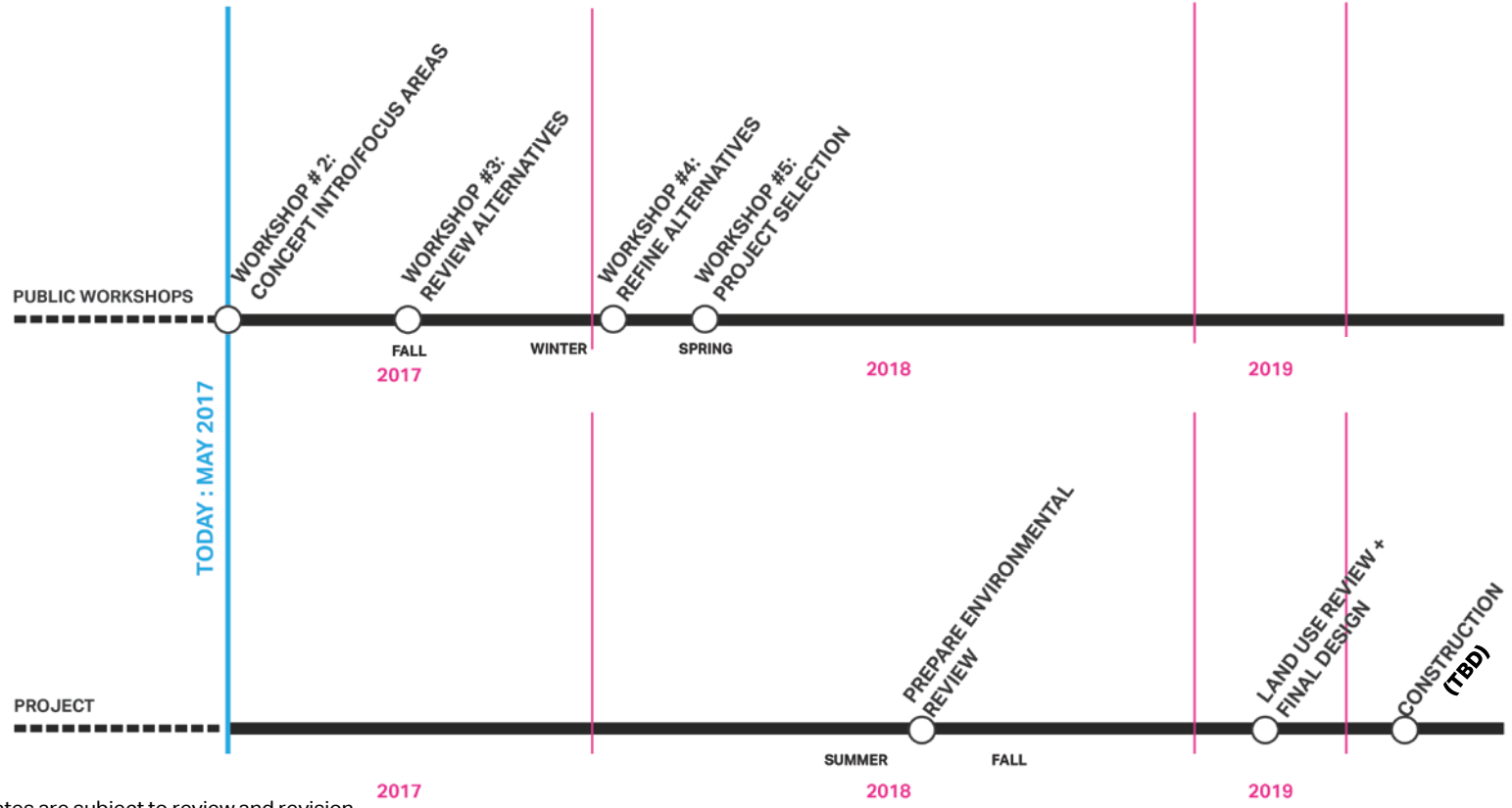
Total: TBD

2050s 100YR FLOOD LINE

MEETING GOALS

- Re-cap the project goals
- Highlight project considerations and challenges
- Provide an update on data collection
- Discuss geographic focus areas
- Identify tradeoffs through design concepts

FUTURE MILESTONES



*All dates are subject to review and revision

COMMUNITY ENGAGEMENT SUMMARY

July 28
Oct 6
public workshops

160
Sign-ins

44%
Residents*

Outreach:
- Distributed over 7,800 flyers; reached 44,000+ online audience and 350,000+ print audience
  (across overall project area)

Evaluation:
- Excellent overall evaluation score between 4-5 (on a 1-5 scale)

* Other 55% includes workers, businesses, and other stakeholders in Lower Manhattan

TOP PRIORITIES FROM PREVIOUS WORKSHOP

RELIABILITY

67 VOTES

RESIDENTS
44 VOTES

NON- RESIDENTS
23 VOTES

SAFETY + LIGHTING

17 VOTES

RESIDENTS
15 VOTES

NON- RESIDENTS
2 VOTES

WATERFRONT ACCESS

14 VOTES

RESIDENTS
7 VOTES

NON- RESIDENTS
7 VOTES

MAINTENANCE + OPERATIONS

14 VOTES

RESIDENTS
6 VOTES

NON- RESIDENTS
8 VOTES

RECREATION

4 VOTES

RESIDENTS
2 VOTES

NON- RESIDENTS
2 VOTES

AMENITIES

4 VOTES

RESIDENTS
3 VOTES

NON- RESIDENTS
1 VOTE

VIEWS

3 VOTES

RESIDENTS
1 VOTE

NON- RESIDENTS
2 VOTES

LOOK + FEEL

2 VOTES

RESIDENTS
1 VOTE

NON- RESIDENTS
1 VOTE

FEEDBACK ON INFRASTRUCTURE TYPES

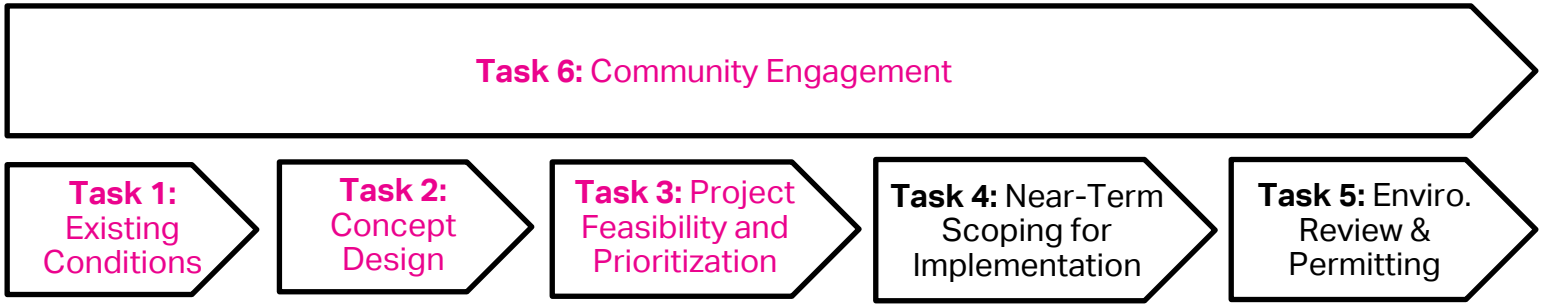
KEY PREFERENCES

- Overall, similar results for BPC and FiDi
- Maintain existing waterfront views and access
- Prioritize infrastructure that has a natural look
- Ensure that resiliency infrastructure is accessible for all ages and residents

KEY CONCERNS

- Blocking the waterfront (BPC - slightly stronger concern)
- High costs
- High maintenance requirements (FiDi - slightly stronger concern)
- Not enough space for berms
- Reliance on manual deployment in times of crisis and the associated risks (FiDi - slightly stronger concern)

PROJECT PROCESS



SUMMER '16 TO SPRING '17

- Research previous plans & concepts
- Mapping
- Site conditions
- Assessments
- Tree survey

FALL '16 TO SPRING '17

- Hydrological mgmt Strategies
- Drainage & sewer analysis
- Economic analysis
- Regulatory framework
- Develop conceptual scenarios

WINTER '17 TO WINTER '18

- Framework to evaluate and identify priorities
- Identify required ULURP actions
- Determine project phasing
- Transportation analysis

SUMMER '16 TO SPRING '18

- Surveying, geotech, sampling
- Schematic design documents
- Cost estimates

WINTER '16 TO FALL 18'

- Preparation of environmental review documents

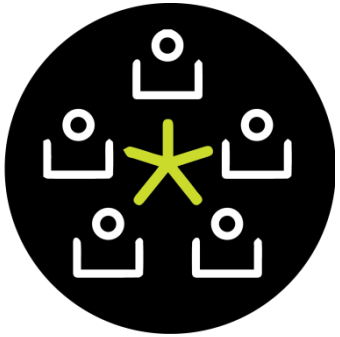
TECHNICAL ANALYSIS INFORMS CONCEPT DESIGN

COASTAL ASSESSMENT

Measuring future risk to inform design decisions and height of protection.

SUBSURFACE CONDITIONS

Modifying design decisions to best accommodate existing constraints.



CAPITAL COORDINATION

Inventory of ongoing projects and city efforts, and how timelines intersect with LMCR.

COASTAL ASSESSMENT

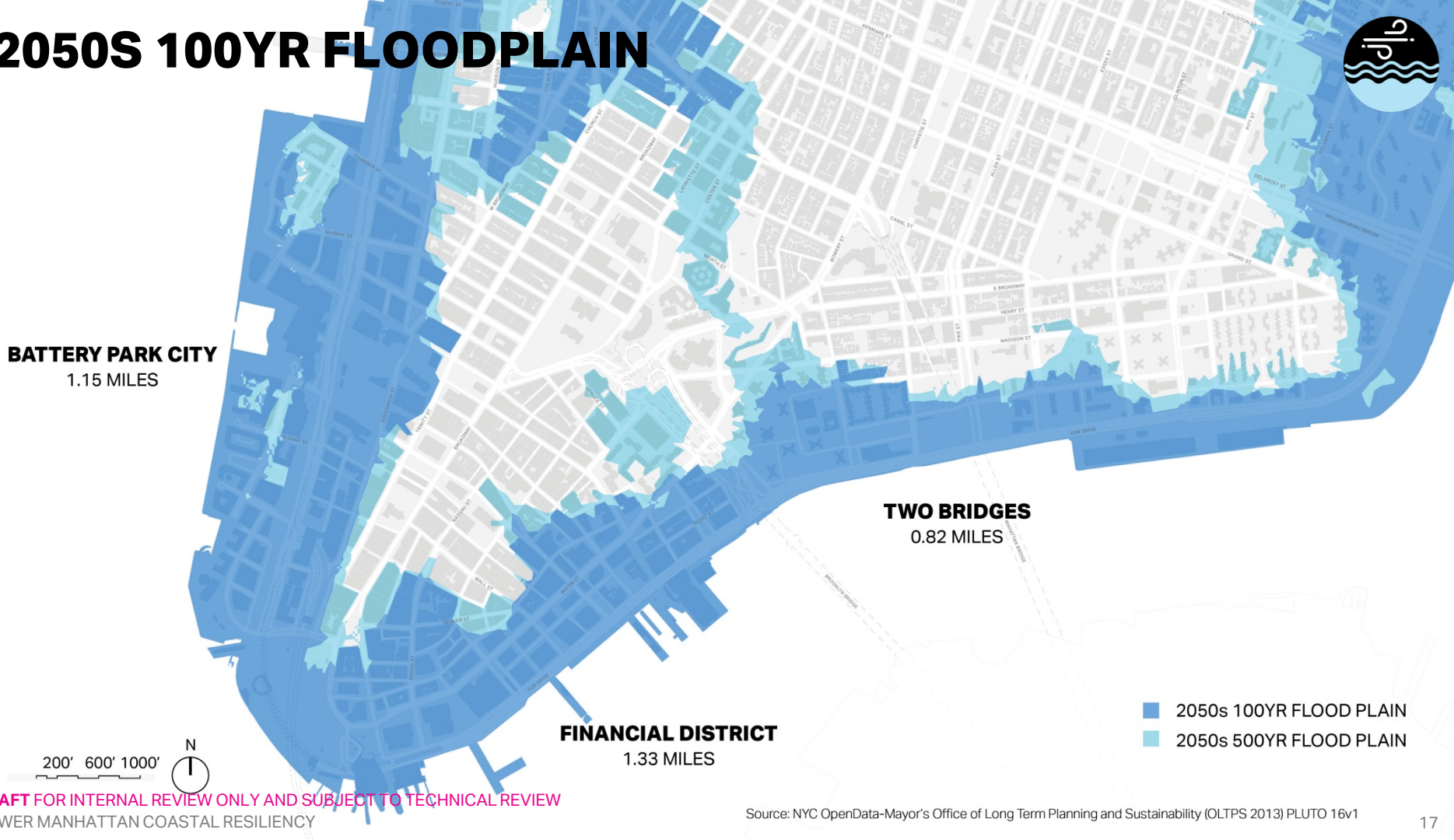
COASTAL FLOOD ASSESSMENT

WHAT WE DID

- Assessed Lower Manhattan's future vulnerability by analyzing:

1. 100-year and 500-year coastal storms based on FEMA flood studies
2. Tidal flooding associated with sea-level rise (SLR) projections for the 2050s and 2100s
3. Future inland flooding as caused by 10-year and 50-year rainstorms + SLR
4. Future coastal flooding as caused by 100-year storm surges + SLR

2050S 100YR FLOODPLAIN



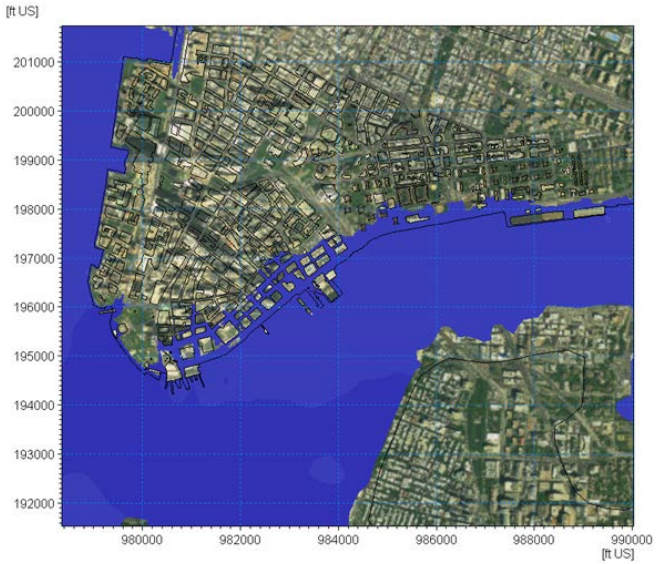
Source: NYC OpenData-Mayor's Office of Long Term Planning and Sustainability (OLTPS 2013) PLUTO 16v1

COASTAL FLOOD ASSESSMENT

FUTURE TIDAL AND SEA LEVEL RISE INUNDATION

Flooding due solely to SLR will be substantial in 2100.

By 2050, South Street Seaport will experience inundation from 10-year storms.



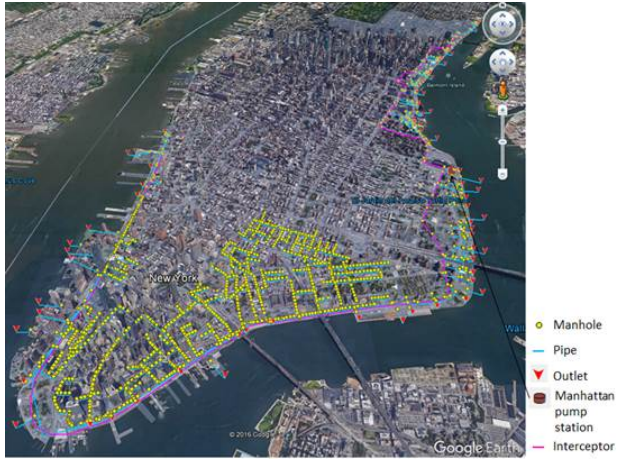
2100

2050s

COASTAL FLOOD ASSESSMENT

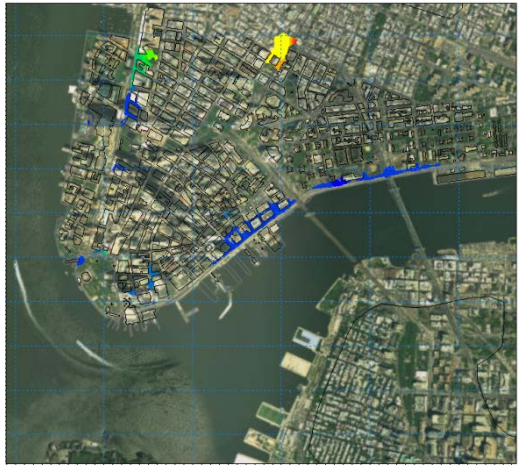
MIKE URBAN - STORMWATER DRAINAGE MODEL

SLR paired with more intense storm surge will bring bigger waves further inland in future flood events, surpassing the city's current drainage capacity.

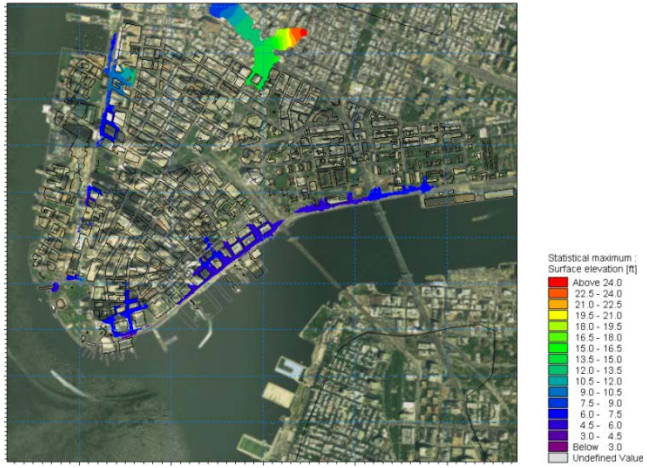


MIKE URBAN Model Domain tested for 2 conditions:

- Two 2014 rainfall events
- 25-year rainfall storm and test tidal boundary condition at outfalls



10-year Rainstorm for 2050s with SLR Flood Map



50-year Rainstorm for 2050s with SLR Flood Map

- Runoff exceeds capacity of existing drainage and sewage infrastructure.
- Countermeasures will have to be taken to reduce future street flooding.

COASTAL FLOOD ASSESSMENT

INTEGRATED STORMWATER + STORM SURGE

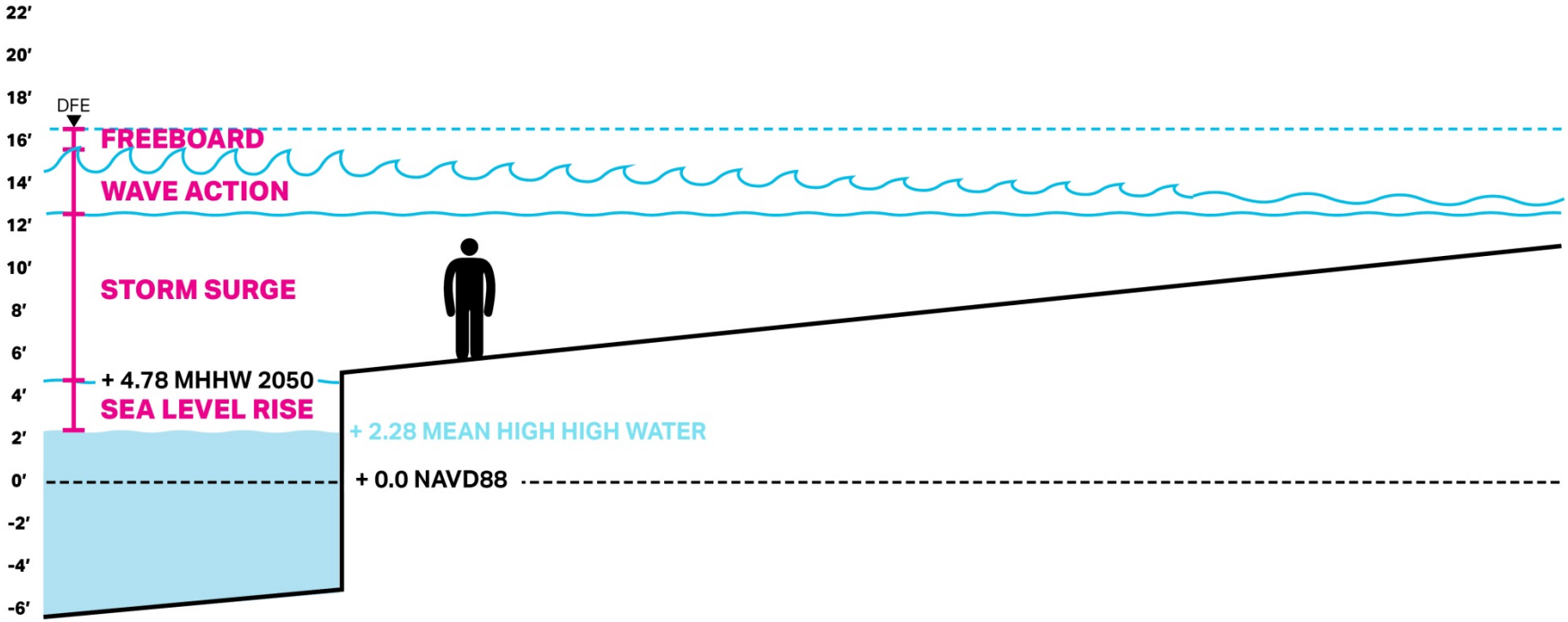
The highest flood levels will be experienced at the tip of Manhattan (the Battery) due to intense hydrodynamic forces and wave action.

100-year Coastal Storm in 2050s with SLR

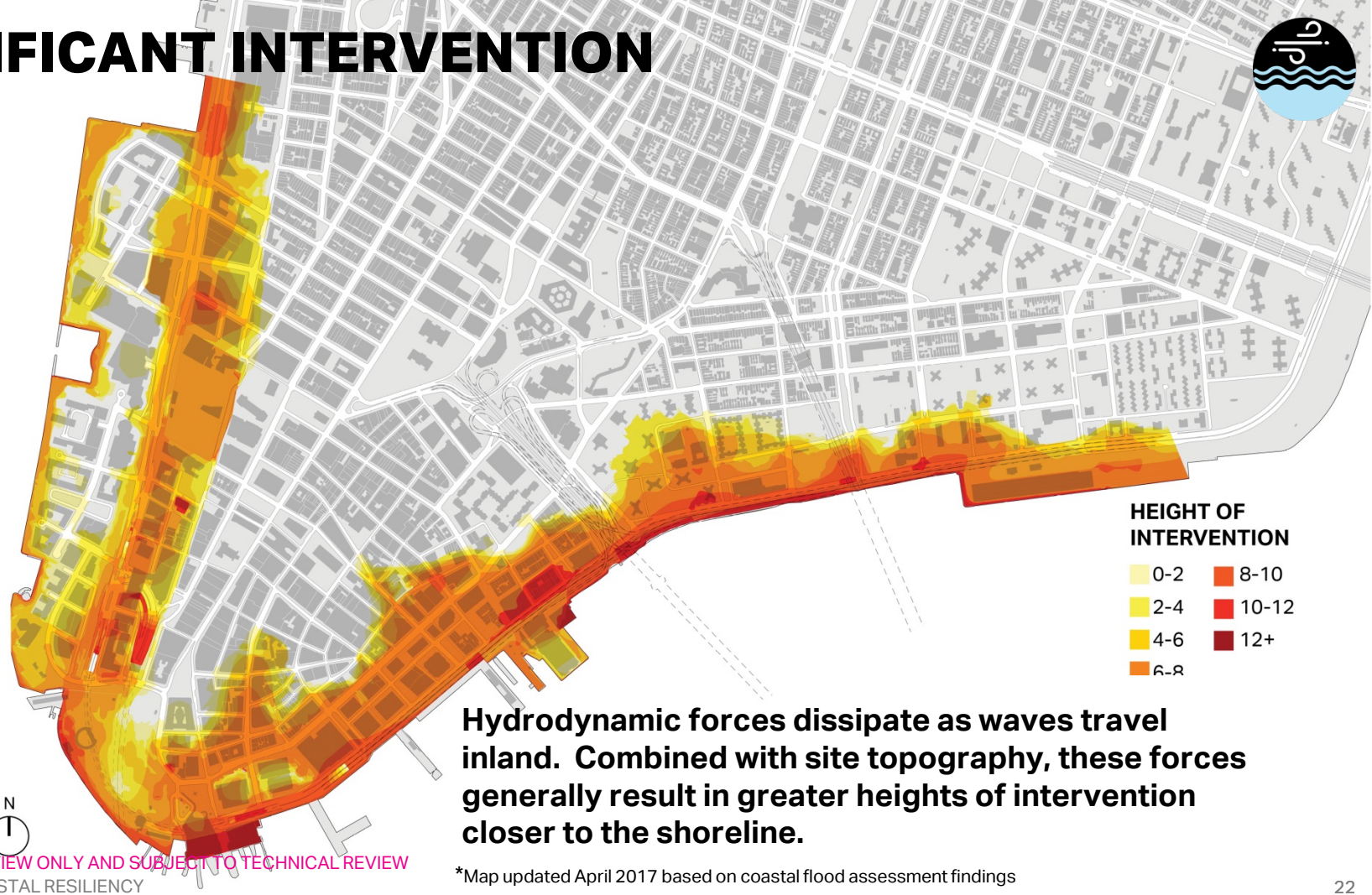
100-year Coastal Storm, 10-year rainstorm for 2050 with SLR

DESIGN FLOOD ELEVATION - COMPONENTS

High tide + Sea Level Rise + 1% annual storm event + Associated wave action + Freeboard = **DFE**



A SIGNIFICANT INTERVENTION



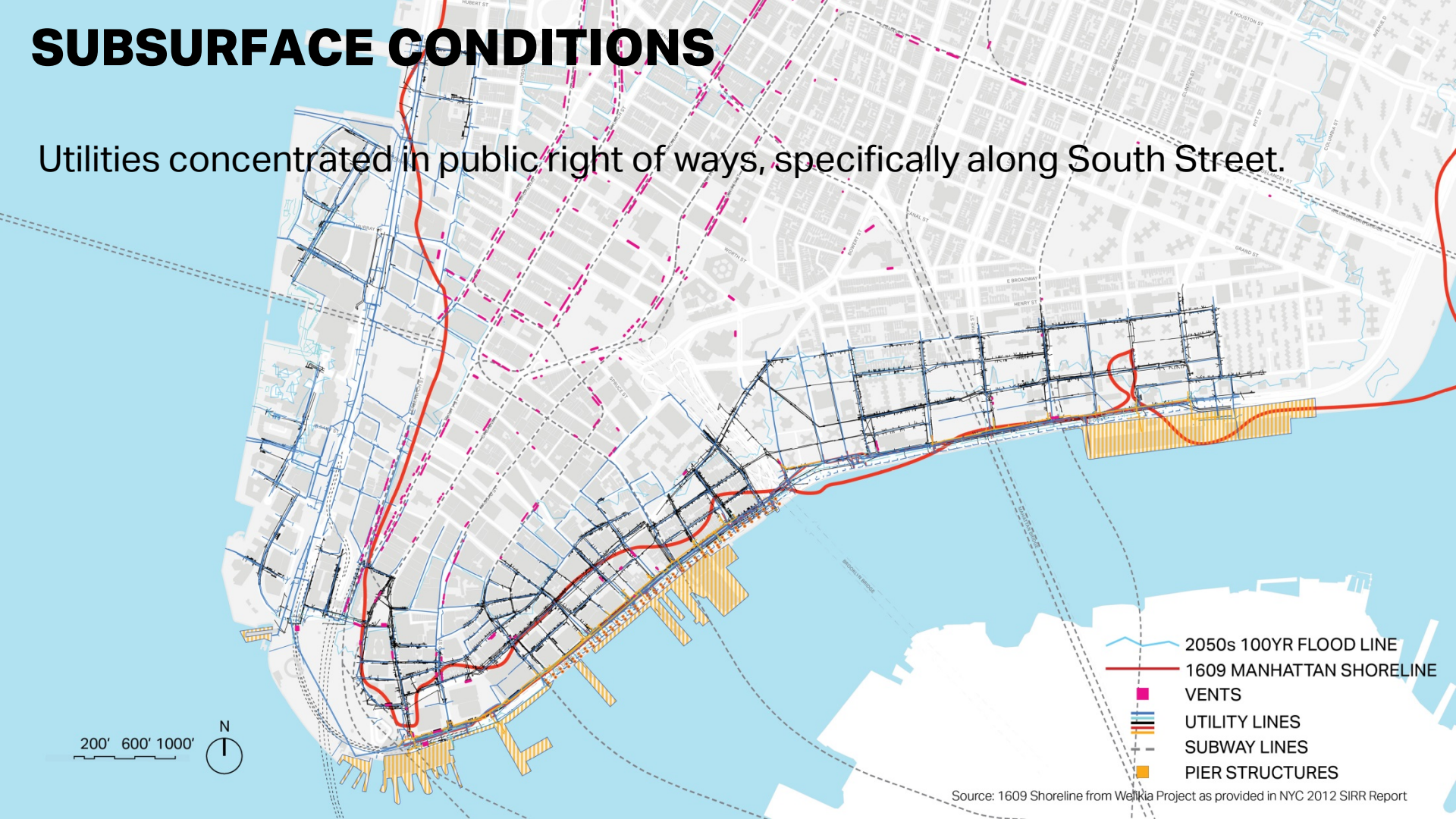
Hydrodynamic forces dissipate as waves travel inland. Combined with site topography, these forces generally result in greater heights of intervention closer to the shoreline.

*Map updated April 2017 based on coastal flood assessment findings

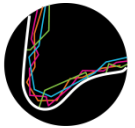
SUBSURFACE CONDITIONS

SUBSURFACE CONDITIONS

Utilities concentrated in public right of ways, specifically along South Street.



KEY TAKEAWAYS: SUBSURFACE CONDITIONS



1. The outer edge of Manhattan is built on fill; wall structures above 6ft tall require **deep foundations (called piles)** to support flood loads.

    a. Unknown debris within the fill may impact construction.
    b. Many piles will mean **higher costs**.

2. South Street Seaport is built on top of very **porous fill**. Preliminary seepage analysis indicates water flows can be **managed by a designed drainage system**.

3. Under the FDR, there is a **limited footprint** to avoid the existing bulkhead and FDR column foundations.

    a. Buffers around FDR columns are necessary to maintain **structural integrity** of the elevated highway.
    b. Relocating or replacing the existing bulkhead brings **significant added cost** to construction.

4. Flood protection infrastructure must navigate the high number of **utilities** running under South Street.

CAPITAL COORDINATION

ONGOING COORDINATION

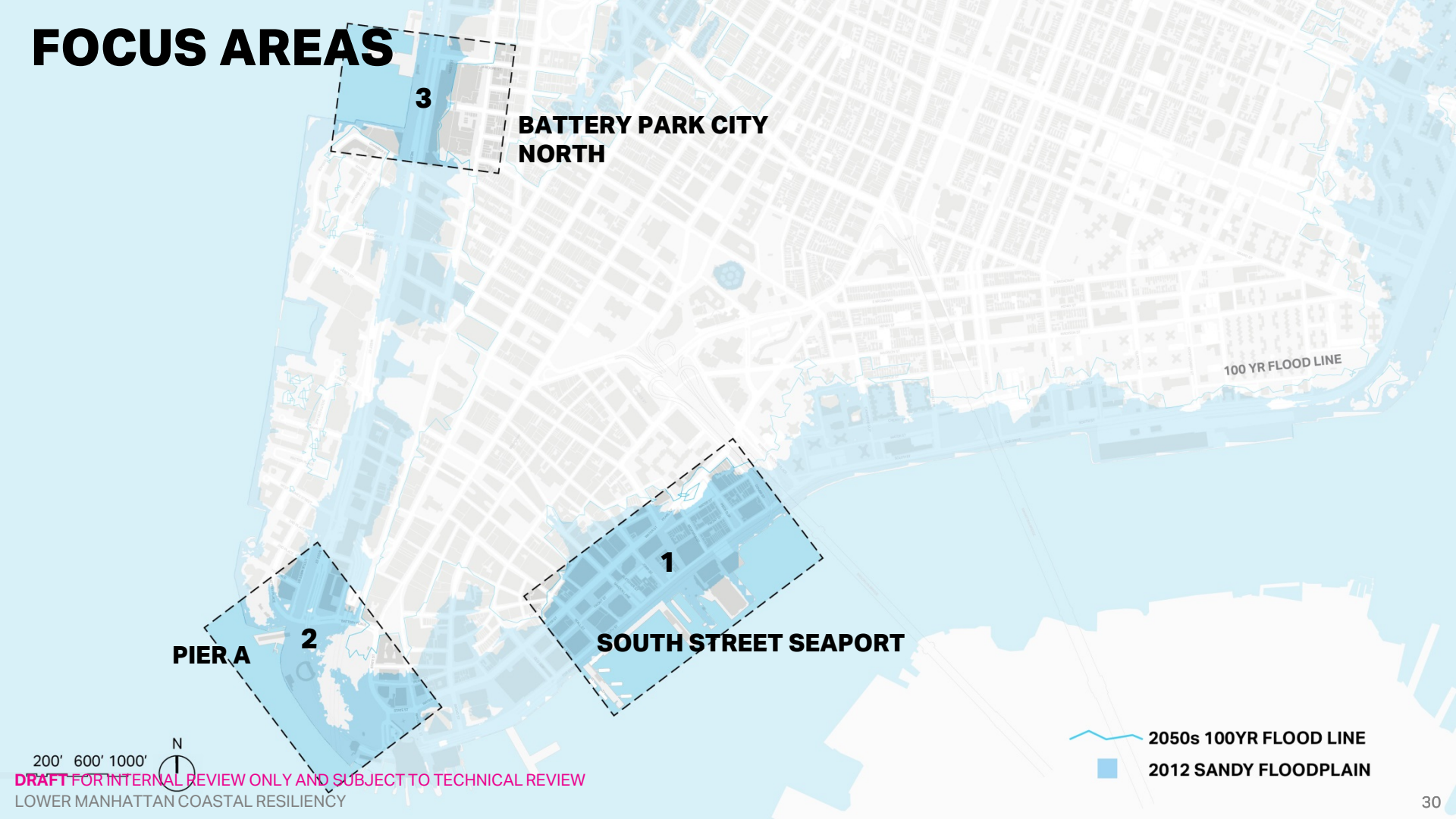
PRIVATE PROPERTY OWNER INTERVIEWS

Private property owners have made significant investments in building-level protection, but to a lower level of protection than LMCR intends to provide.

- LMCR Project team gathered data on 27 privately-owned properties across the Financial District and Two Bridges neighborhoods
- Average recovery period for buildings to be fully operational for tenants was 3-5 months.
- Average water-level of flooding at the lobby level of the building was 4-5ft.
- The total amount of capital put into protection across the properties was $114,000,000
- 67% of properties have relocated mechanical equipment such as electrical and cooling systems to a higher floor
- 69% of properties interviewed had implemented or planned flood protection.
- Average Height of Protection = 6ft 10in
- Average time to deploy protection is between 9-17 hours

FOCUS AREAS

FOCUS AREAS



FOCUS AREA 1 | SOUTH STREET SEAPORT

A VULNERABLE HISTORICAL DISTRICT

2050s Tidal and Sea Level Rise Inundation

Deep floodplains + low elevations mean daily tidal inundation from SLR by 2050s

50-year Rainstorm for 2050s with SLR

Stormwater runoff from 10-year and 50-year rainstorms + SLR exceeds capacity of existing drainage & sewage infrastructure

2 days after Hurricane Sandy, 2012

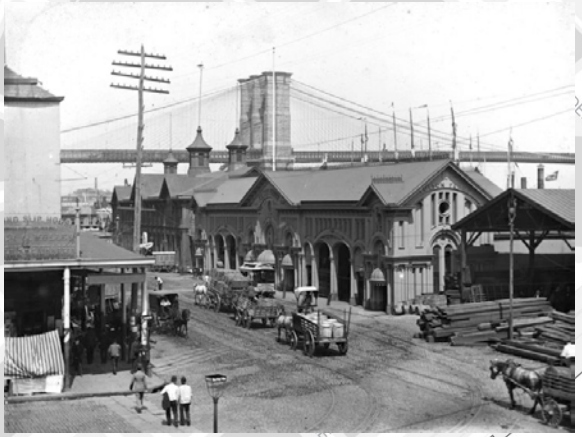
Deep floodplains + low elevations+ excess water means street flooding will occur and drain slowly from the site

Photo Source: EPA

FOCUS AREA 1 | SOUTH STREET SEAPORT

A VULNERABLE HISTORICAL DISTRICT

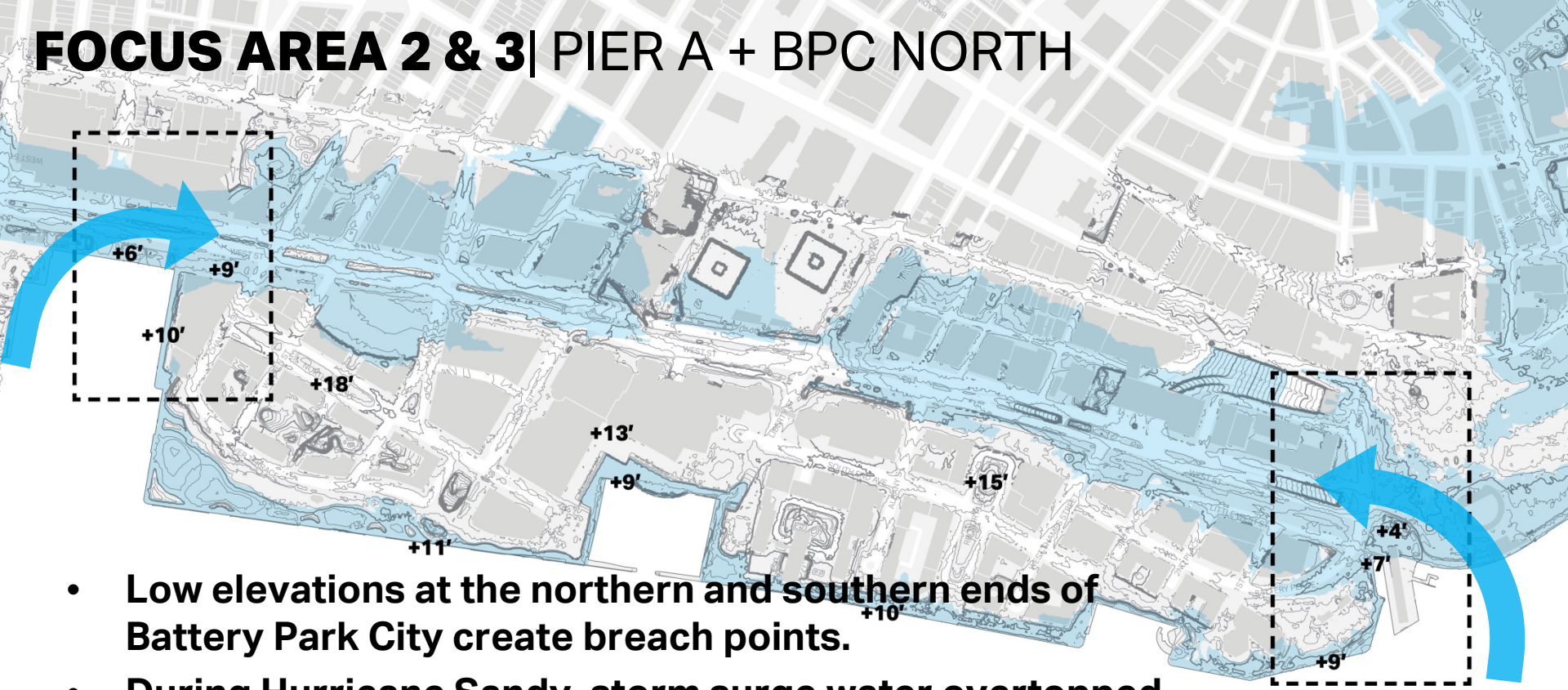
- **Significant historic building stock**
- **Small businesses at risk**
- **Limited opportunity for building level protections**



HISTORIC DISTRICT - NATIONAL REGISTER

HISTORIC DISTRICT - NYC LPC

FOCUS AREA 2 & 3| PIER A + BPC NORTH



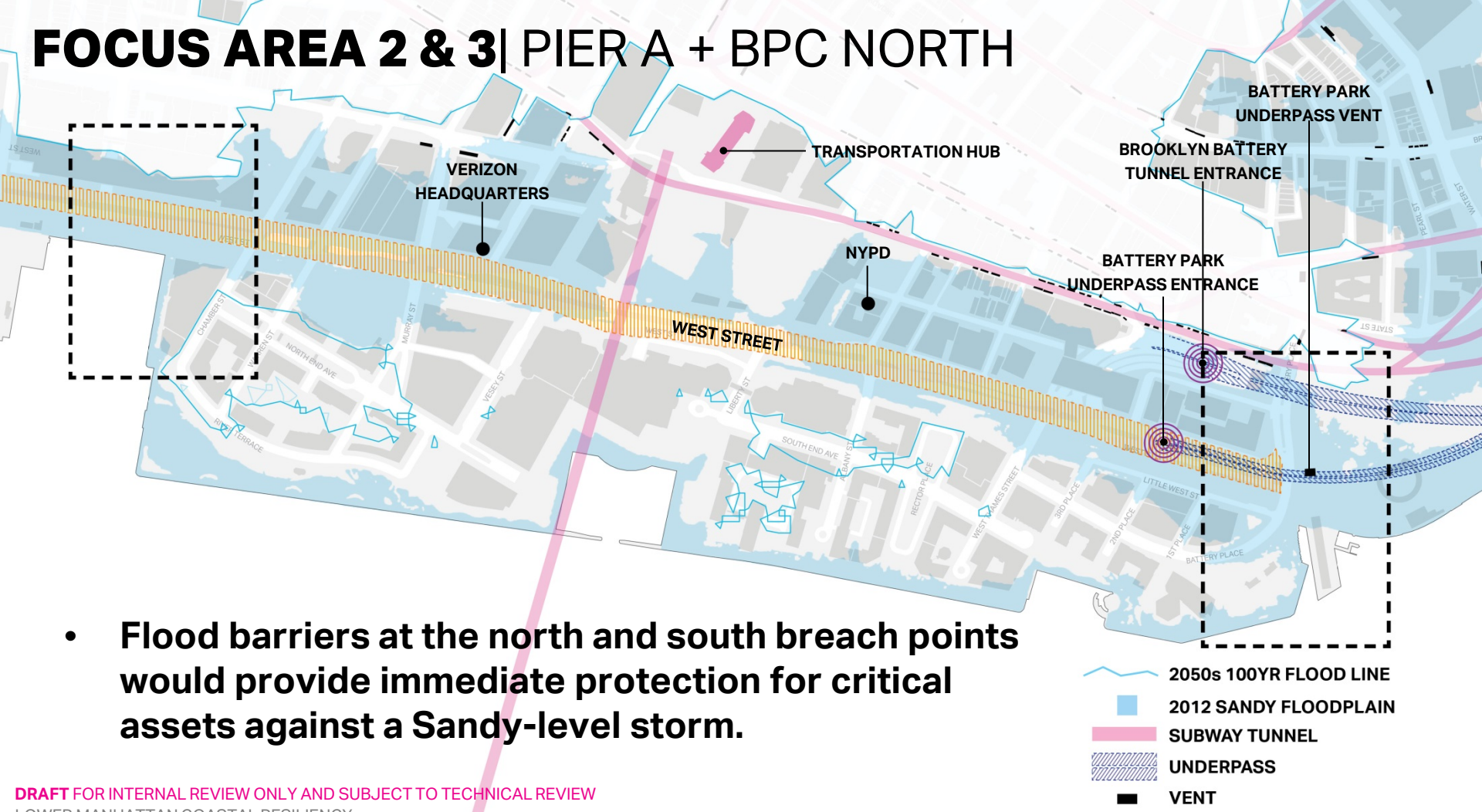
- **Low elevations at the northern and southern ends of Battery Park City create breach points.**
- **During Hurricane Sandy, storm surge water overtopped these breach points and flooded inland areas of BPC**

2012 SANDY FLOODPLAIN

FOCUS AREA 2 & 3| PIER A + BPC NORTH

- **Hydrodynamic forces resulted in significant wave overtopping at The Battery**

FOCUS AREA 2 & 3| PIER A + BPC NORTH

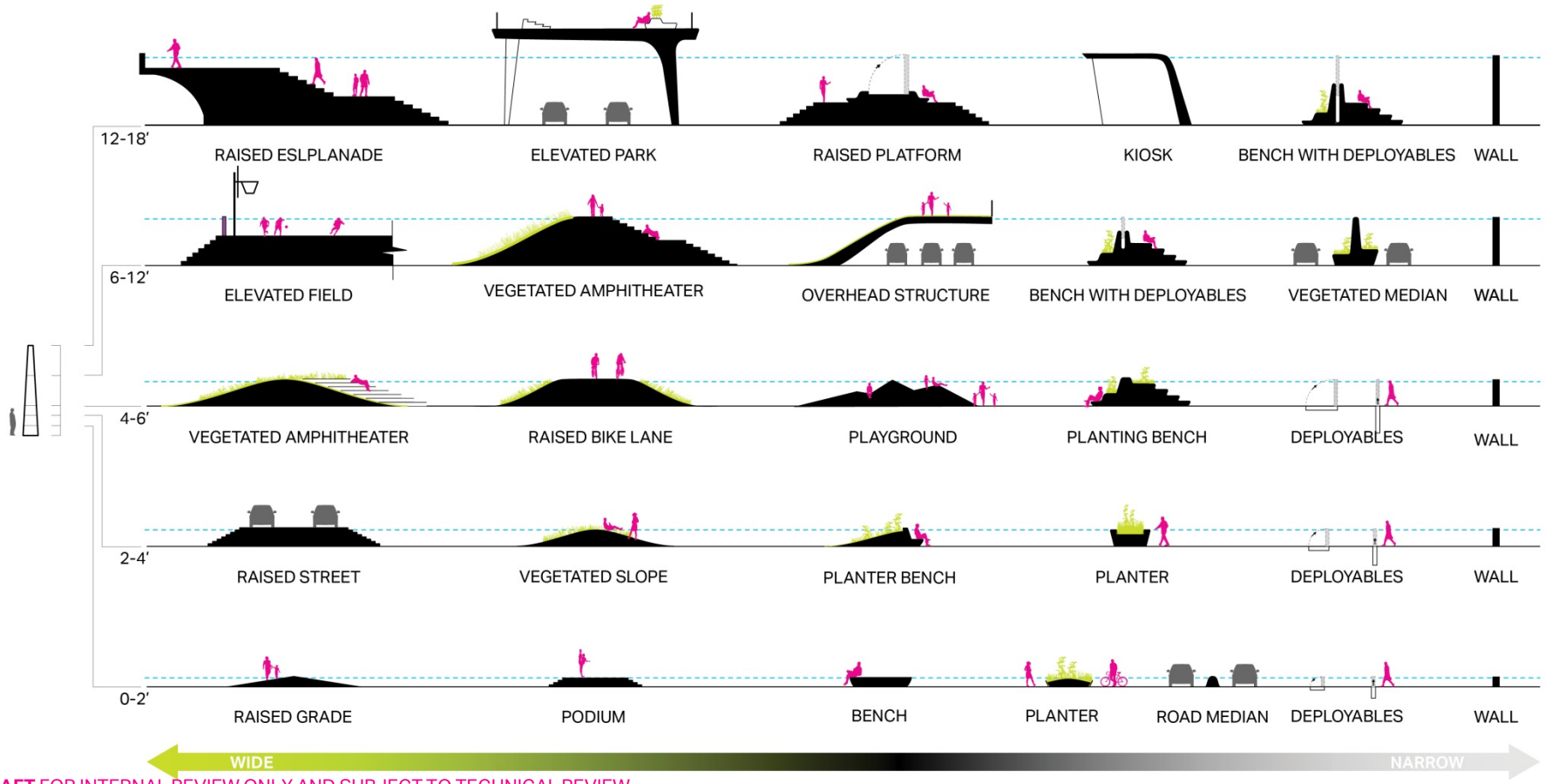


- **Flood barriers at the north and south breach points would provide immediate protection for critical assets against a Sandy-level storm.**

Q & A

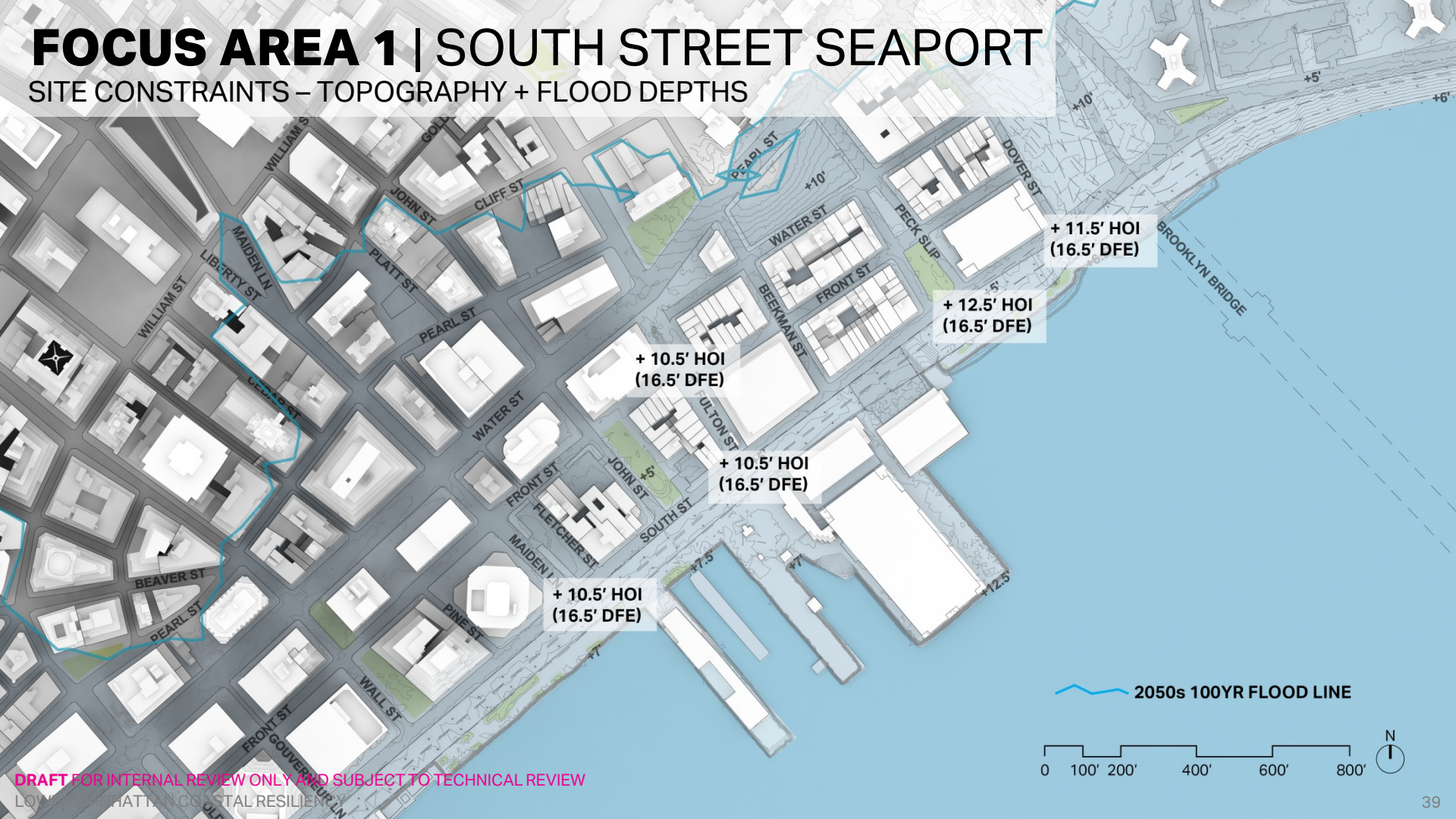
SITE CONSTRAINTS + DESIGN CONCEPTS

INFRASTRUCTURE TOOLKIT



FOCUS AREA 1 | SOUTH STREET SEAPORT

SITE CONSTRAINTS – TOPOGRAPHY + FLOOD DEPTHS



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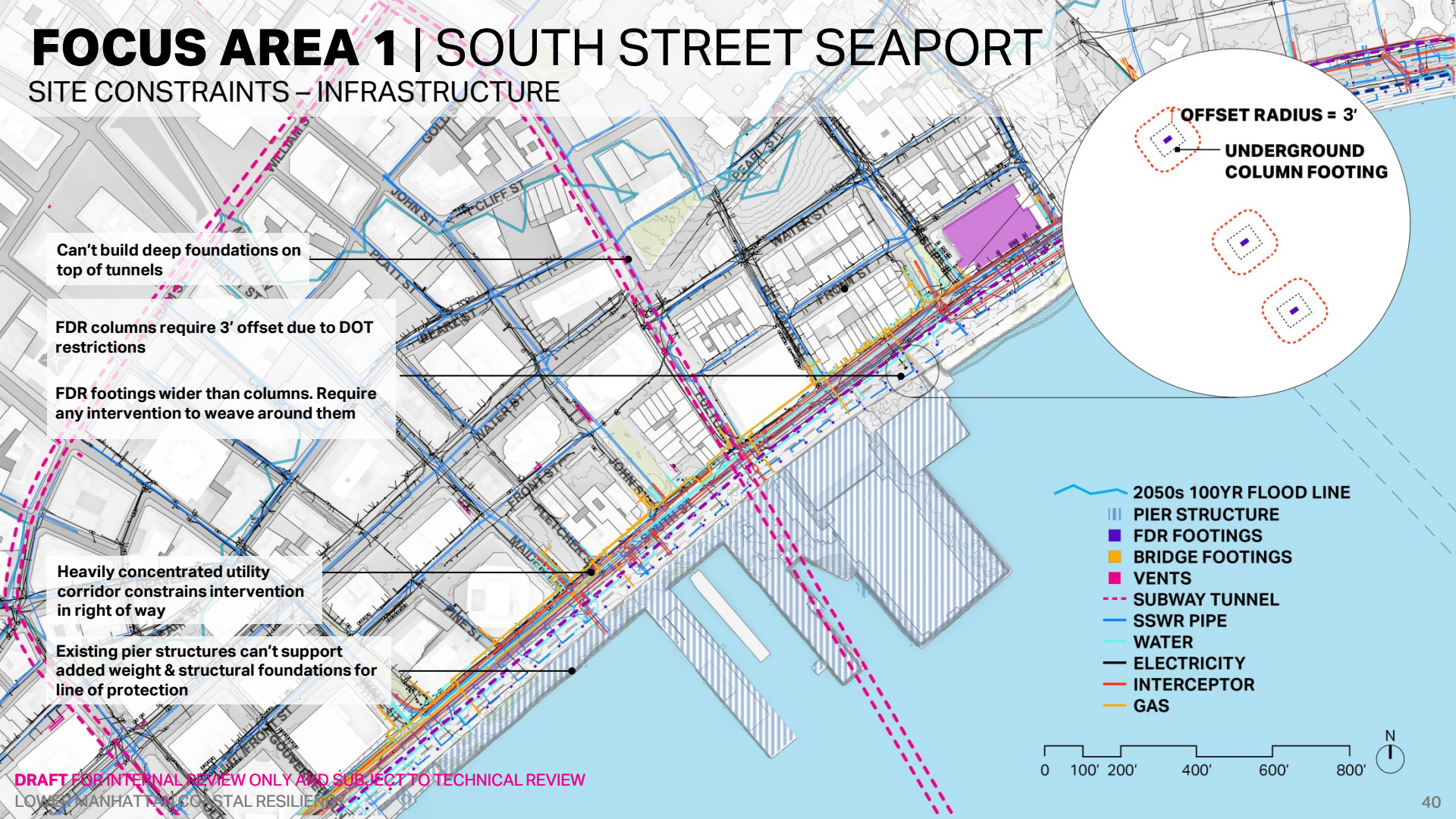
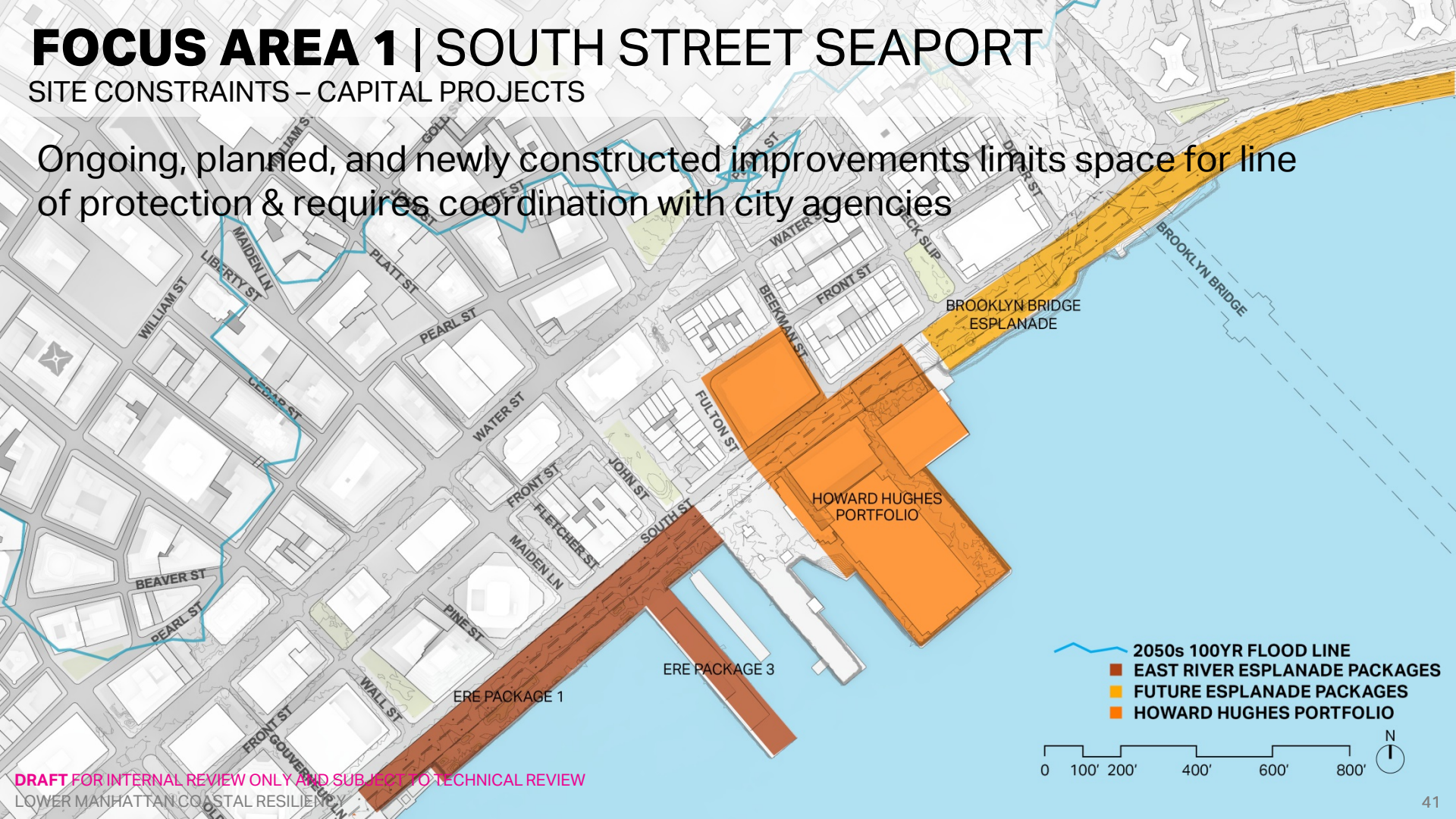
SITE CONSTRAINTS – INFRASTRUCTURE



FOCUS AREA 1 | SOUTH STREET SEAPORT

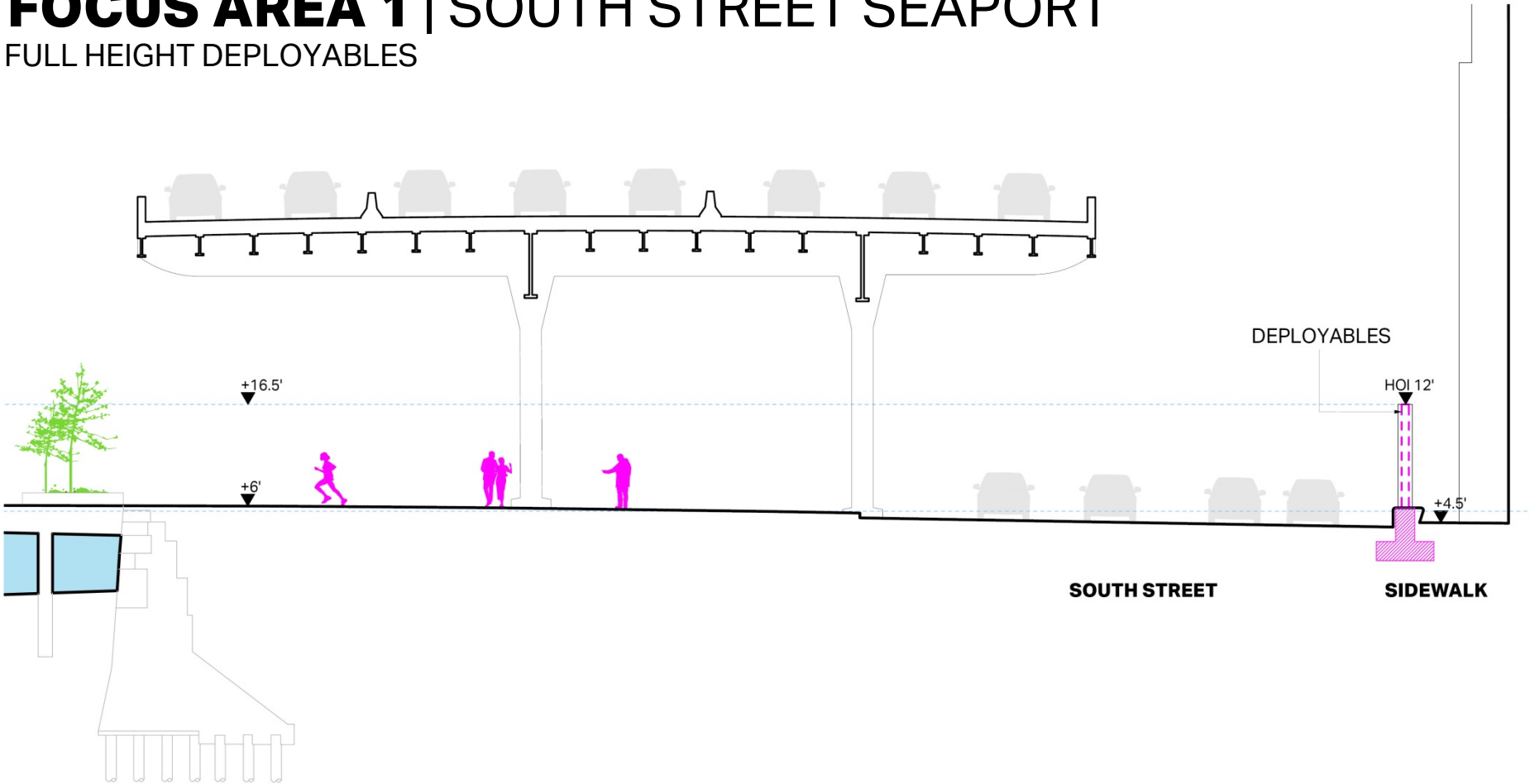
SITE CONSTRAINTS – CAPITAL PROJECTS

Ongoing, planned, and newly constructed improvements limits space for line of protection & requires coordination with city agencies



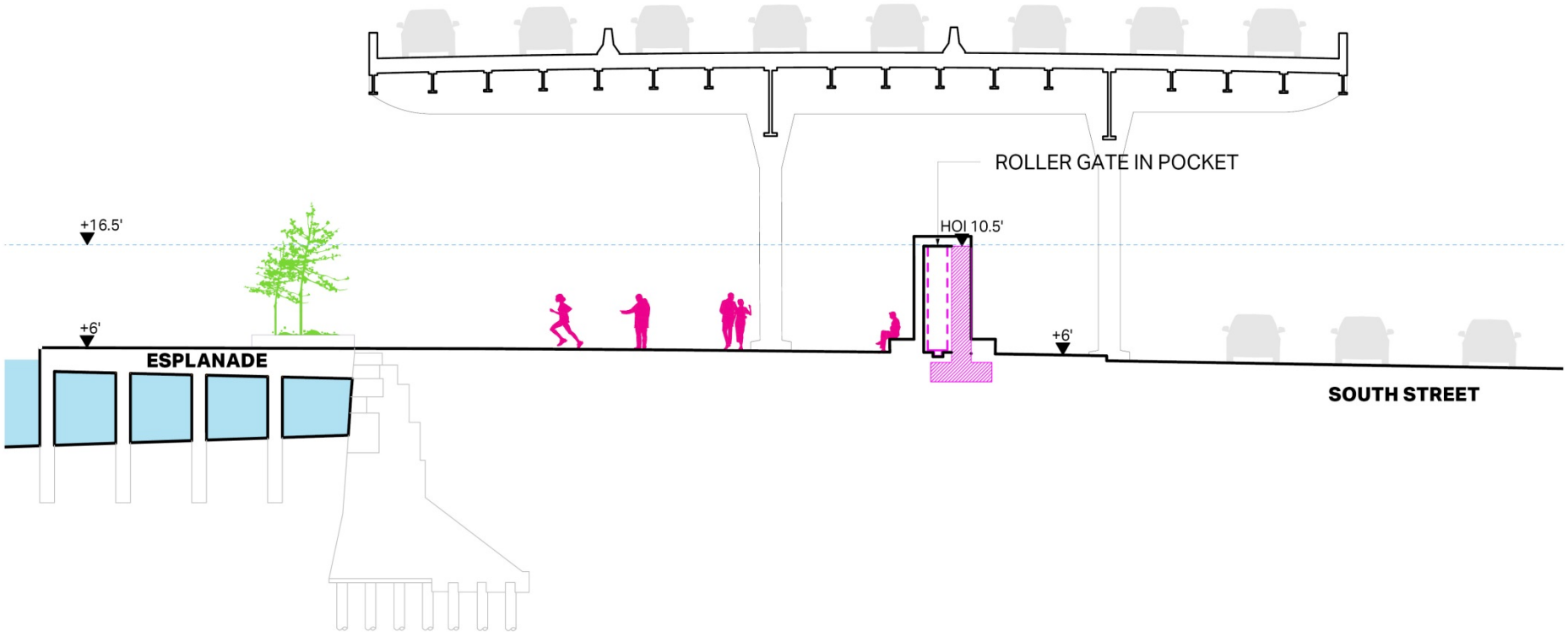
FOCUS AREA 1 | SOUTH STREET SEAPORT

FULL HEIGHT DEPLOYABLES



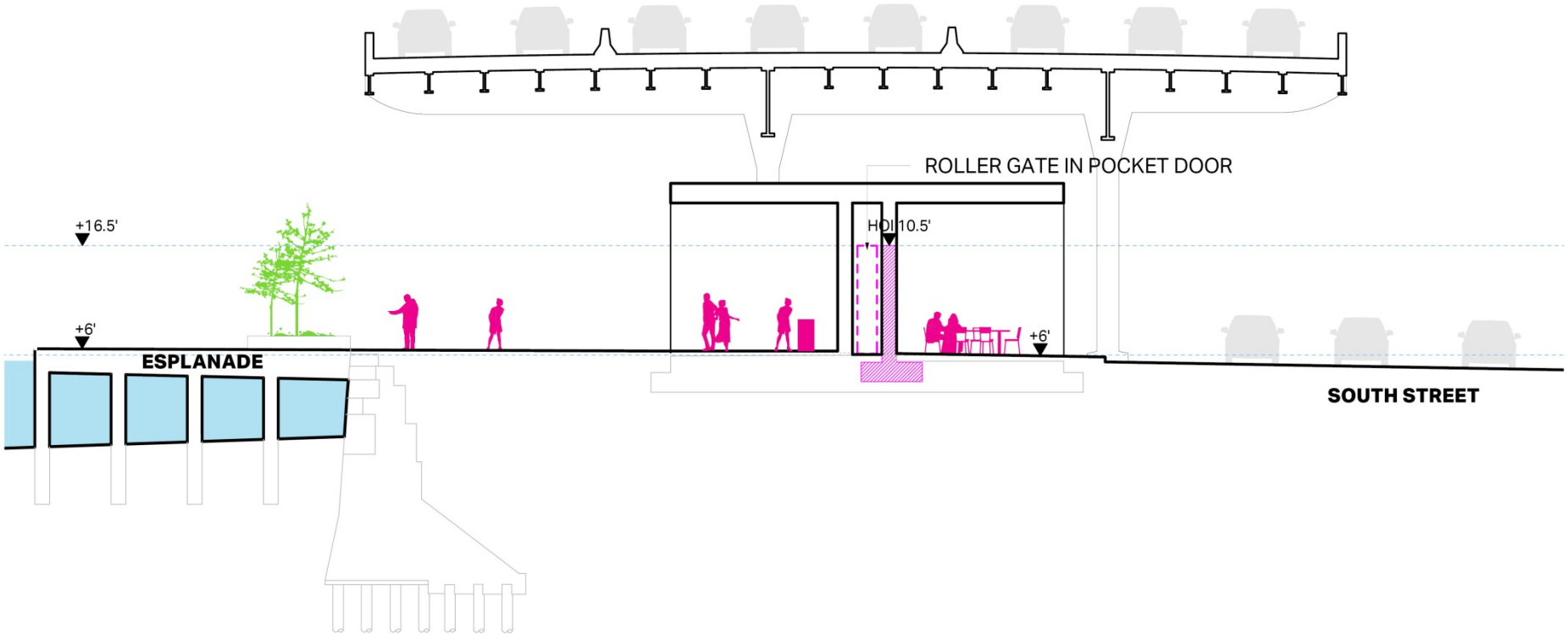
FOCUS AREA 1 | SOUTH STREET SEAPORT

WALL WITH ROLLER GATES



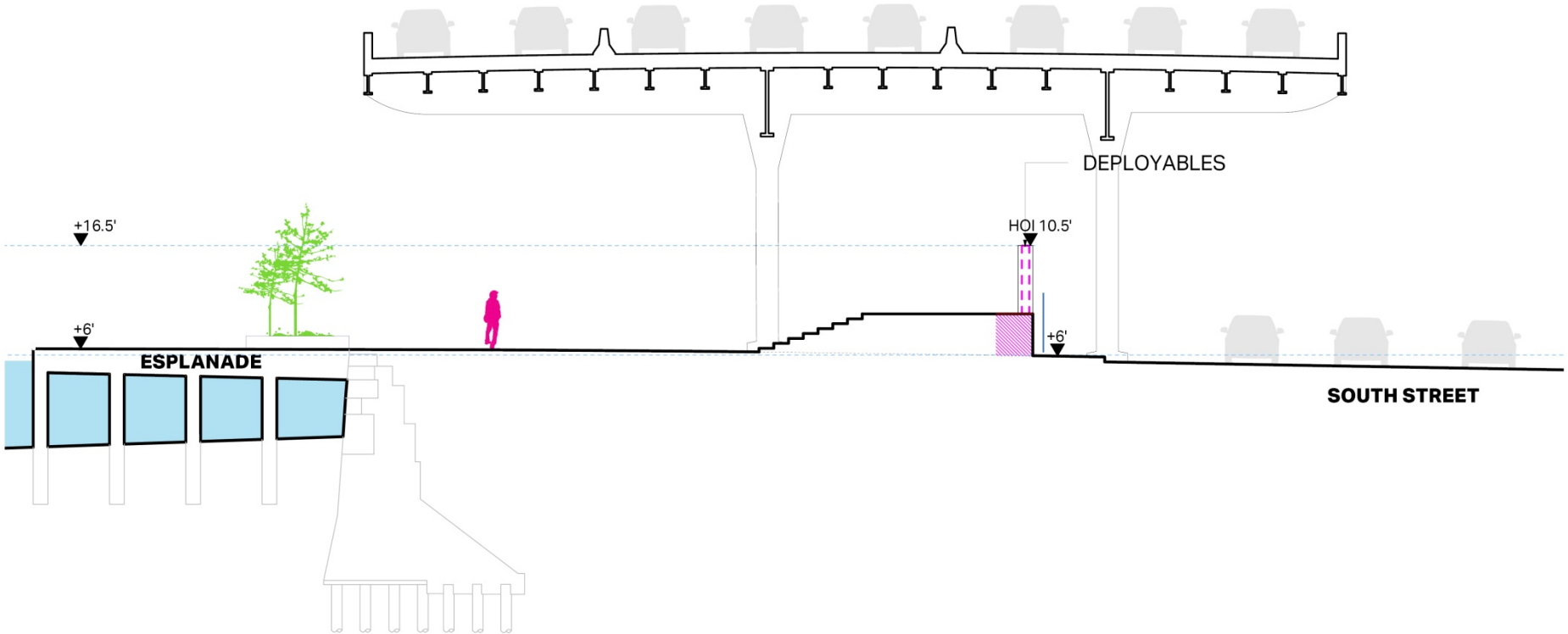
FOCUS AREA 1 | SOUTH STREET SEAPORT

KIOSKS WITH ROLLER GATES



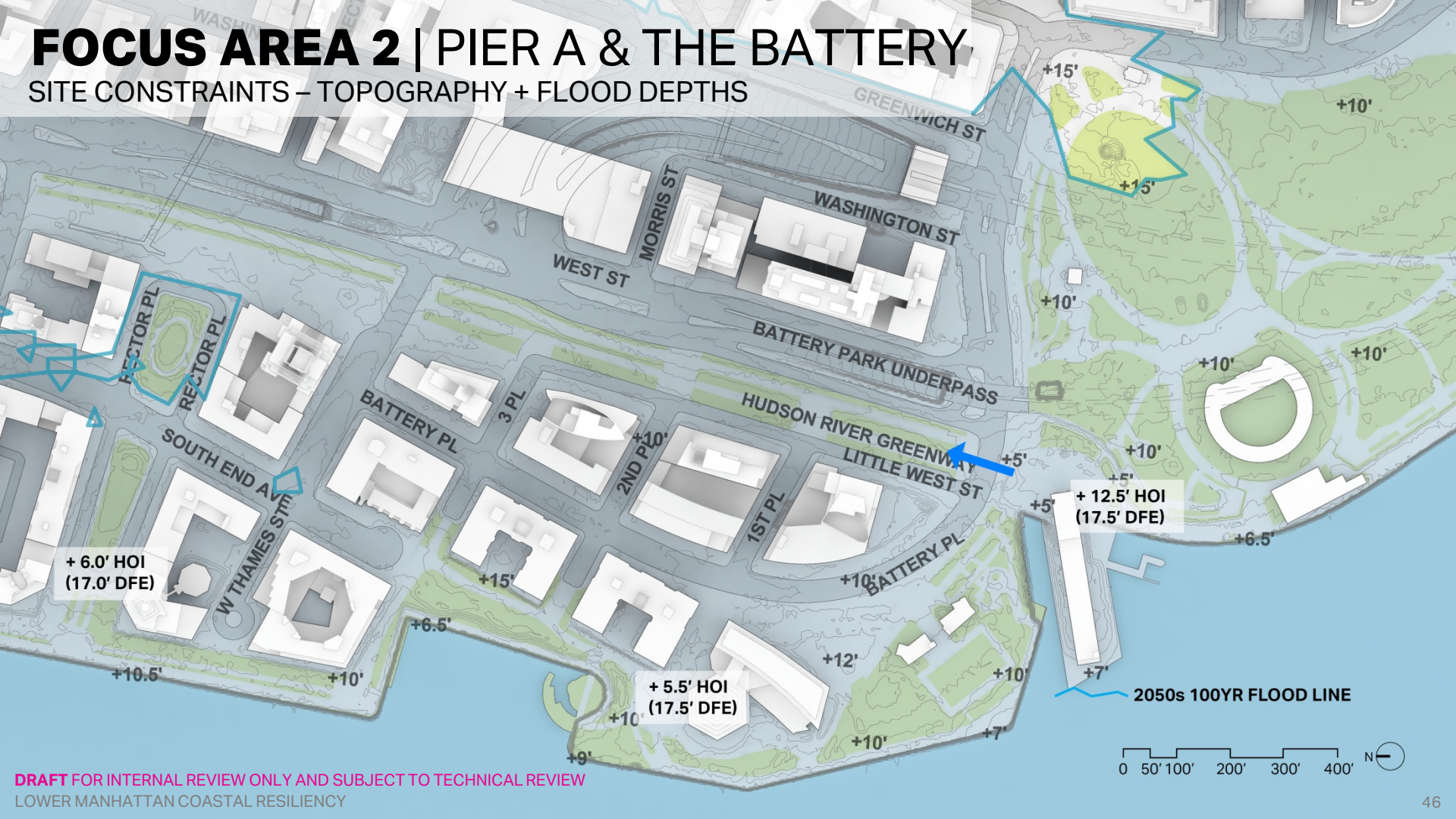
FOCUS AREA 1 | SOUTH STREET SEAPORT

PLATFORM WITH DEPLOYABLES



FOCUS AREA 2 | PIER A & THE BATTERY

SITE CONSTRAINTS – TOPOGRAPHY + FLOOD DEPTHS



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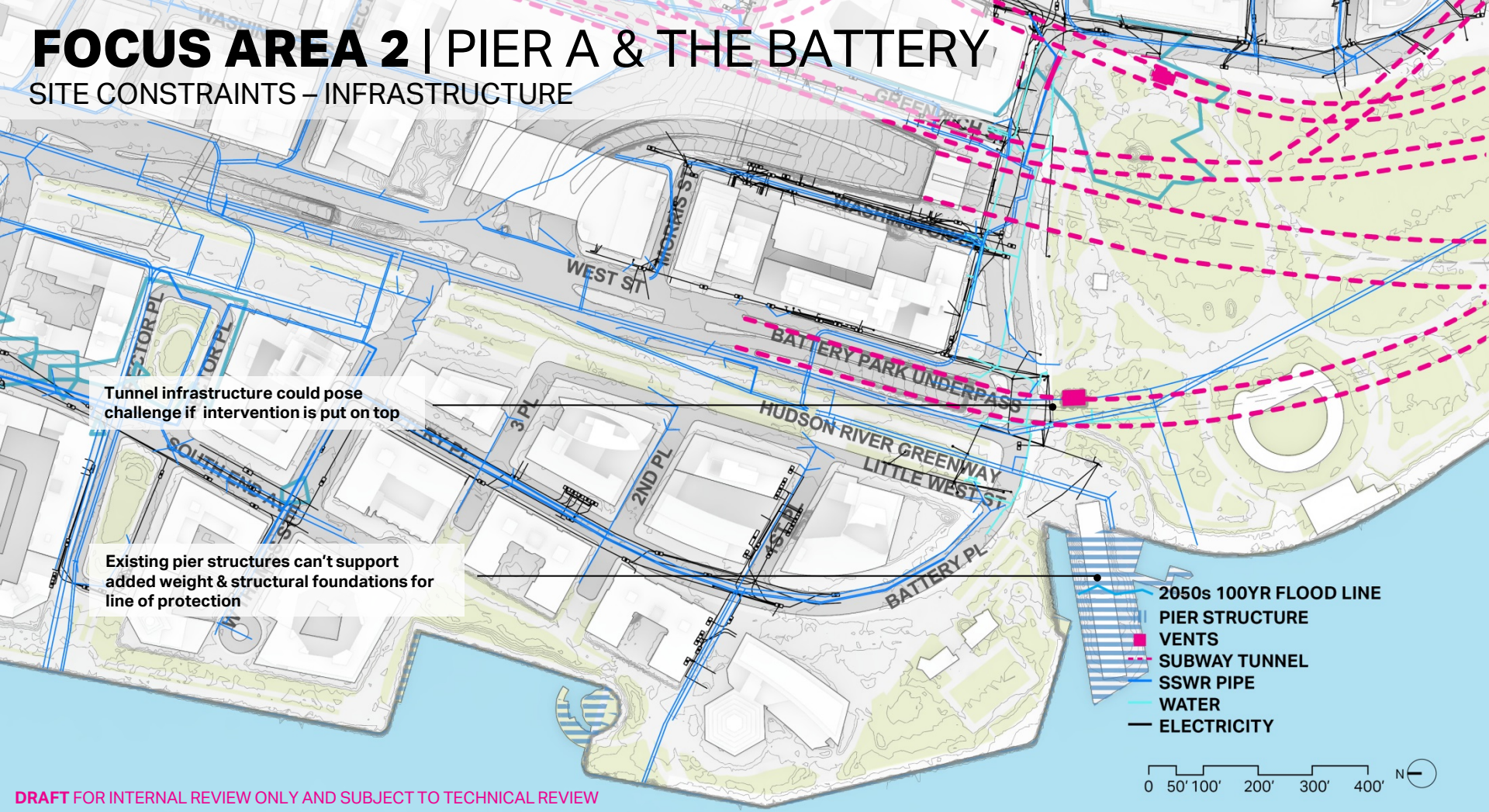

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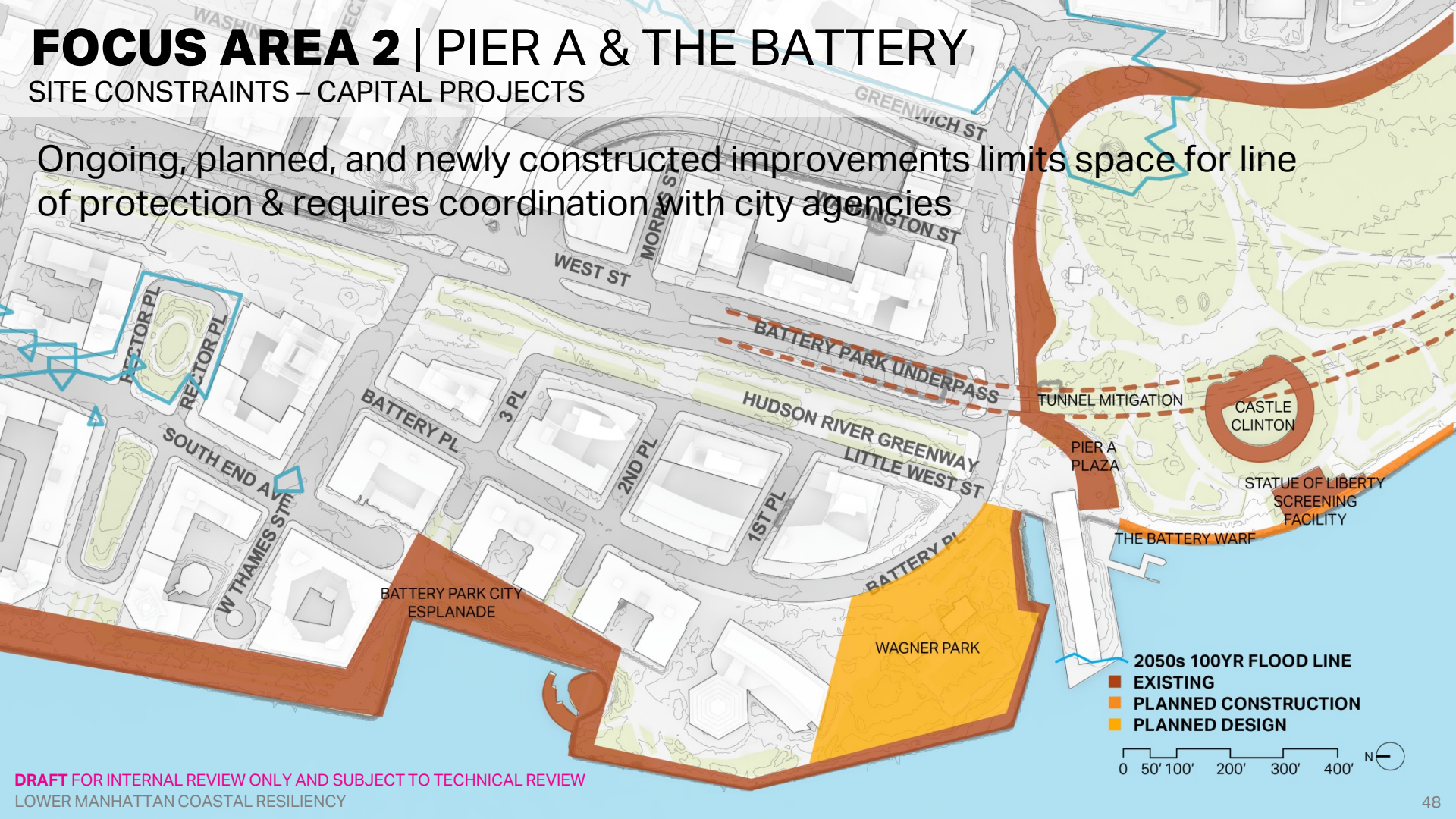
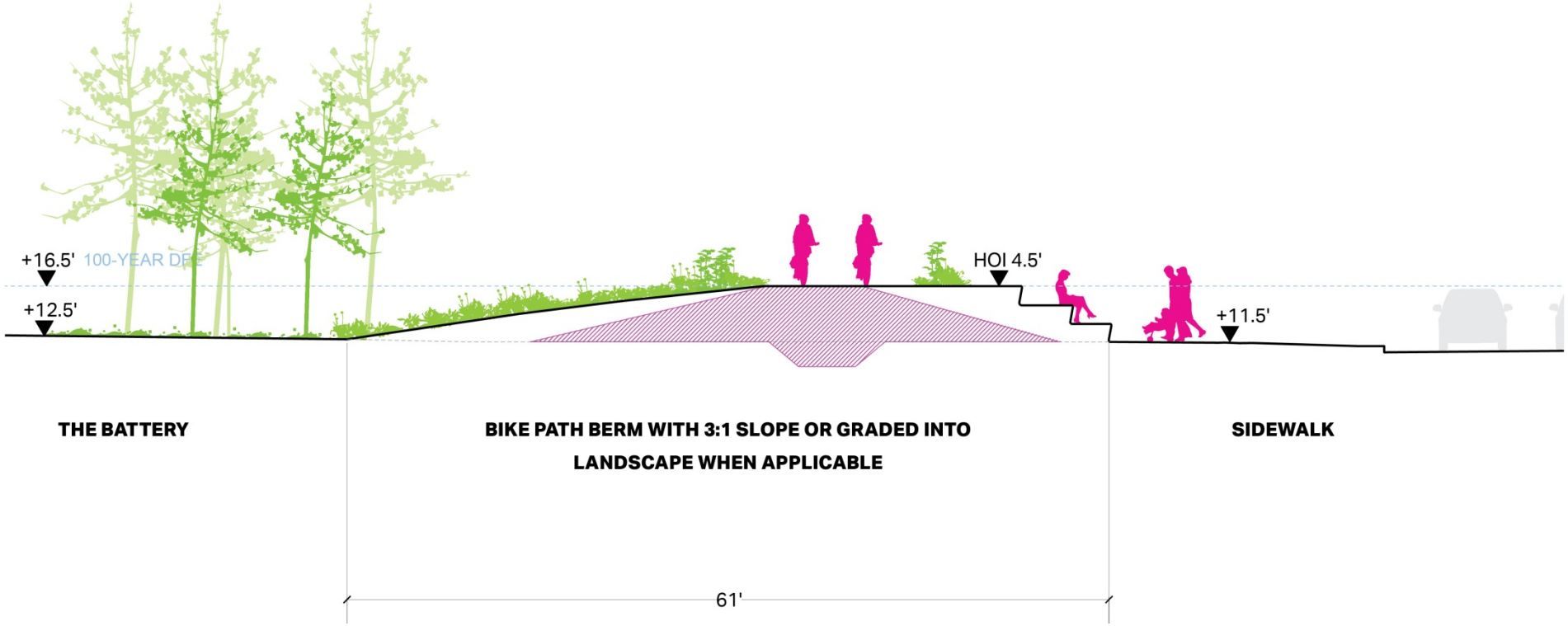


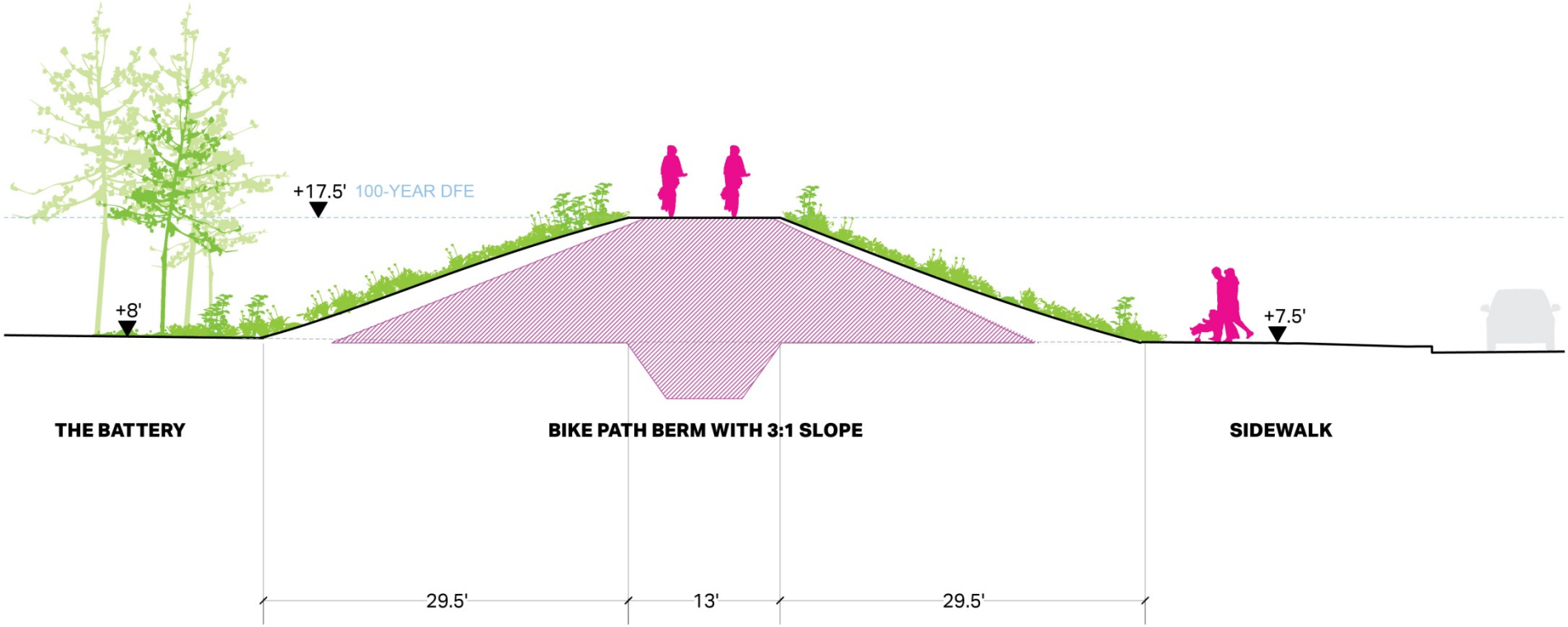
FOCUS AREA 2 | PIER A & THE BATTERY

BATTERY BERM SOUTH



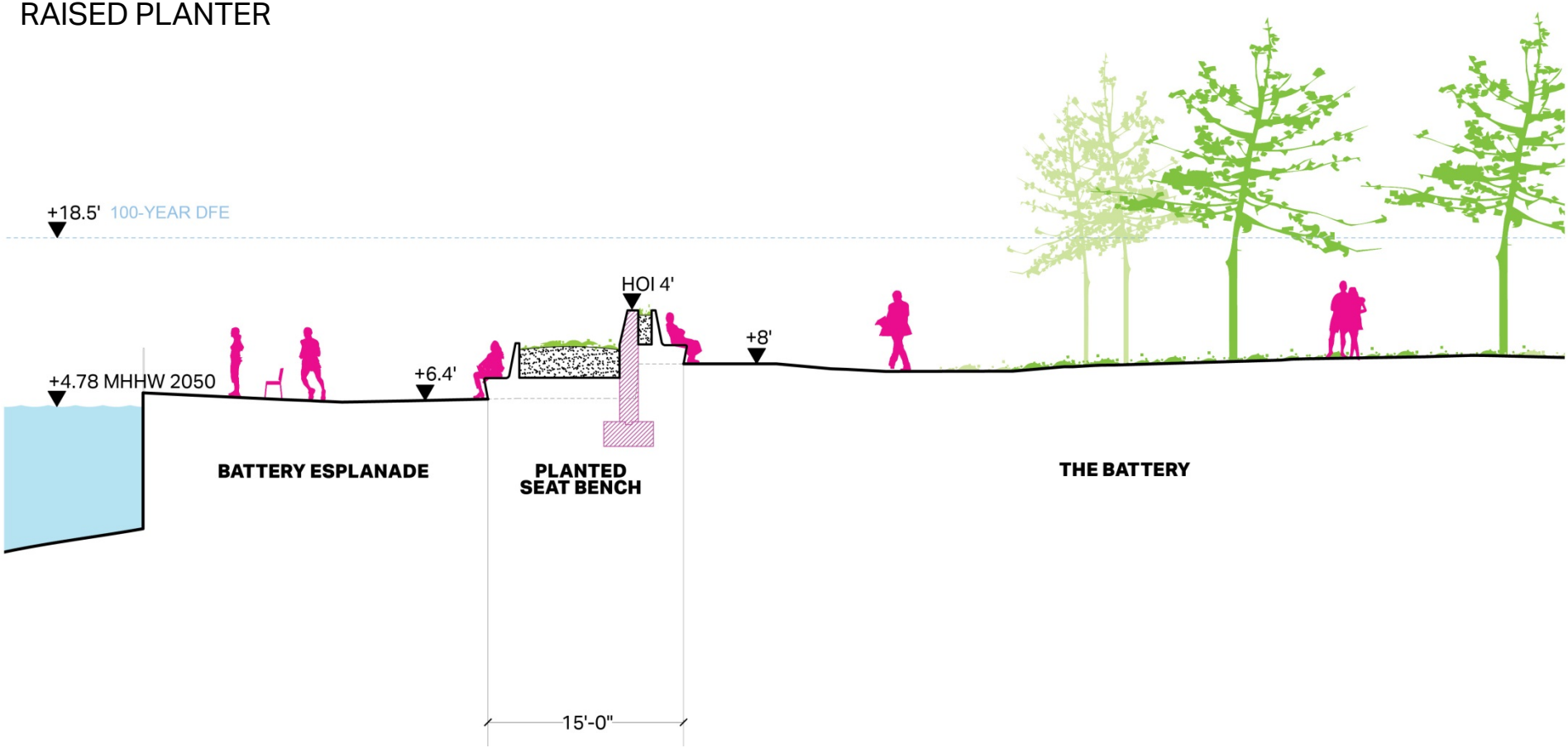
FOCUS AREA 2 | PIER A & THE BATTERY

BATTERY BERM NORTH



FOCUS AREA 2 | PIER A & THE BATTERY

RAISED PLANTER



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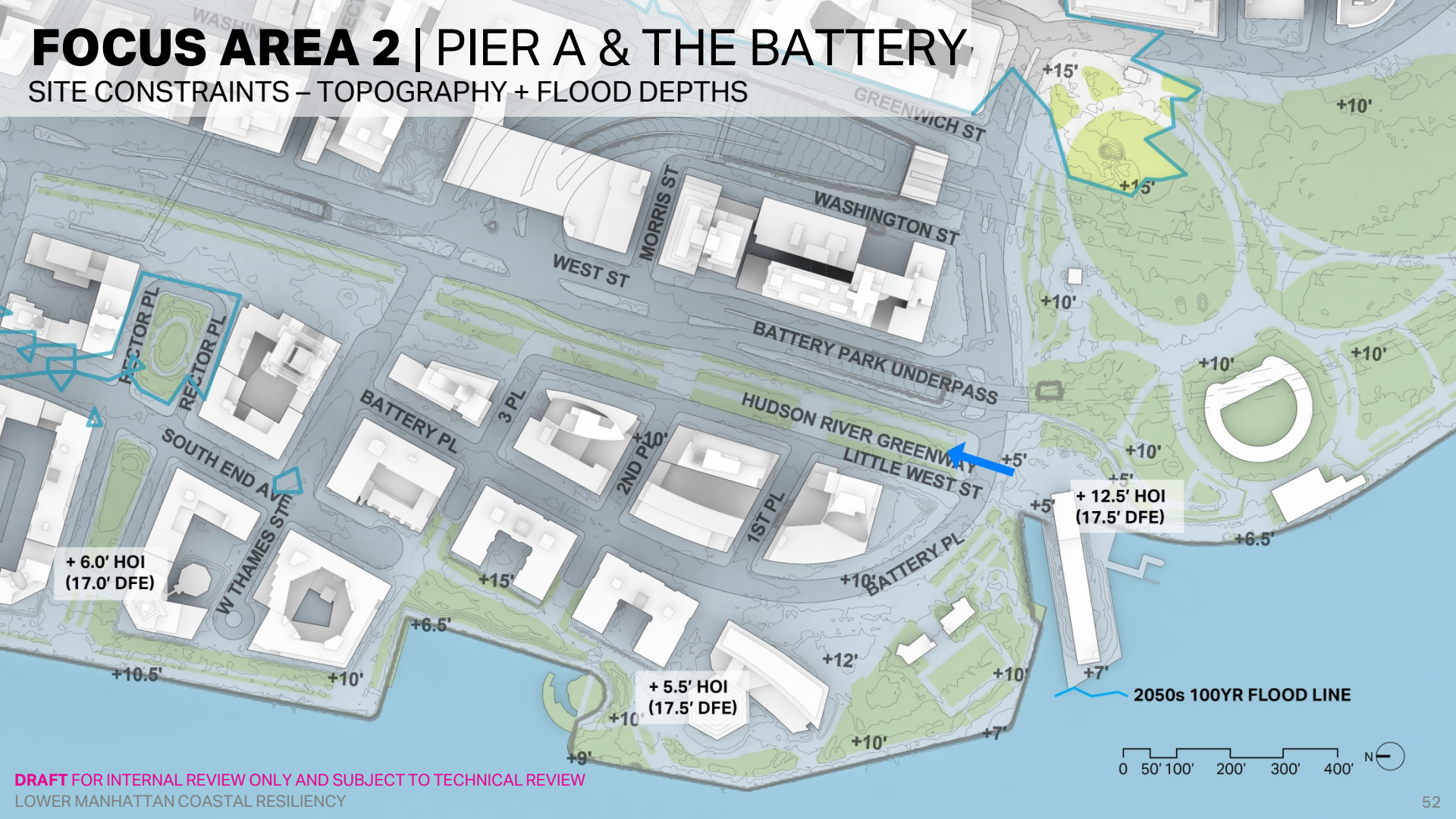
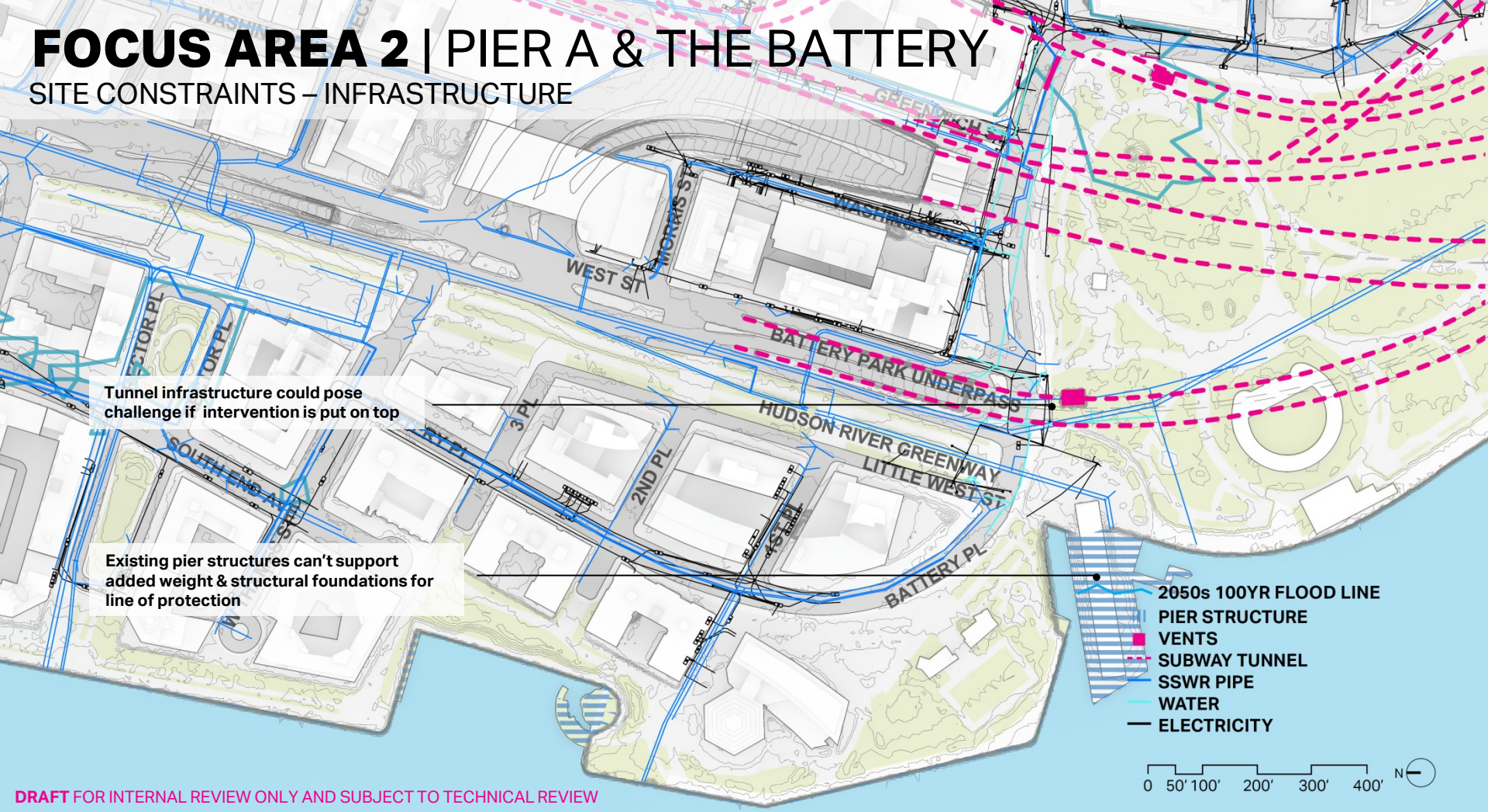
SITE CONSTRAINTS – TOPOGRAPHY + FLOOD DEPTHS



FOCUS AREA 2 | PIER A & THE BATTERY

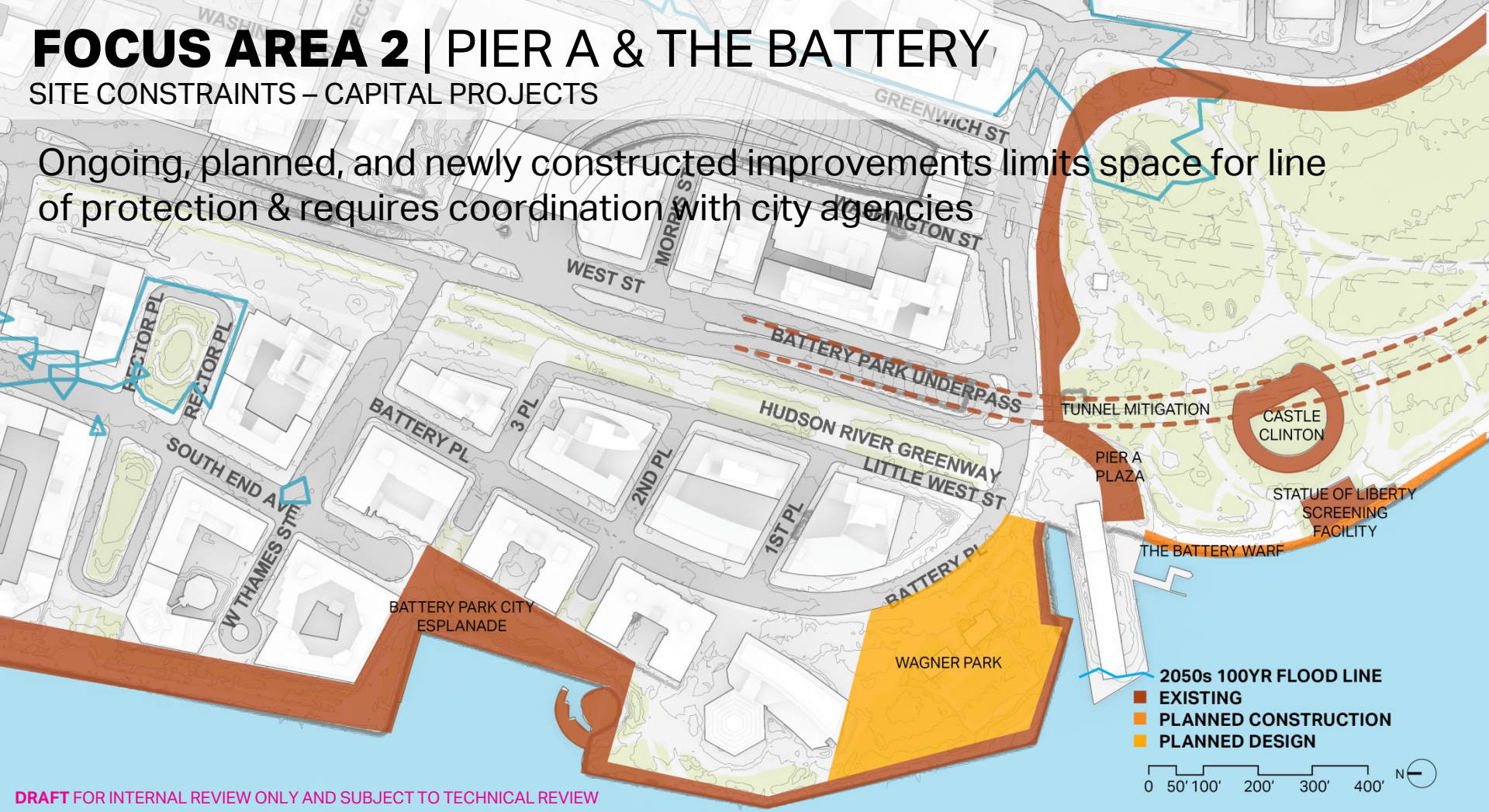
SITE CONSTRAINTS – INFRASTRUCTURE



FOCUS AREA 2 | PIER A & THE BATTERY

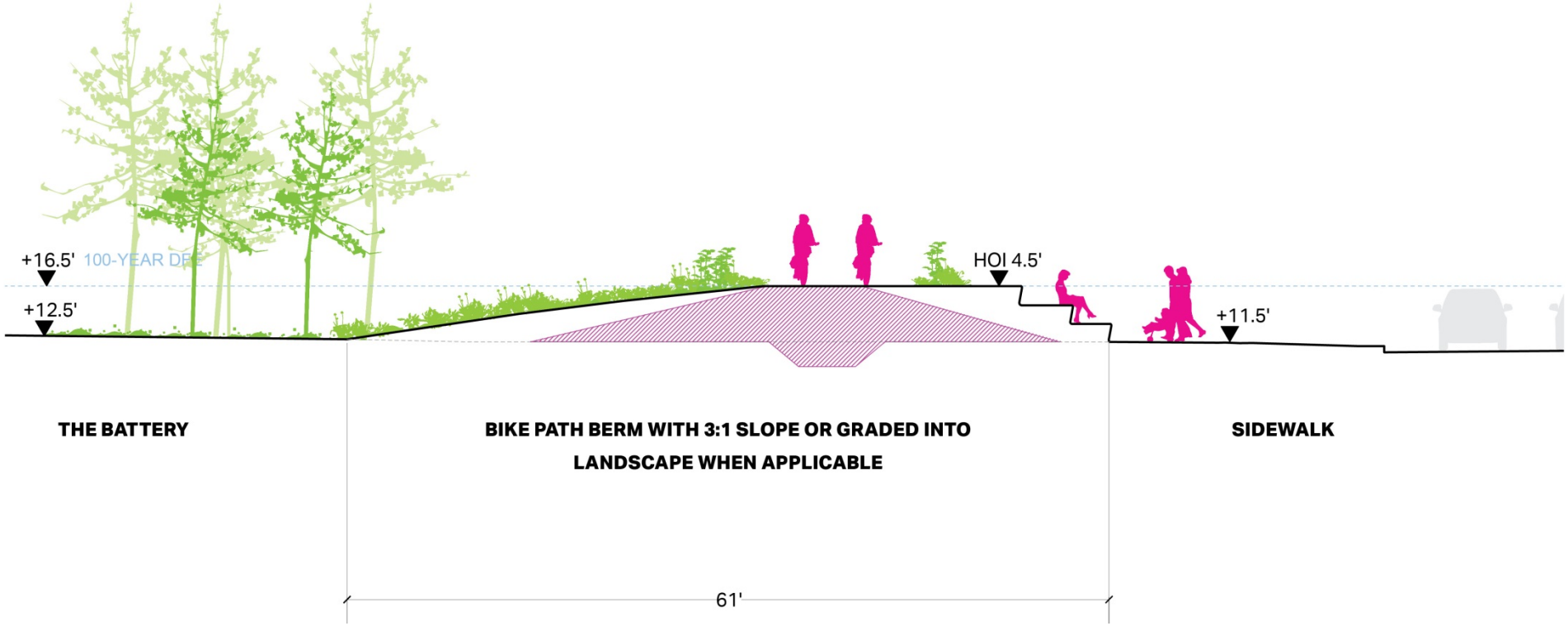
SITE CONSTRAINTS – CAPITAL PROJECTS

Ongoing, planned, and newly constructed improvements limits space for line of protection & requires coordination with city agencies



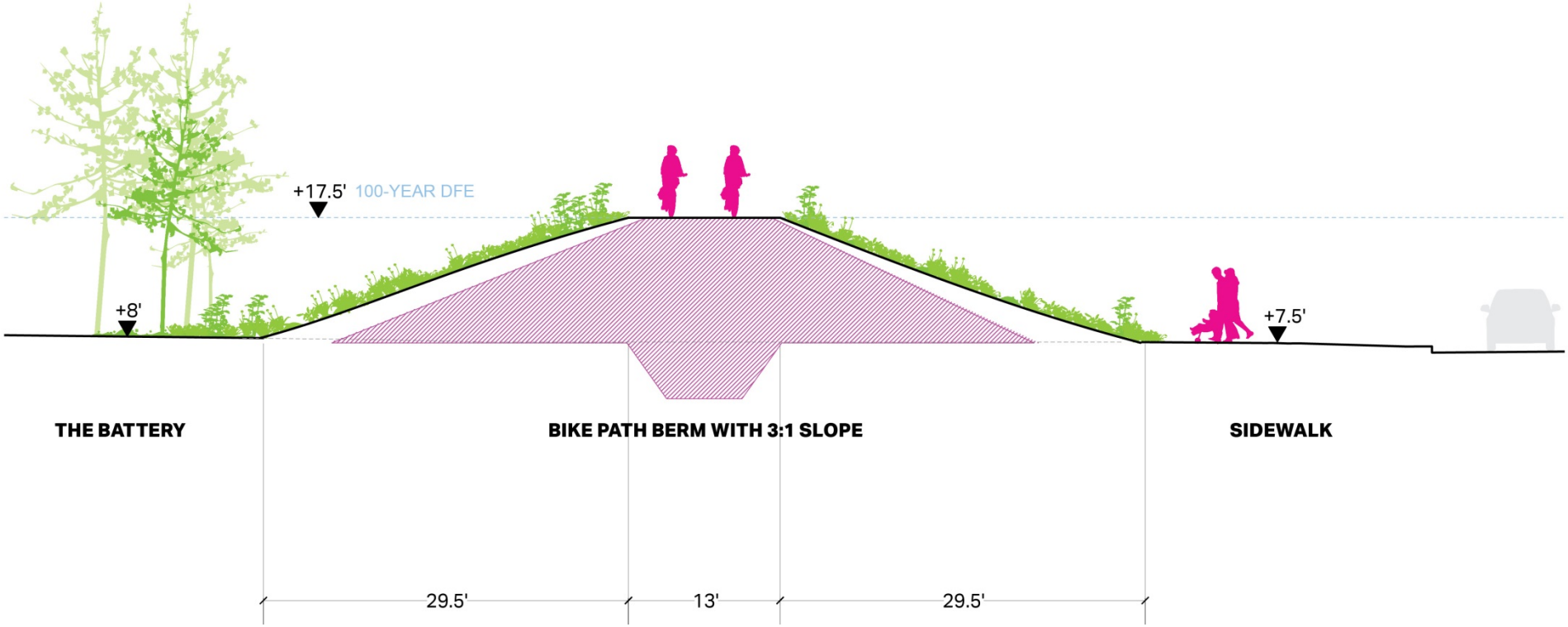
FOCUS AREA 2 | PIER A & THE BATTERY

BATTERY BERM SOUTH



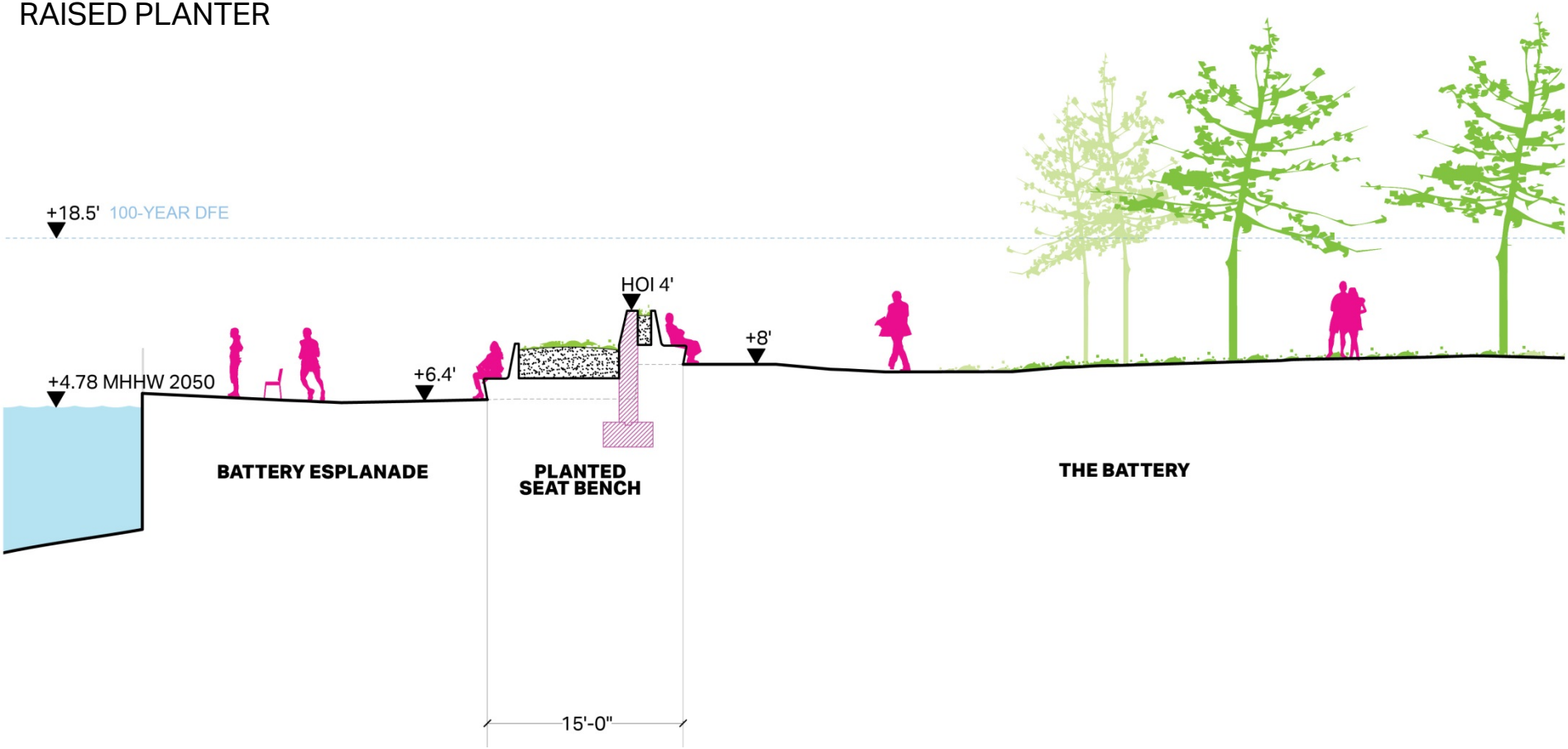
FOCUS AREA 2 | PIER A & THE BATTERY

BATTERY BERM NORTH



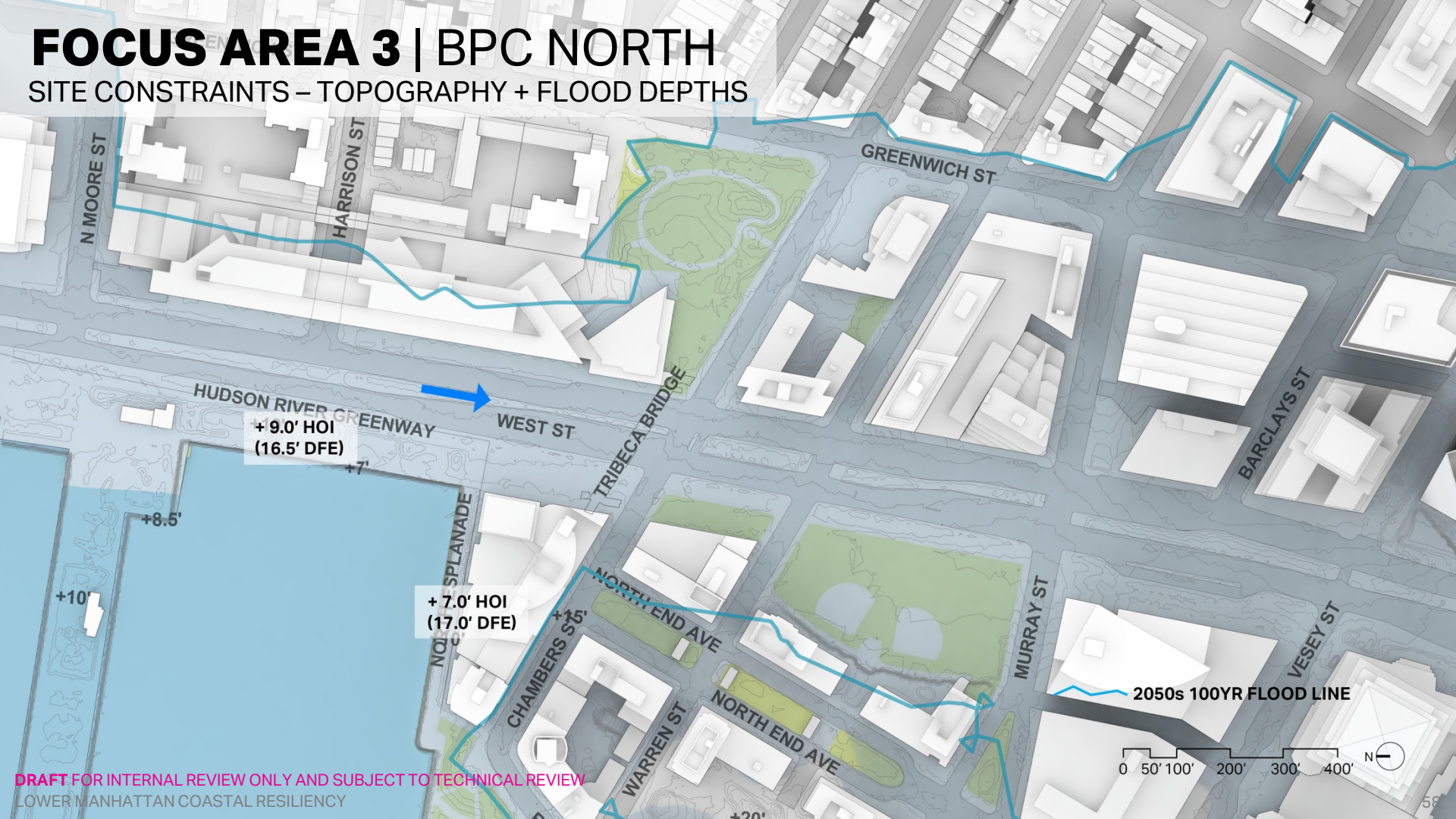
FOCUS AREA 2 | PIER A & THE BATTERY

RAISED PLANTER



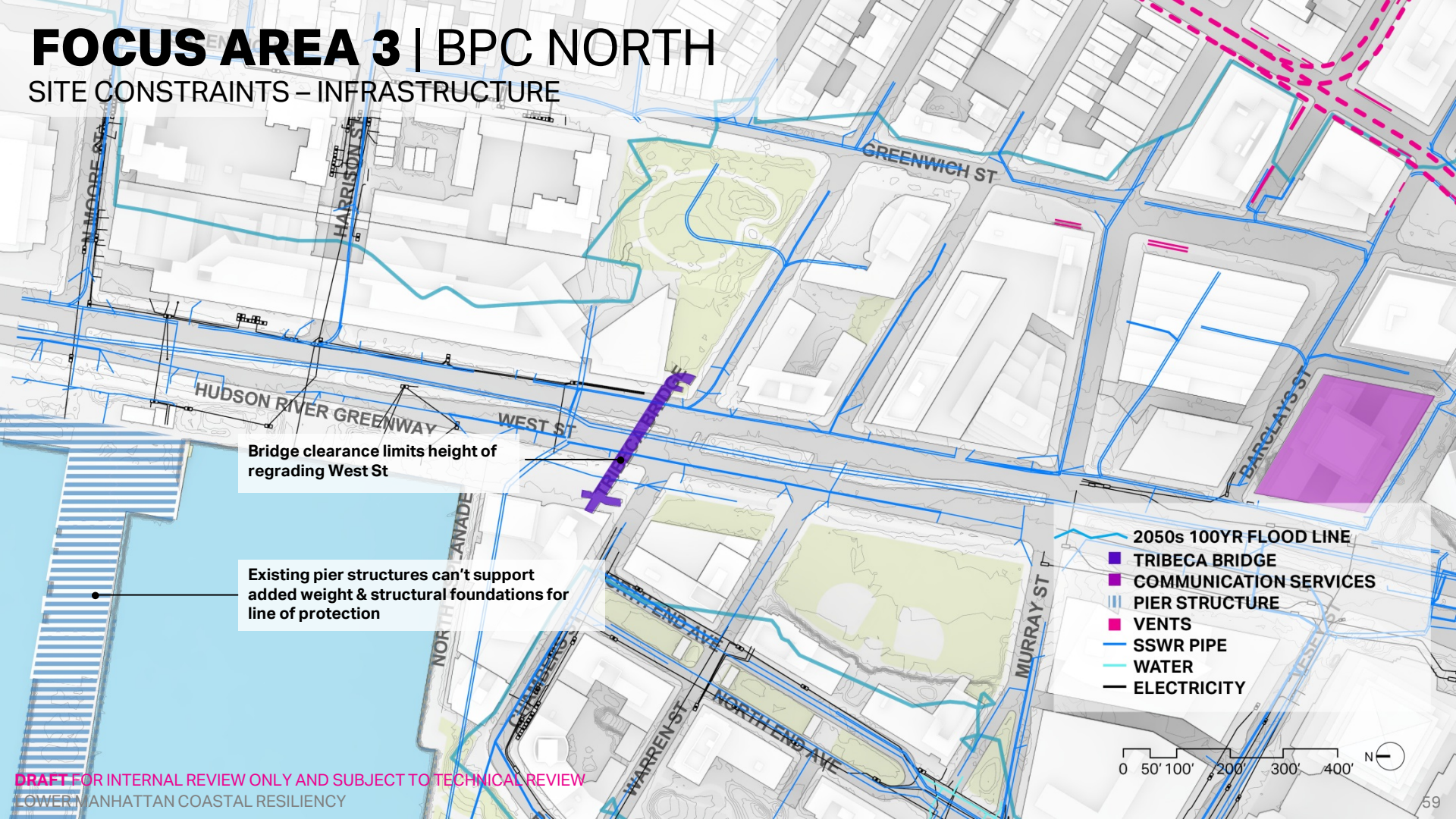
FOCUS AREA 3 | BPC NORTH

SITE CONSTRAINTS – TOPOGRAPHY + FLOOD DEPTHS



FOCUS AREA 3 | BPC NORTH

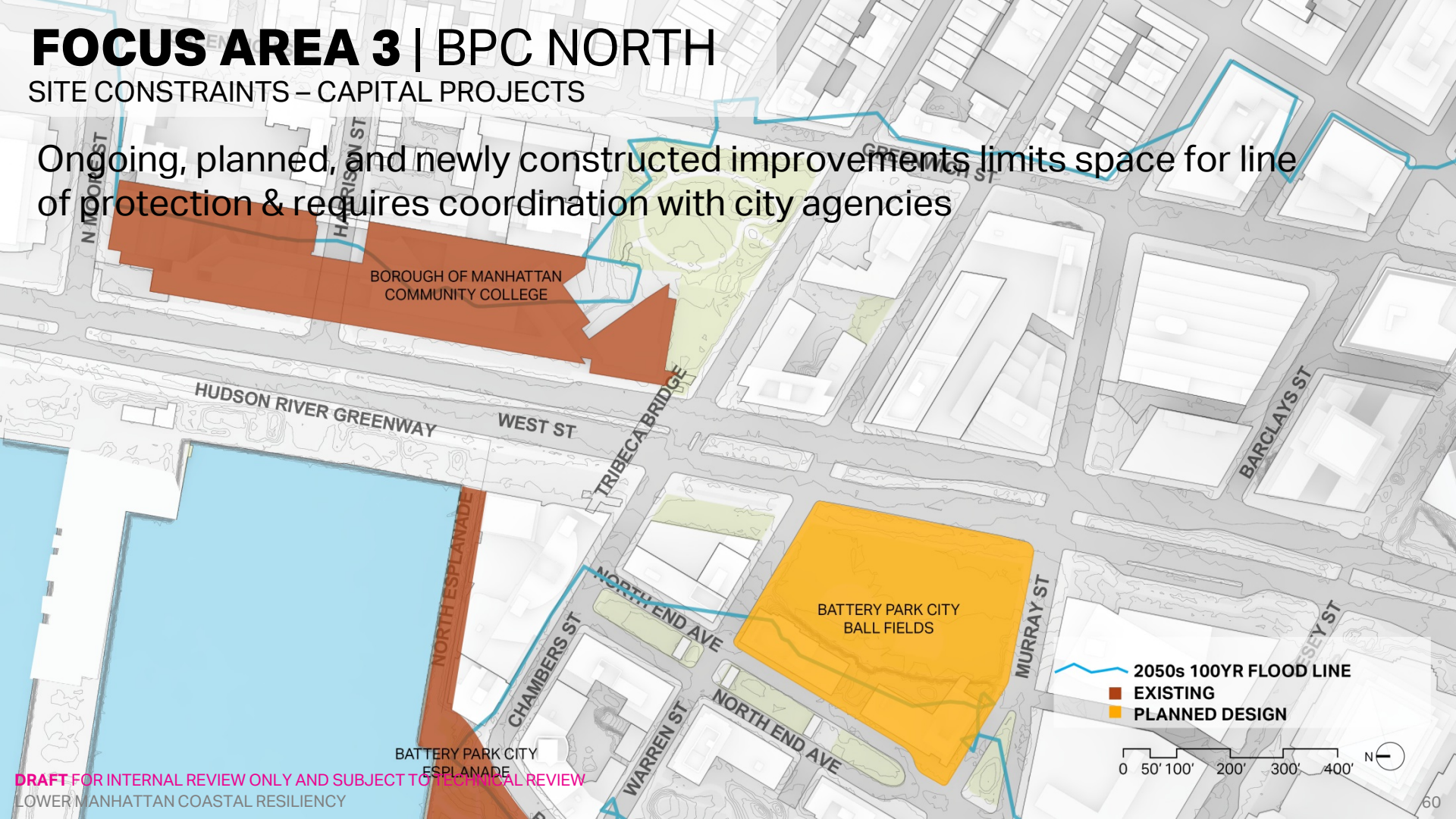
SITE CONSTRAINTS – INFRASTRUCTURE



FOCUS AREA 3 | BPC NORTH

SITE CONSTRAINTS – CAPITAL PROJECTS

Ongoing, planned, and newly constructed improvements limits space for line of protection & requires coordination with city agencies

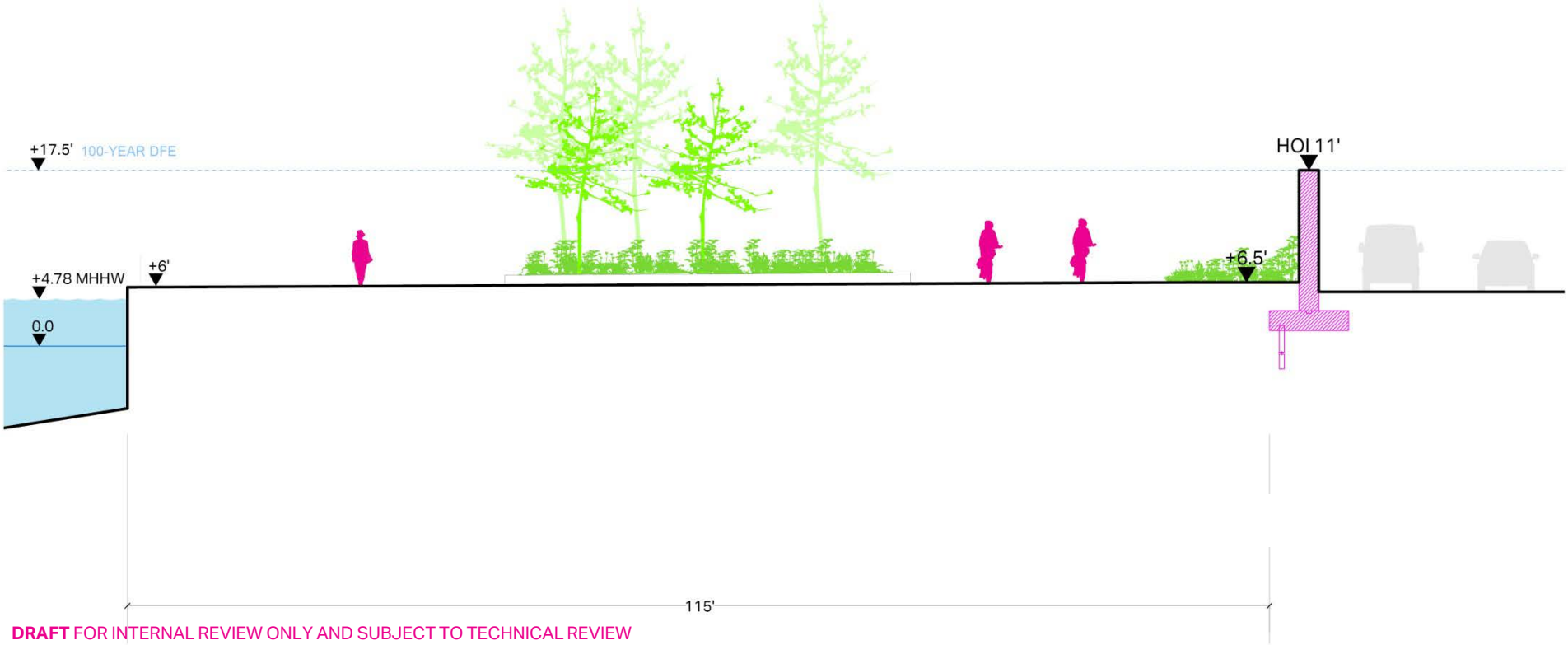


FOCUS AREA 3 | BATTERY PARK CITY

HARDENED EXISTING WALL

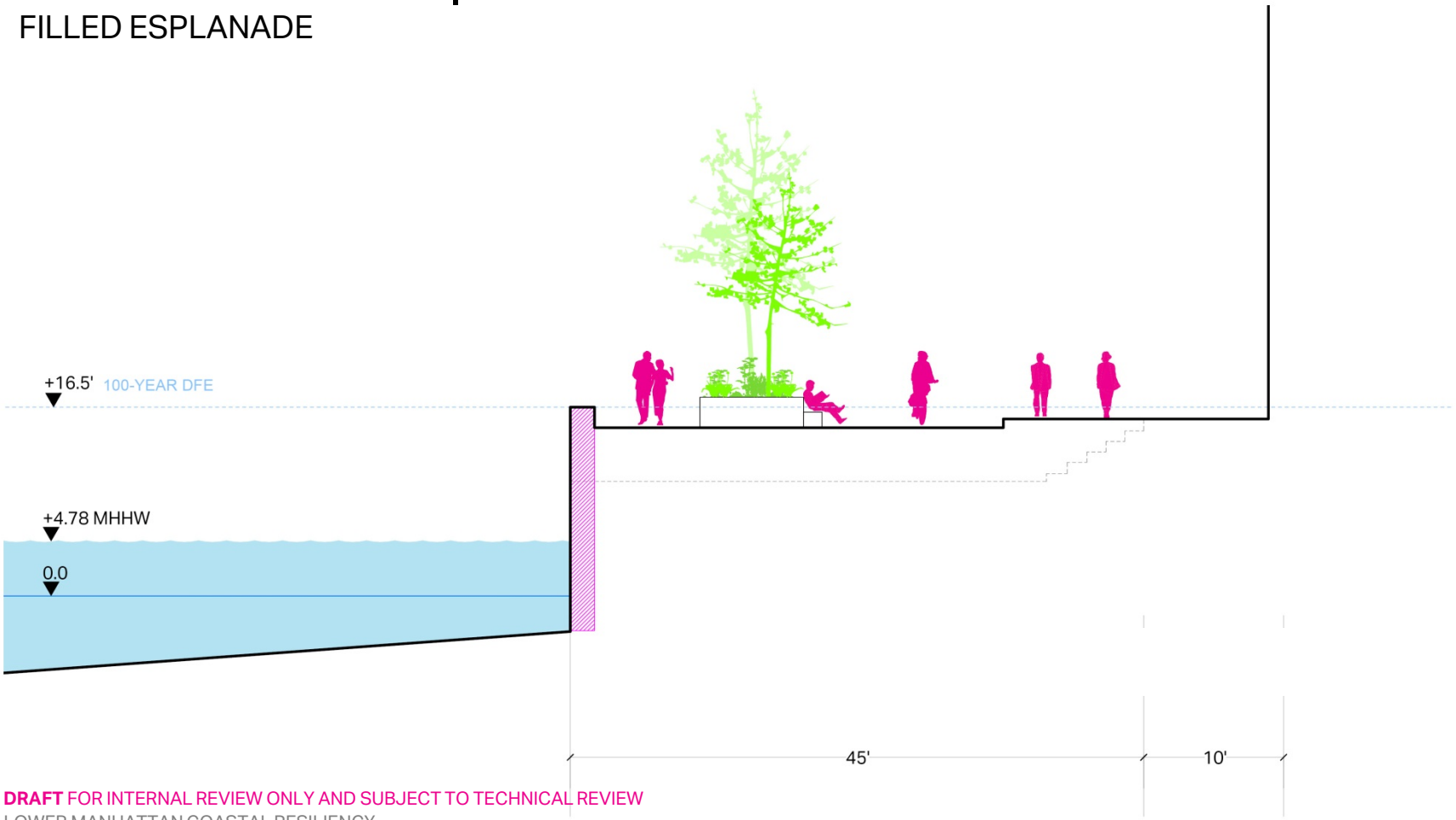
FOCUS AREA 3 | BATTERY PARK CITY

WALL



FOCUS AREA 3 | BATTERY PARK CITY

FILLED ESPLANADE

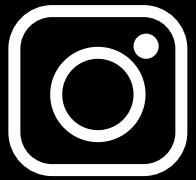


PROJECT NEXT STEPS

- Discuss trade-offs of each concept
- Incorporate coastal model to inform concept and drainage
- Further evaluate land use and environmental review timelines
- Develop preliminary cost estimates
- Narrow in on potential concepts

STAY IN TOUCH

www.nyc.gov/lmcr



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By Mail
253 Broadway – 14th Floor

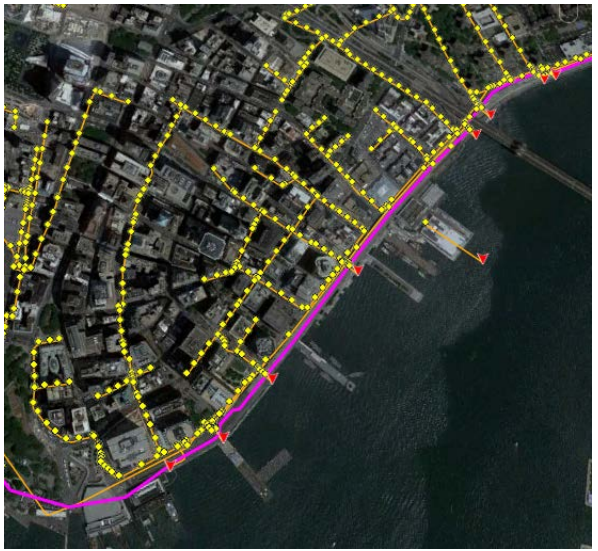
In person

nycresiliency@cityhall.nyc.gov

APPENDIX

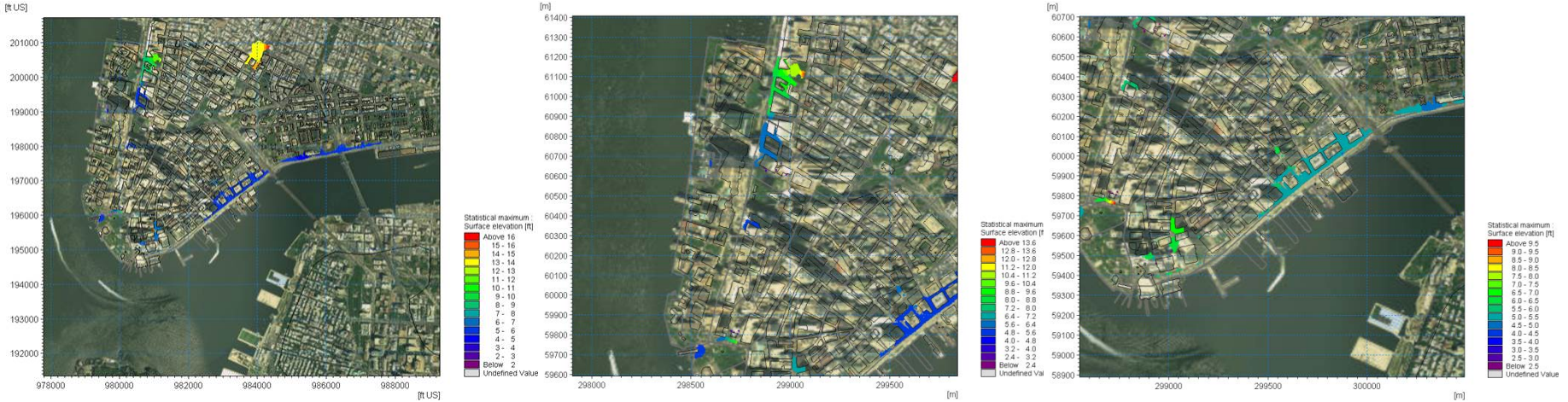
MIKE URBAN WATER MODEL

MIKE URBAN MODEL DOMAIN IN GOOGLE EARTH FORMAT



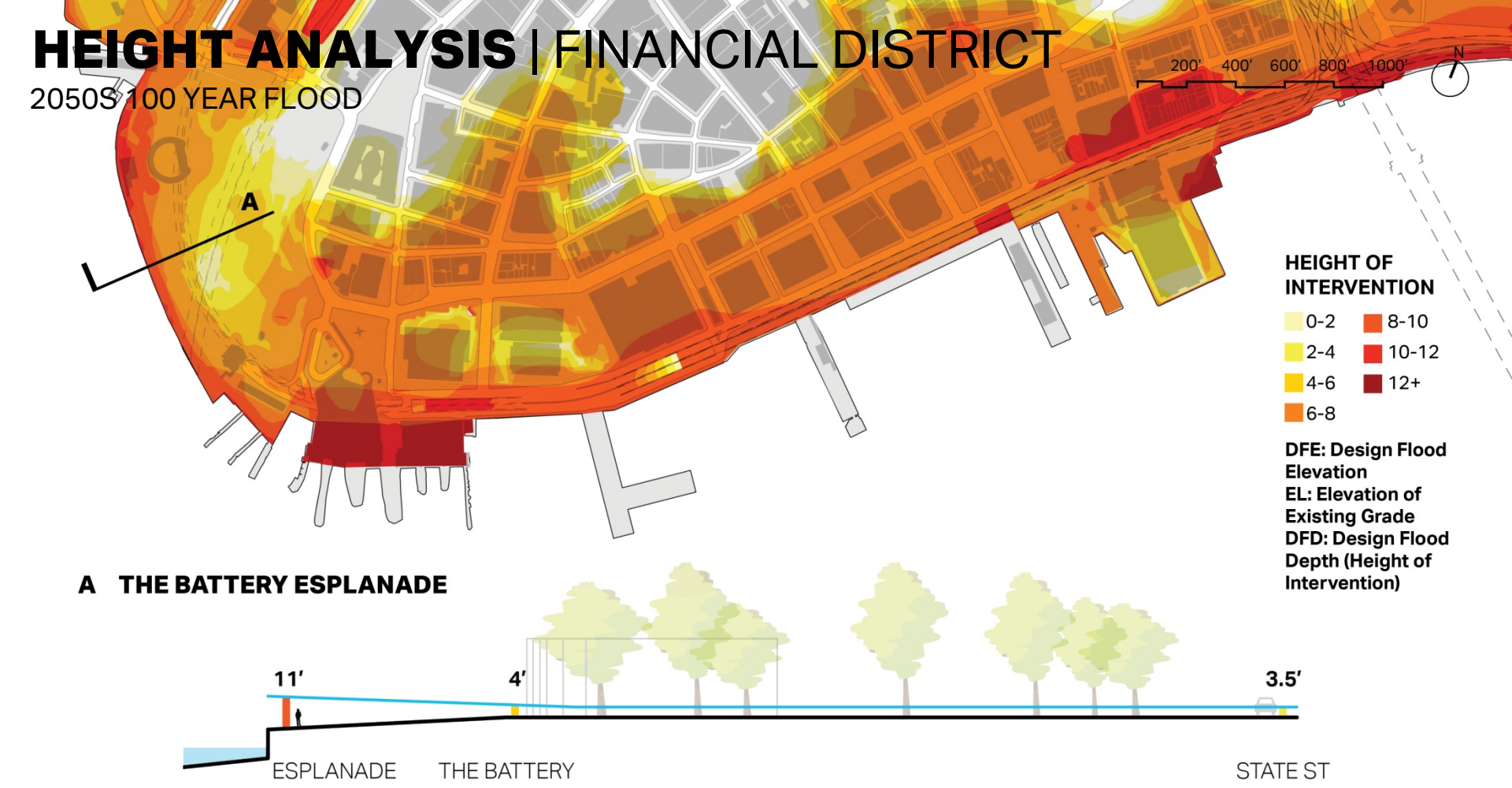
MIKE URBAN WATER MODEL

10-YEAR RAINSTORM FOR 2050S WITH SLR



HEIGHT ANALYSIS | FINANCIAL DISTRICT

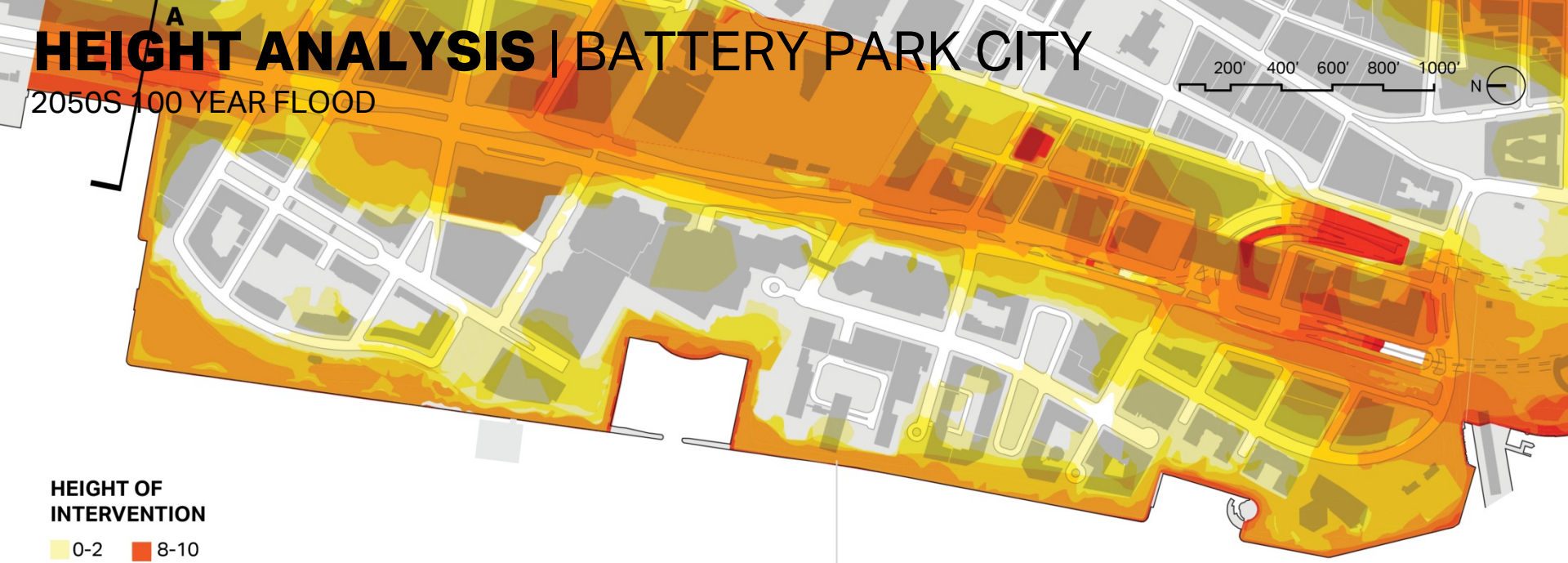
2050S 100 YEAR FLOOD



ENGINEERING DFE ASSUMPTIONS COMPARED AGAINST 2' CONTOURS (DOITT 2006)

HEIGHT ANALYSIS | BATTERY PARK CITY

2050S 100 YEAR FLOOD



HEIGHT OF INTERVENTION

0-2	8-10
2-4	10-12
4-6	12+
6-8	

DFE: Design Flood Elevation
EL: Elevation of Existing Grade
DFD: Design Flood Depth (Height of Intervention)

A WEST STREET AT BMCC

ENGINEERING DFE ASSUMPTIONS COMPARED AGAINST 2' CONTOURS (DOITT 2006)