ARCADIS
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CONEY ISLAND CREEK RESILIENCY STUDY

August 6th, 2015

Coney Island Community Update

NYCEDC

City of New York
Bill de Blasio, Mayor

Presentation Agenda

- Overview
- Regional Resiliency
- Long-term Flood Protection Recommendations
  - Alignments and Precedents
  - Floodgate Typologies
  - Water Quality and Ecology
- Outreach and Next Steps

Current Study Status

Overview

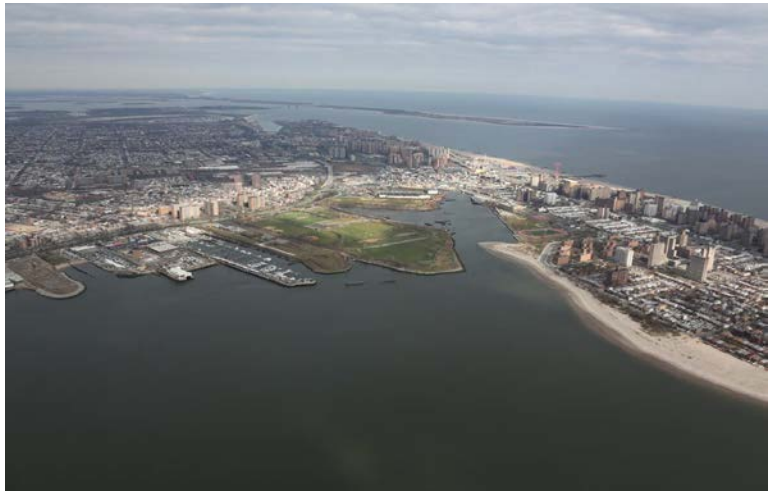
Purpose of feasibility study: ***Develop long-term strategy to protect Coney Island & Gravesend from effects of storm surge and sea level rise***

- Conduct robust technical analysis of large-scale tidal barrier & wetlands concept presented in SIRR report
- Identify specific measures to provide near-term flood protection
- Recommend comprehensive flood protection plan and define implementation steps

Coordinated interagency effort:

- Managed by NYCEDC on behalf of ORR
- Close partnership with DEP, Parks, City Planning
- State and Federal agencies (e.g., DEC, Army Corps) also involved

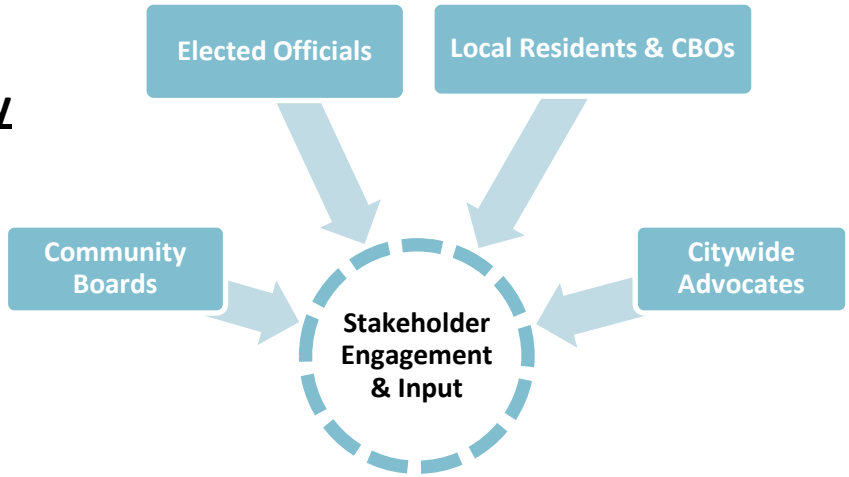
Funding: 100% Sandy CDGB funds

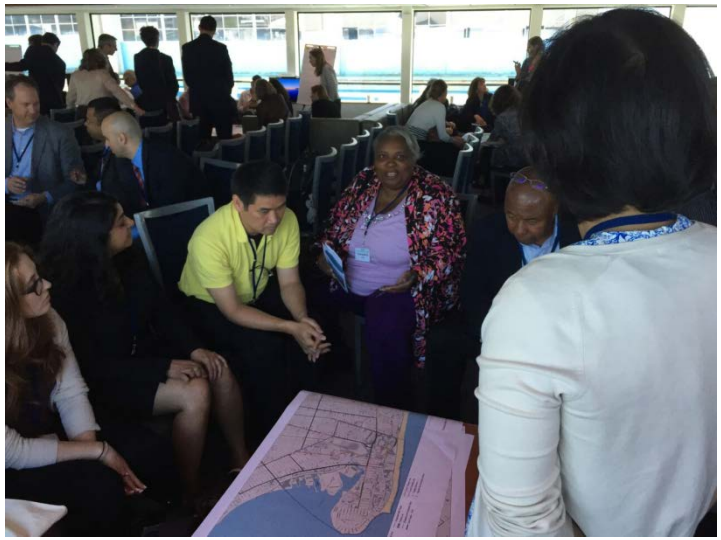


Scope of Study

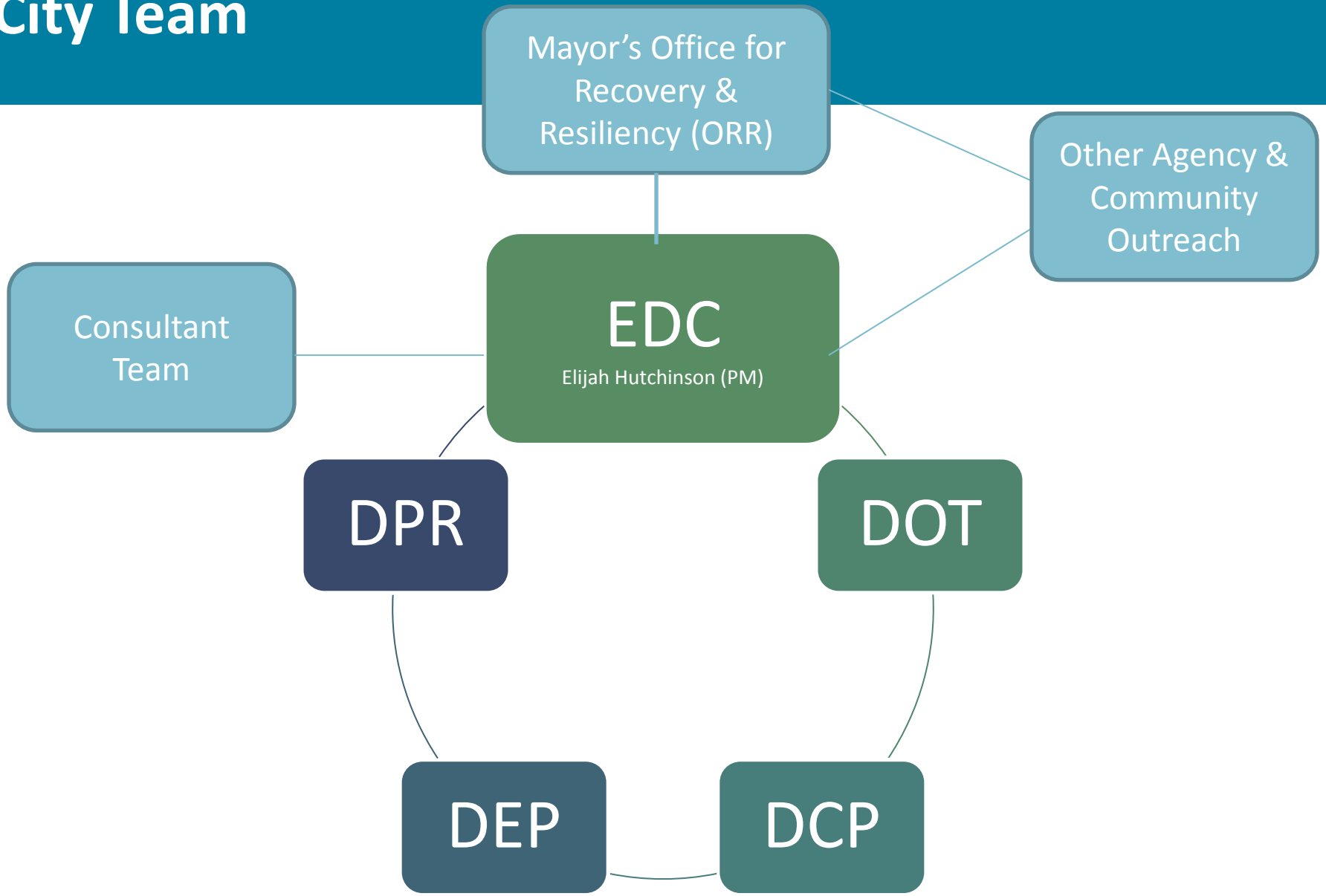
Questions to be answered:

1. Is the tidal barrier & wetlands concept **technically feasible**? What are the environmental, engineering, and regulatory challenges, and how could they be overcome?
2. Is this a **cost-effective** way of addressing the threats severe weather and sea level rise pose to Coney Island and Gravesend?
3. What measures can be advanced to provide **near-term flood protection**?
4. Are there opportunities to provide other **community benefits**, such as improved access to waterfront recreation, without compromising the primary goal of flood protection?
5. What do community stakeholders think about the Creek proposal and how it could **best address their needs**?





City Team


Mayor's Office for Recovery & Resiliency (ORR)
Other Agency & Community Outreach
Consultant Team
EDC
Elijah Hutchinson (PM)
DPR
DOT
DEP
DCP

HANDOUT A: Organizational Chart

NYCEDC

EDC Project Manager
Elijah Hutchinson

Ecological Council
Carter Strickland (H)
Ron Alevras (H)
Rob Steijn (A)
Piet Dircke (A)
Edgar Westerhof (A)
Walter Meyer, LEED AP (L)
Michael Feller (E)
Michael Ludwig (O)

Project Manager
Peter Glus, PE, BCEE (A)

Regulatory/Legal Advisor
David Paget (P)

Deputy Project Manager
Julie Stein, LEED AP BD+C, ENV SP (H)

Bi-Monthly Core Management Team

Ecology and Environment
Jennifer Curran (H)

Coastal Engineering and Hydrology
Stephen Famularo, PE (O)

Community Planning and Connections
Kim Mathews, ASLA (M)

Economics & Finance
Jamie Springer (R)

Outreach and Engagement
Steve Whitehouse (SW)

Permitting/NEPA
Sandy Collins (K)

Water Quality Assessment
Rich Isleib (H)

Soil & Sediment Quality
Robin Miller (H)

Ecological Assessment
Dave Yozzo, PhD (H)

Ecological Design
John Roebig, PhD (H)
Barbara Barnes, RLA LEED AP (H)

Barrier Design
Anwar Zahid (A)
Dale Berner, PhD, PE, FASCE(O)

Edge & Shoreline Treatments
Azure Dee Sleicher, PE (O)

Civil Engineering
Stu Appelbaum, PE (A)
Wes Jacobs, PE (A)
Bryan Jones, PE (H)

Hydrodynamics
Hugh Roberts, PE (A)
Roni Deitz (A)

Meteorological Conditions & Climate
Mike McMahon (H)

Drainage
Karen Franz (K)

Urban Design
Marc Sharifi (B)

Land Use Planning & Zoning
Allison Ruddock (K)

Open Space Planning Landscape Architecture
Kim Mathews, ASLA (M)

Transportation & Intermodal Access
Sam Schwartz (S)

Cost-benefit Analysis
Alex Stokes (R)

Market Analysis
Alex Stokes (R)

Funding & Financing Strategies
Kate Wittels (R)

Public Outreach & Participation
Steve Whitehouse (SW)

Interagency Communications
Kate Wittels (R)

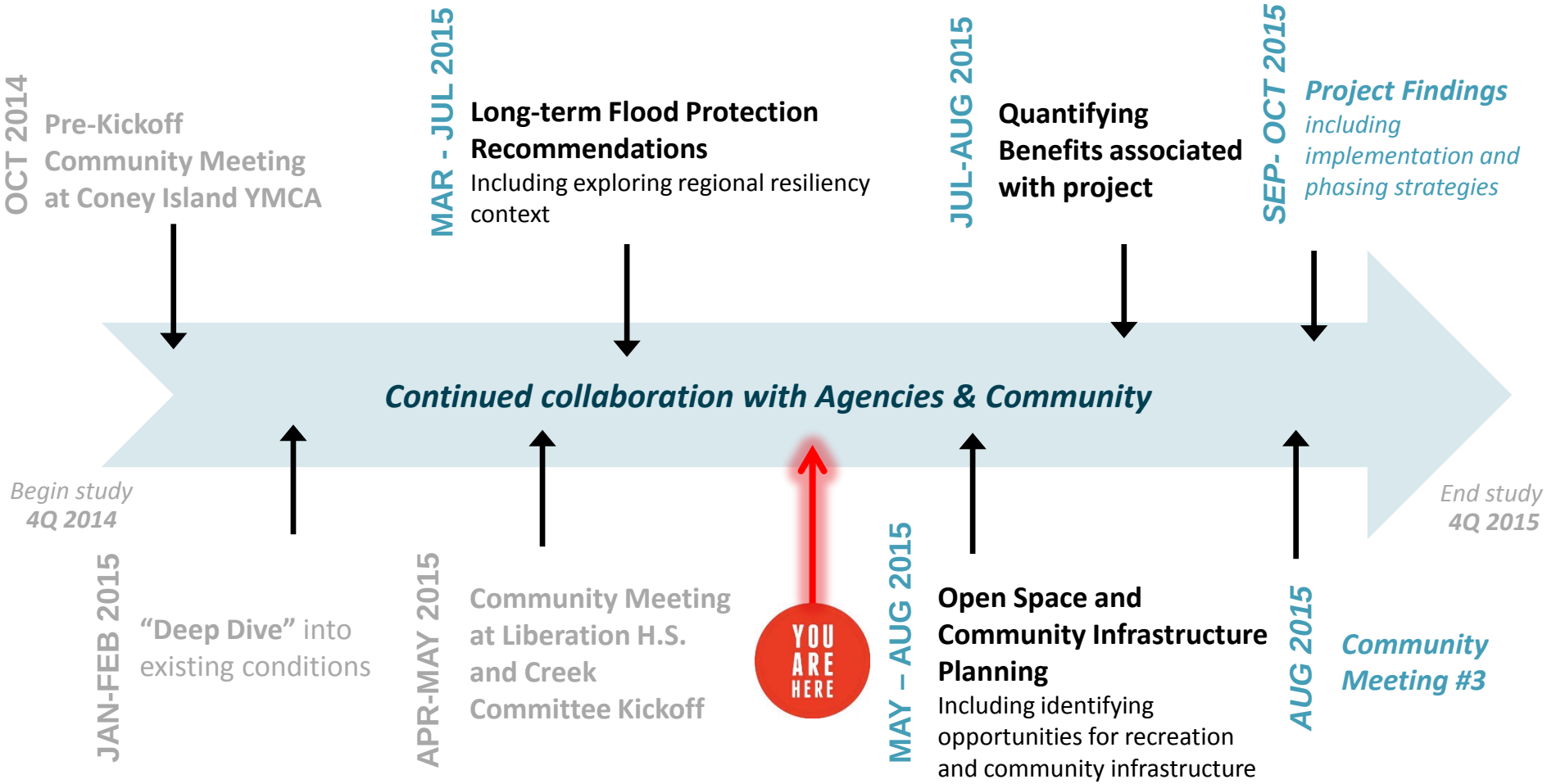
Permitting & Funding Agency Coordination
David Paget (P)

Document Manager
Ertan Akbas (A)

LEGEND: **A** – ARCADIS of New York, Inc. **H** – HDR, Inc. **O** - Ocean and Coastal Consultants, Inc. **K** - AKRF, Inc. **M** - Mathews Nielsen **L** – Local Office Landscape Architecture **E** – eDesign Dynamics, LLC
R – HR&A Advisors, Inc. **B** – Beyer Blinder Belle Architects and Planners, LLP **S** – Sam Schwartz Engineering, D.P.C. **P** – Sive, Paget & Riesel P.C. **SW** – Starr Whitehouse

ARCADIS | HDR

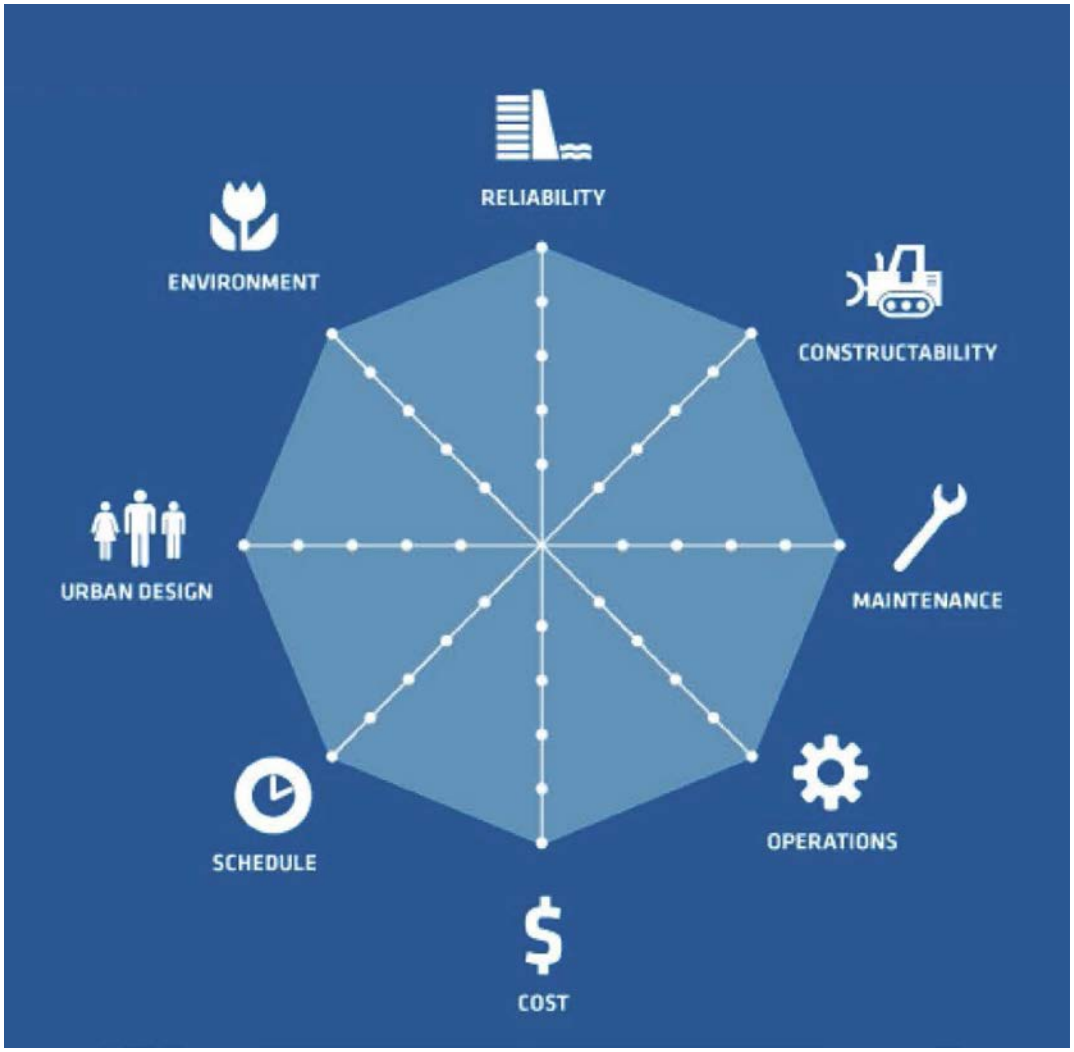
Study Milestones



Key Feedback & Principles

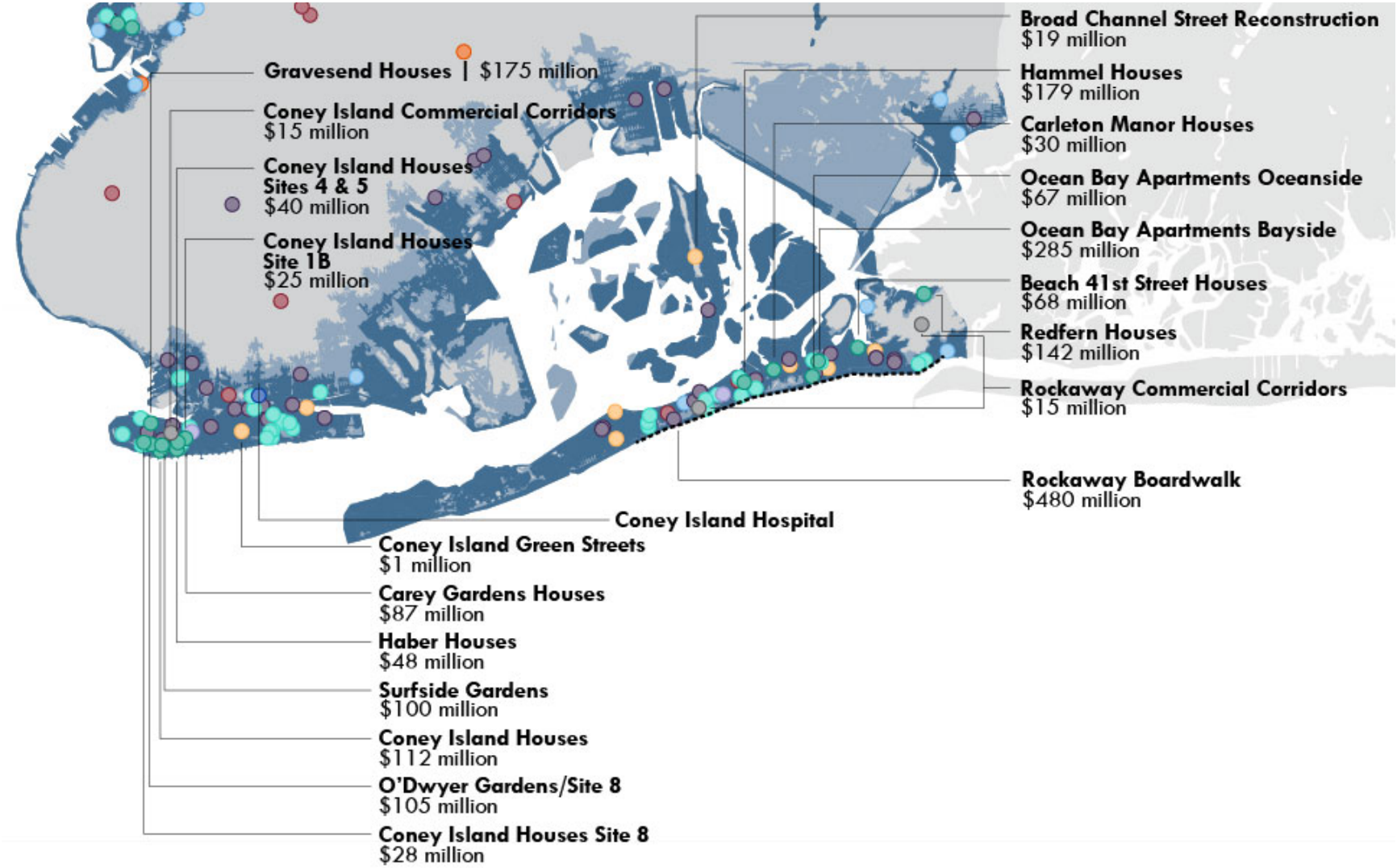
- DEC AND US ARMY CORPS OF ENGINEERS:
  - ***Water Quality:*** Post-barrier condition should avoid exacerbating existing hydrodynamic and water quality conditions
  - ***Sediment Quality:*** Sediment quality and the origins of materials currently found in the Creek need to be managed
  - ***Barrier Performance:*** Important to understand the sustainability of the long-term protection measures in terms of hydrodynamics and O&M
  - ***Ecological "success":*** Discussed a range of measures of project success, including habitat complexity, species richness, benthic functioning, sediment quality improvements and sustainability
  - ***Alternatives:*** Options evaluated for the long-term protection measure should include a non-barrier alternative

Key Considerations



Regional Resiliency Efforts

Regional Resiliency Efforts



Comprehensive Regional Planning

1. T-groins in Sea Gate will diminish erosion
2. Bulkheads in Sea Gate will reduce wave action
3. Coney Island Creek study will determine feasibility of tidal barrier and wetlands concept
4. 670,000 cubic yards of sand added to replenish Coney Island beaches

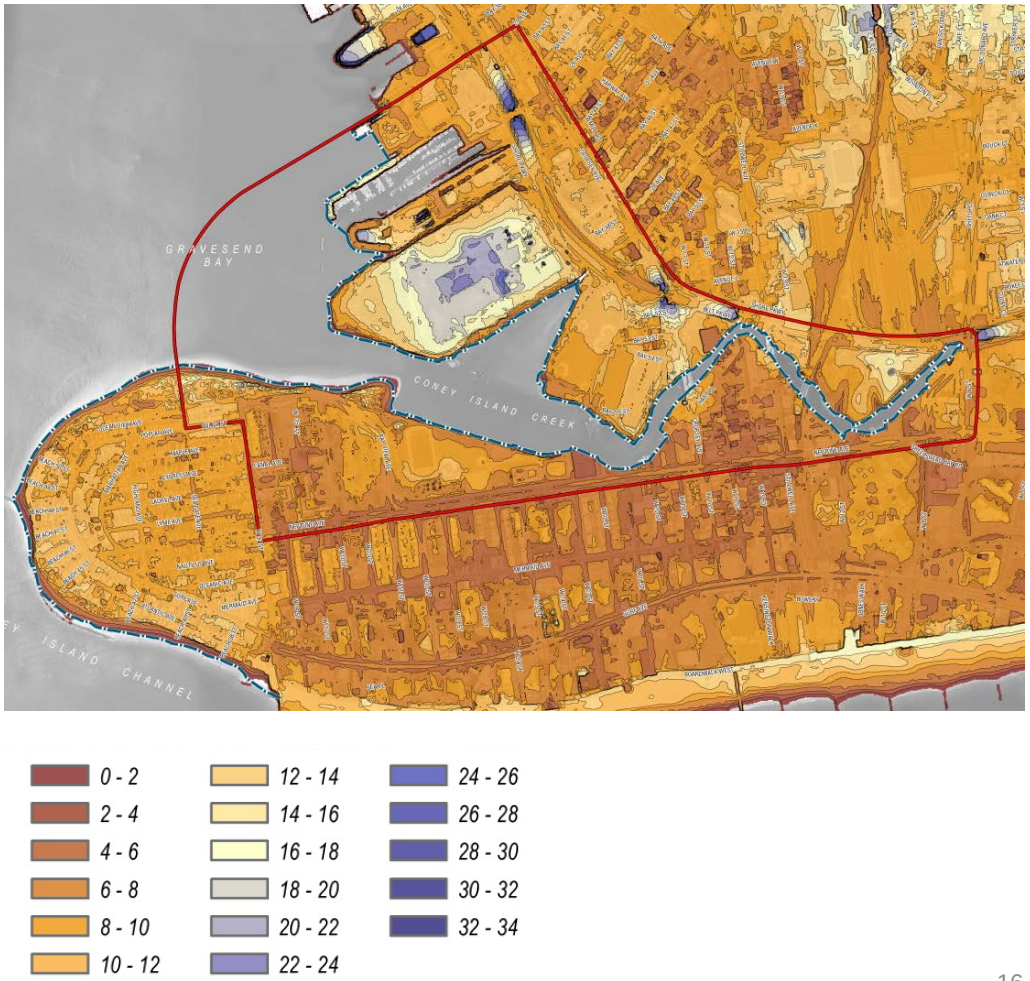
A Regional View

Coney Island Creek

Study Area – Coney Island Creek

- Shoreline is primarily low-lying
  - Majority of the shoreline between 6 and 9 feet NAVD88
  - Regions below 6 feet NAVD88 are easy entryways for flood waters during low- and high-frequency storm events
- Low-lying areas are often adjacent to important community facilities, including public schools, NYCHA, senior housing developments, and community clinics

Elevation (feet NAVD88)



Rapid Waterfront Inspection Assessment
Shoreline Types

- Shoreline configurations include:
  - Engineered structures:
    - Bulkhead
    - Revetment
  - Non-engineered shorelines
    - Debris-strewn embankments
    - “Homemade" bulkheads

Rapid Waterfront Inspection Assessment
Shoreline Condition

- Some engineered shorelines in "serious" condition along the Creek
- Target lowest lying and gravest engineered shorelines first

Long-term Flood Protection Recommendations

Design Elevation Components

Base Design → **Freeboard**

Design Storm Event

100-Year Storm Event

FEMA Storm Tide Elevation from Flood Insurance Studies

Sea Level Rise (SLR)

90th Percentile (High Estimate)

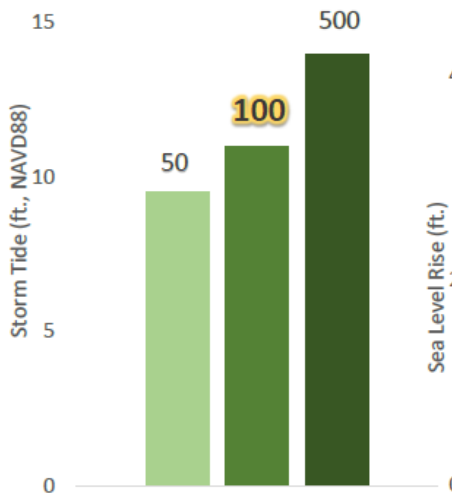
New York City Panel on Climate Change (NPCC) 2015- SLR Projection for 2050s

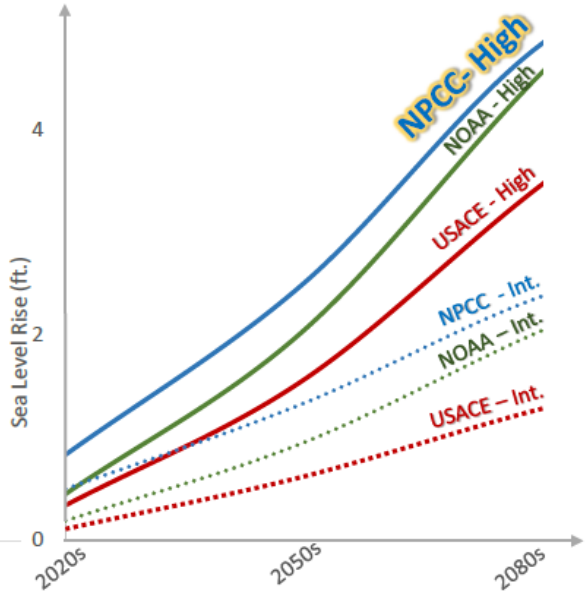
Wave Runup

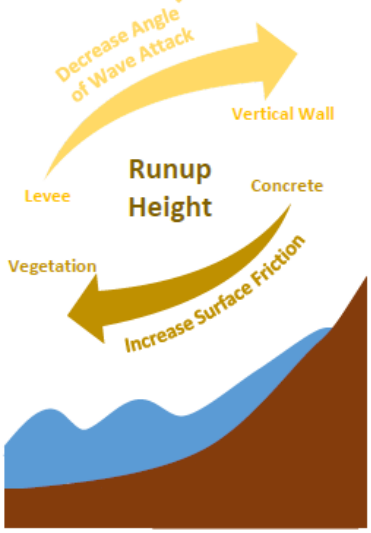
EurOtop Wave Overtopping of Sea Defense And Related Structures: Assessment Manual

Wave Overtopping

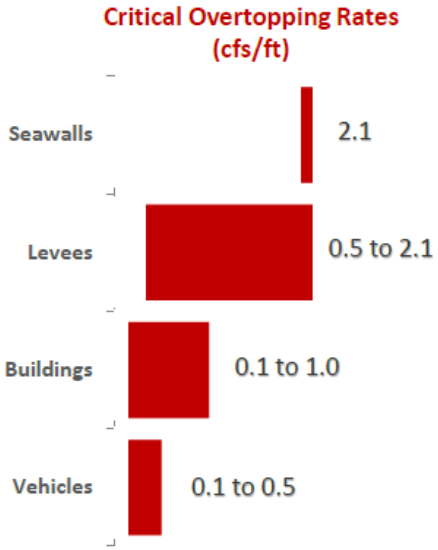
EurOtop Wave Overtopping of Sea Defense And Related Structures: Assessment Manual





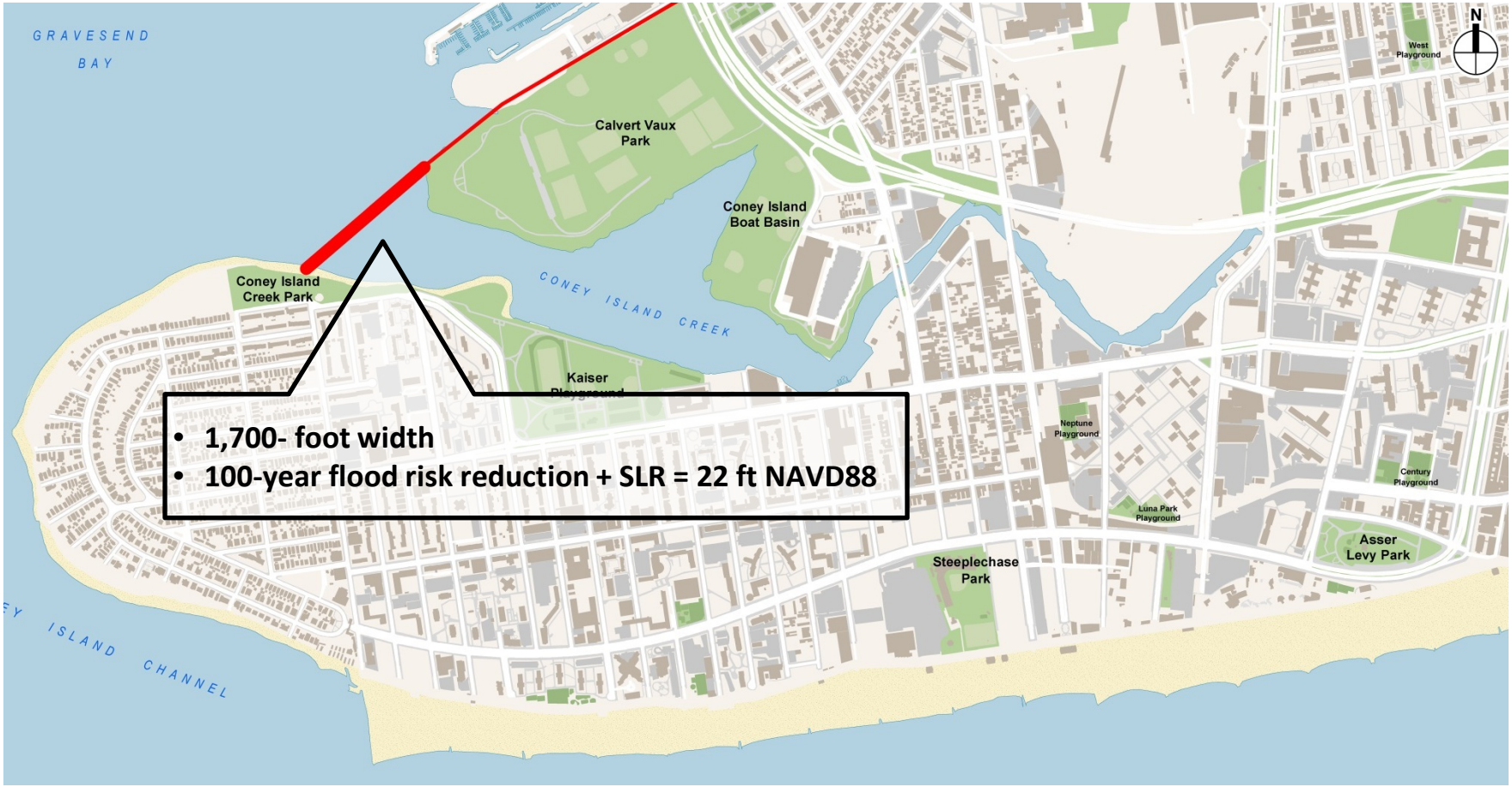


FEMA specifies runup criteria for levee certification



West Barrier Alignment

West Barrier Alignment



Flood Protection Strategies and Considerations

Feasibility Considerations:

- Flood Risk Reduction
- Ecological Enhancement / Environment
- Drainage
- Implementability / Feasibility

West Barrier

West Barrage + Wetlands

East Barrier

East Barrage + Wetlands

Perimeter Flood Protection

All Wetlands

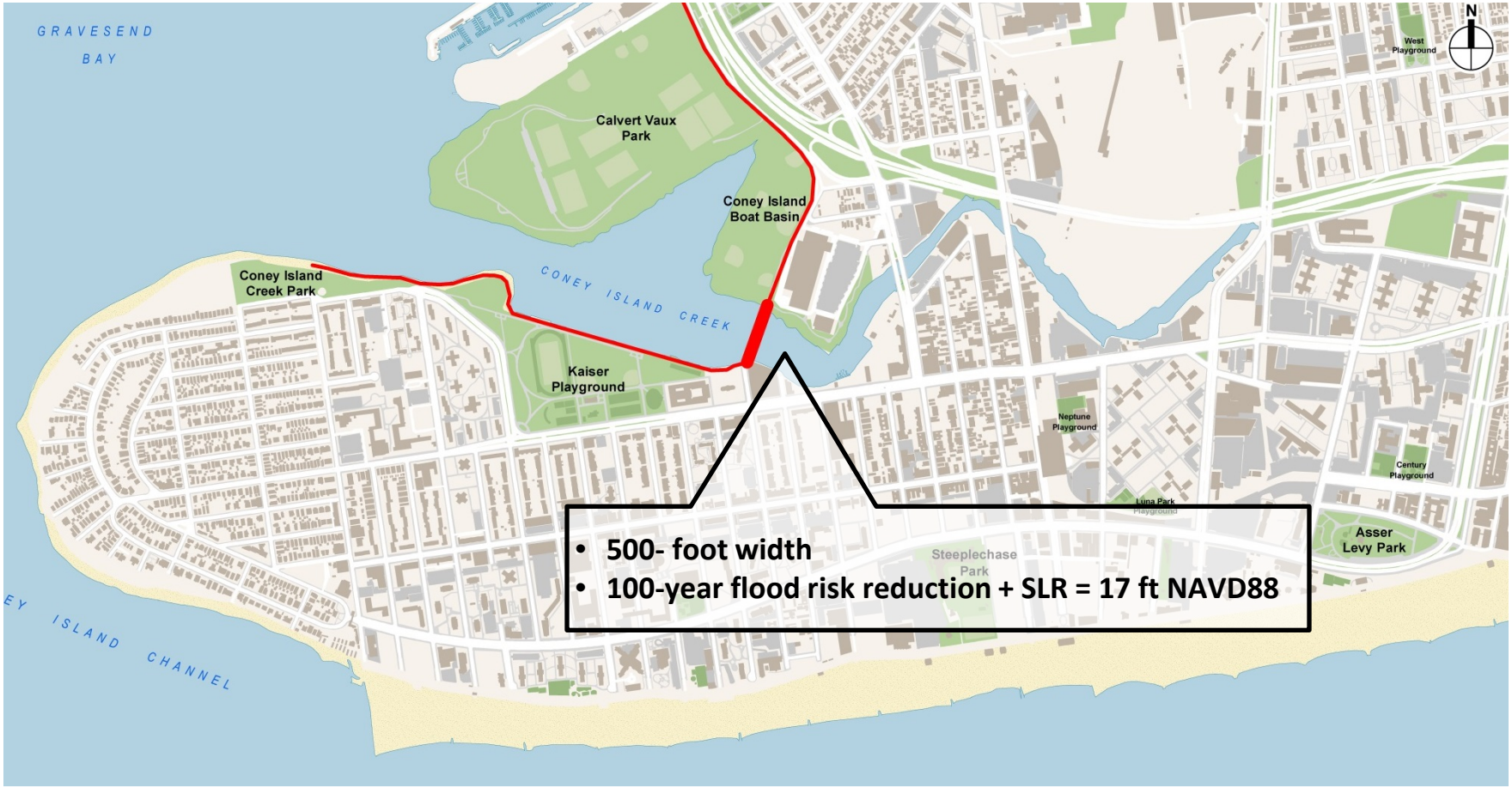
Flood Protection Strategies Comparison

Strategy	Flood Risk Reduction	Ecological Impact	Drainage	Implementation Feasibility
West Barrier				
West Barrage + Wetlands				
East Barrier				
East Barrage + Wetlands				
Perimeter Protection				
All Wetlands				

Flood Protection Strategies Comparison

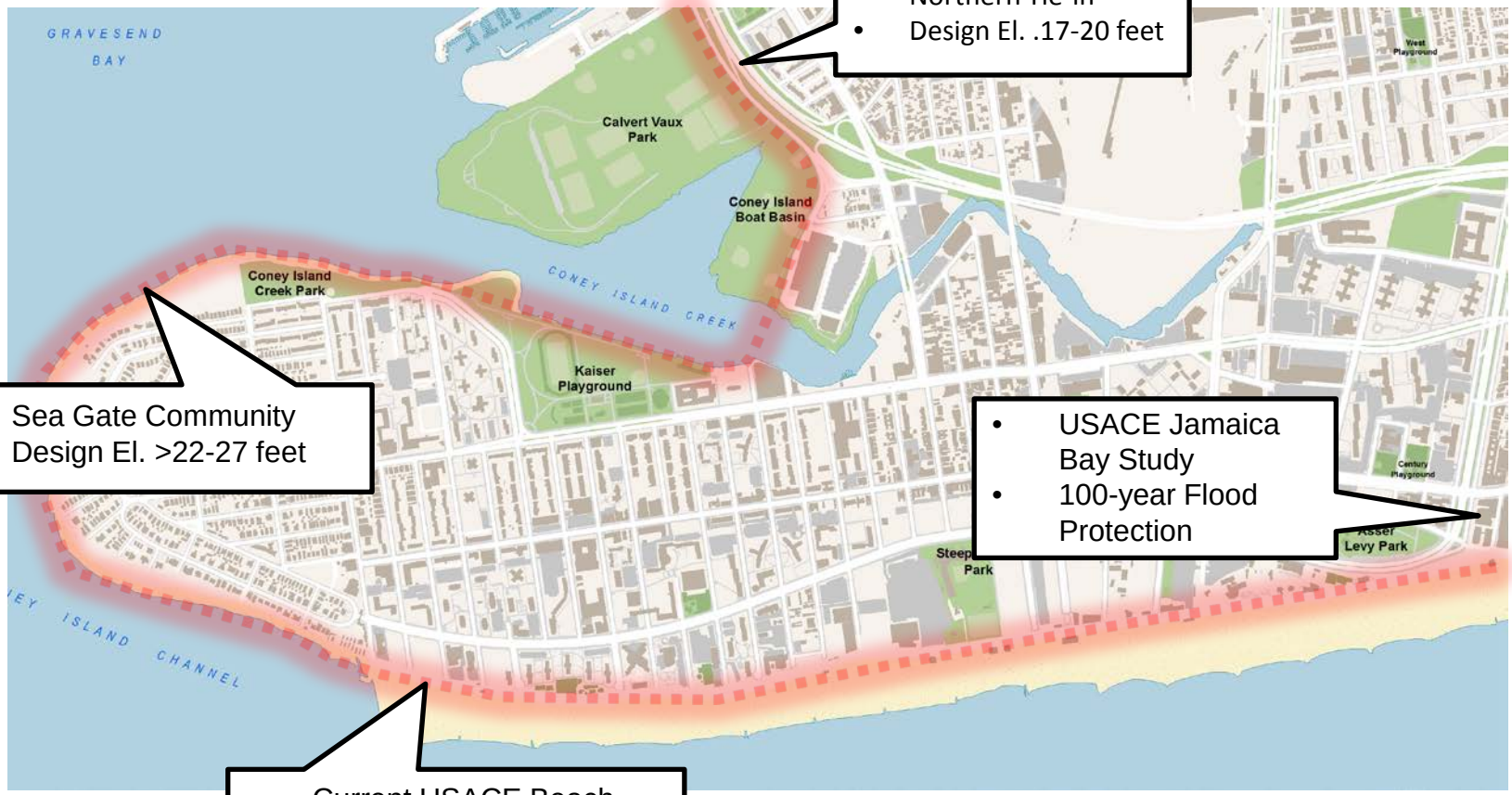
Strategy	Flood Risk Reduction	Ecological Impact	Drainage	Implementation Feasibility
West Barrier				
West Barrage + Wetlands				
East Barrier				
East Barrage + Wetlands				
Perimeter Protection				
All Wetlands				

East Barrier Alignment



- 500- foot width
- 100-year flood risk reduction + SLR = 17 ft NAVD88

Regional Resiliency Context
(100-Year Design Elevation 2050 SLR [NAVD88])



- Northern Tie-in
- Design El. .17-20 feet

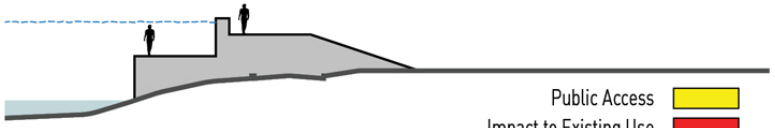
- Sea Gate Community
- Design El. >22-27 feet

- USACE Jamaica Bay Study
- 100-year Flood Protection

- Current USACE Beach Nourishment Project
- Design El. 12 feet

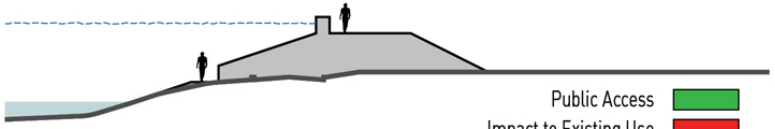
Flood Protection "Kit of Parts" for Creek

Vertical Wall



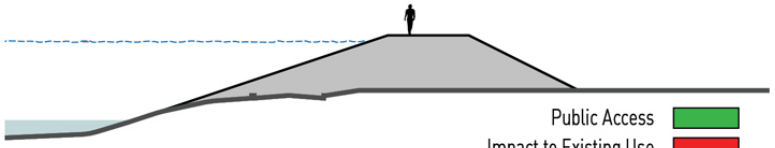
Terraced Vertical Wall

Vertical Structure with Promenade

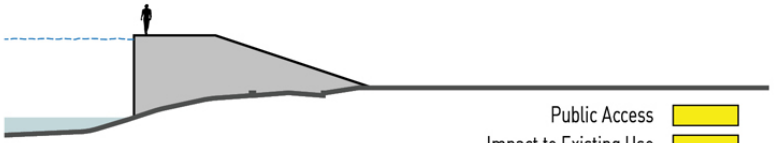


Terraced Levee

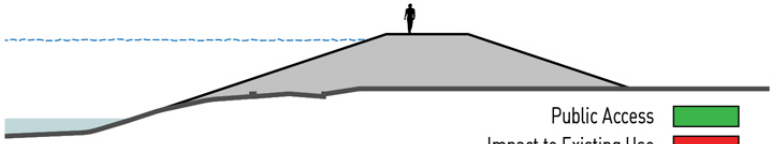
Vertical Bulkhead + Knee Wall / Sloped Back



Levee (2:1 Back Slope)



Vertical Bulkhead / Sloped Back

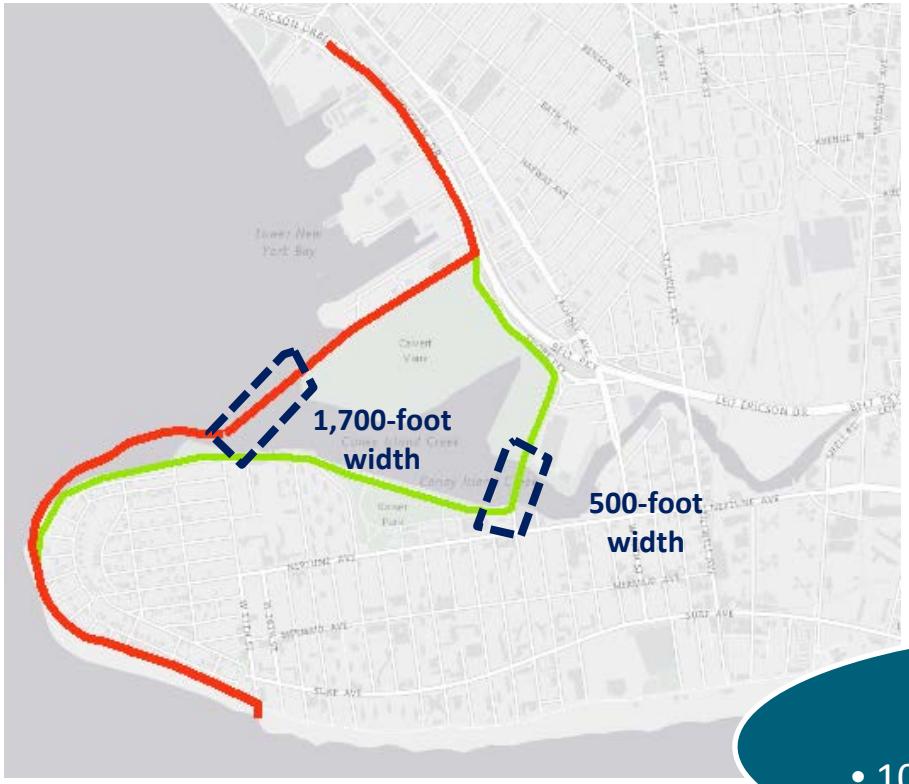


Levee (3:1 Back Slope)

Tidal Barrier Alignments

Level of Protection for in-water measures

Plan View



Bird's Eye View

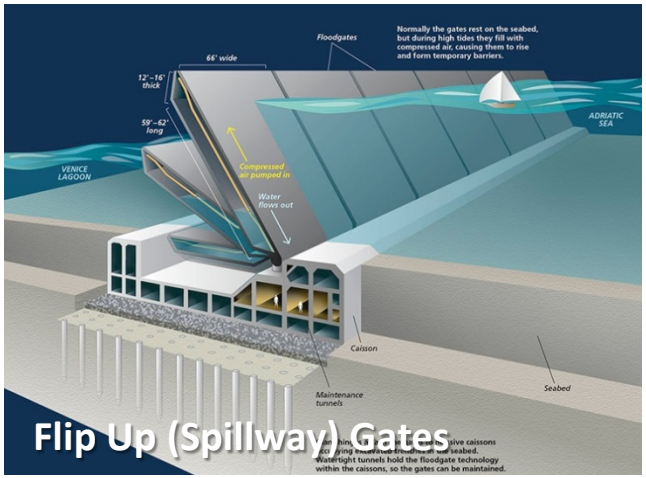
East Barrier:
- 500-foot width
- 100-year + SLR =17 ft NAVD88

West Barrier:
- 1,700-foot width
- 100-year + SLR = 22 ft NAVD88

Flood Protection Precedents

Rhode Island, USA

Venice, Italy



Marina Bay, Singapore

Thames River, UK

Long-Term Flood Protection
Opening Size

No Opening

- **Passive Flood Protection is most reliable**
- Most cost-effective
- Connection across Creek
- Minimal O&M
- Pumps needed for WQ

Narrow Opening

- Combination of passive and mechanical parts
- Cost-effective
- Connection across Creek is feasible with non-nav.
- O&M required to maintain and operate mechanical components
- Pumps needed for WQ

Wide Opening

- Most mechanical parts; least reliable
- Most expensive option
- Connection across Creek is feasible with non-nav.
- Most O&M required
- **Least impact on WQ and aquatic habitat**

FOR BOTH "WEST" AND "EAST" ALIGNMENTS

Ecological Considerations for Barrier

- Minimize impacts based on **opening size, footprint, alignment**
- East Alignment preferred:
  - **Decreases** substrate and habitat disturbance
  - **Avoids** existing aquatic habitat value
  - **Lessens** impact on water flow throughout Creek
  - Provides more opportunities for **restoration**

Ecological Opportunities for Programming

Maritime Forest / Shrubland

Beach / Dune

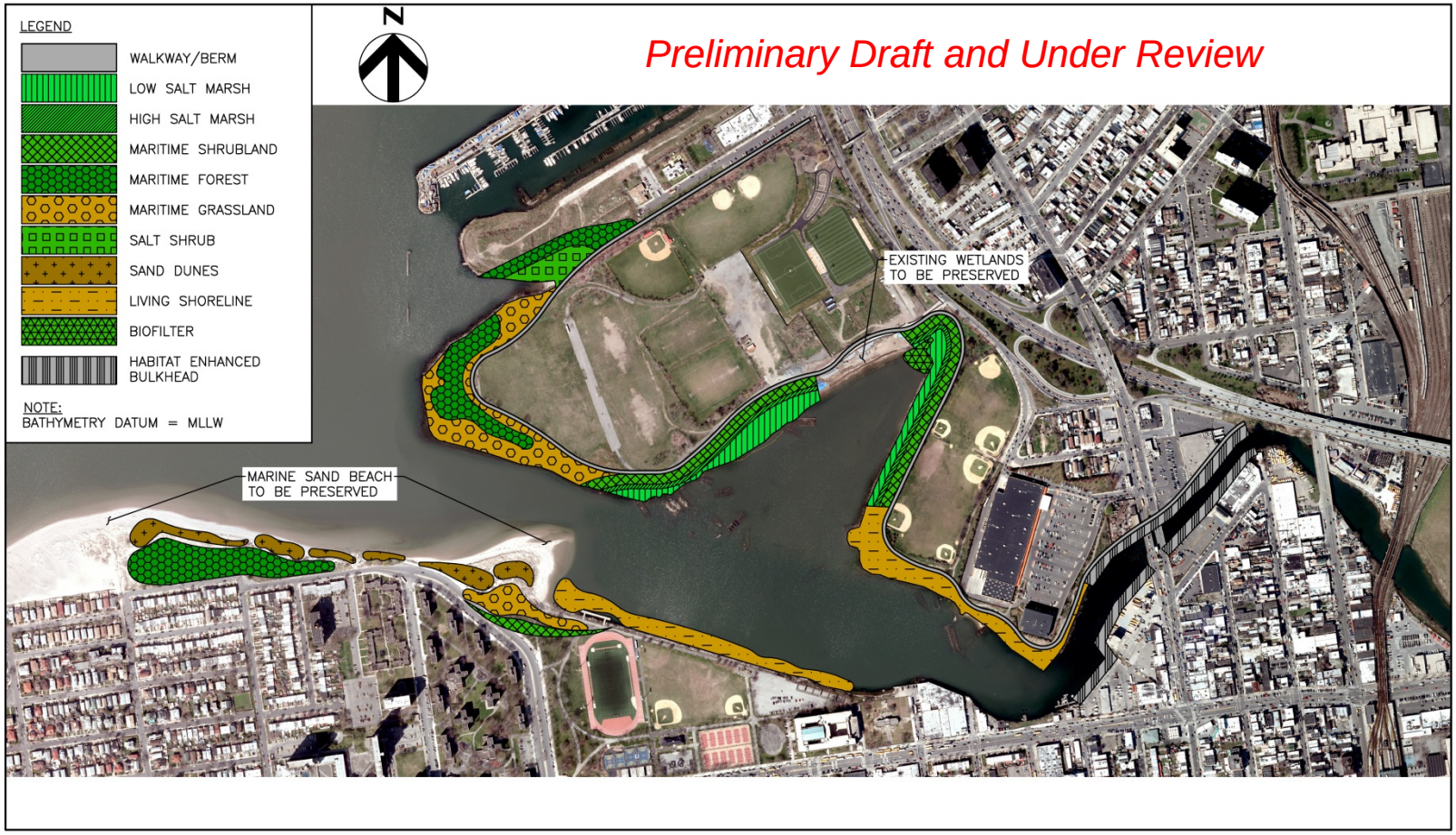
Fishing

Salt Marsh

Boat Launch

Passive Parkland

Ecological Enhancement Opportunities



0 500 1000
SCALE IN FEET

Water Quality in Coney Island Creek

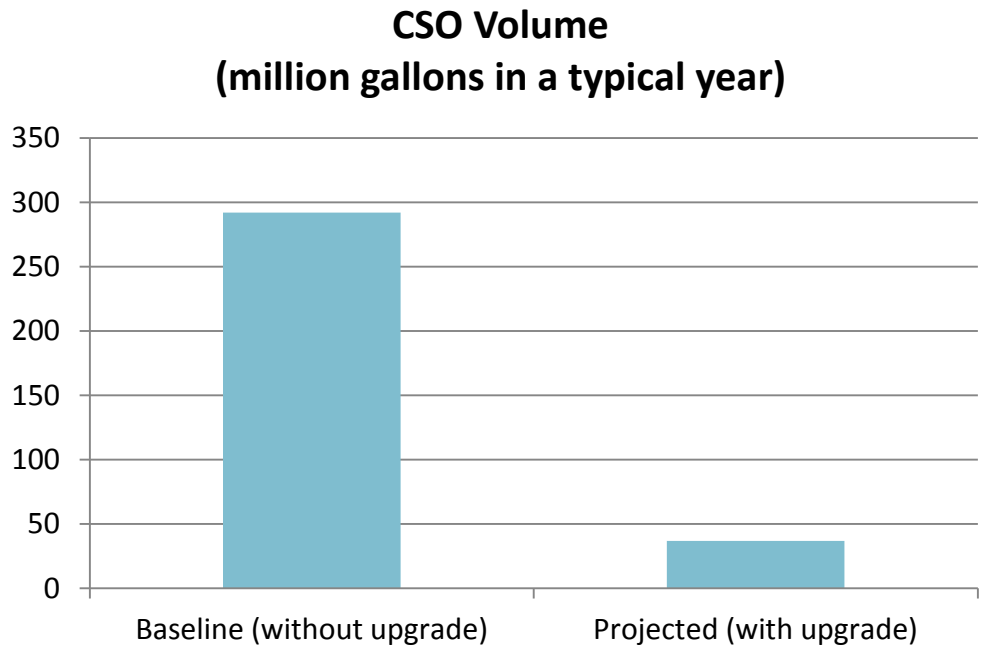
Water Quality Existing Conditions

- Overall water quality is limited by the confined nature of the Creek, low tidal flushing, background concentrations and illicit discharges
- Receiving waterbody for 1 CSO outfall and 10 stormwater outfalls operated by the City
- Designated as a Class I Waterbody by New York State best used for secondary contact recreation and fishing

Combined Sewer Overflow in Coney Island Creek

Water Quality Projected Conditions

- Completion of Avenue V Pumping Station Upgrade is expected to reduce CSO volumes by 87%
- Dissolved oxygen expected to improve



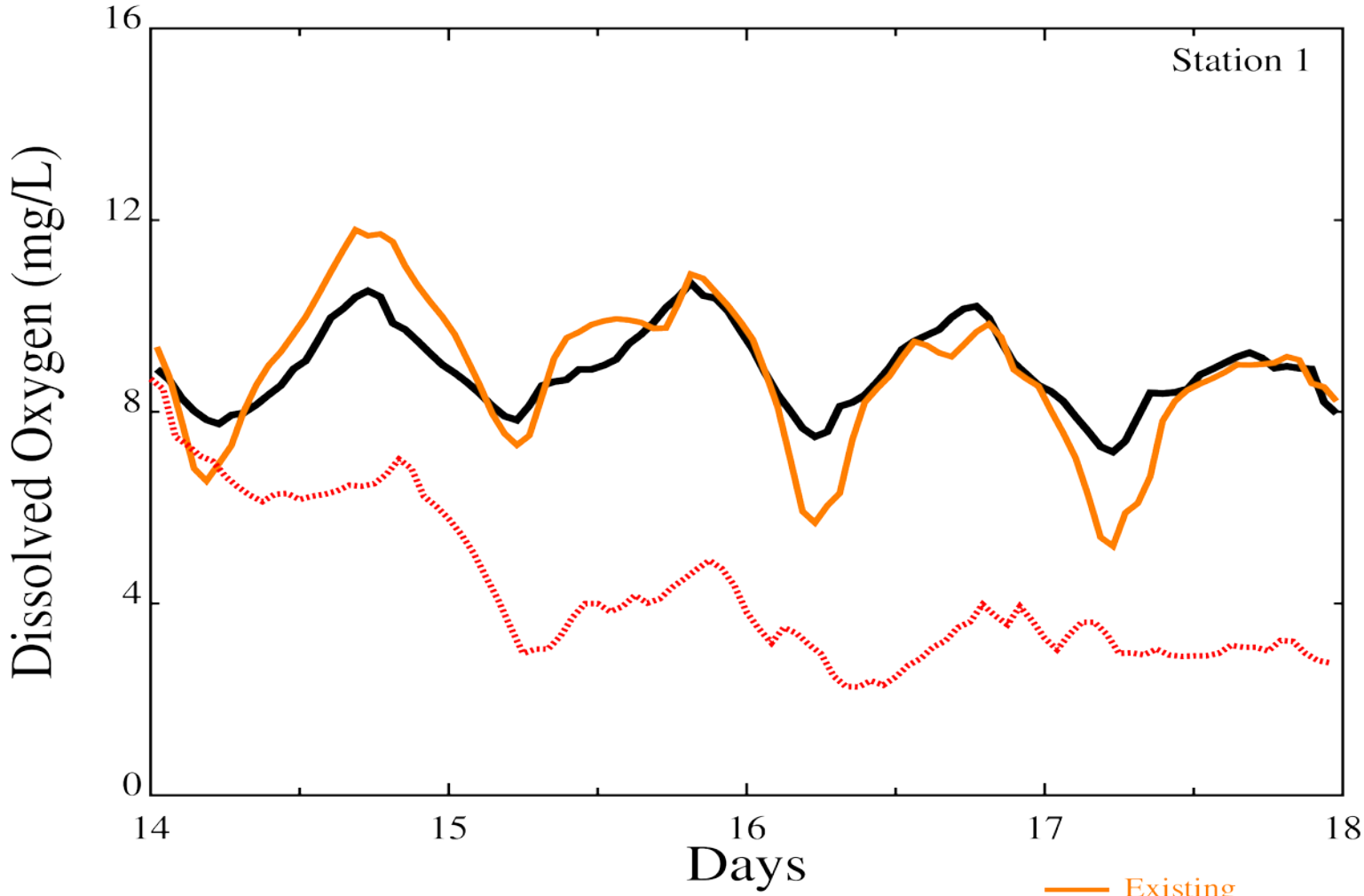
Water Quality Modeling Study Area

Water Quality Scenarios Modeled

- Tidal Elevations
- Tidal Flushing
- Salinity
- Bacteria
- Dissolved Oxygen

Water Quality Results – Dissolved Oxygen

Vertically Averaged Hourly Concentrations (mg/L)



Coney Island Creek

Water Quality Results – Dissolved Oxygen

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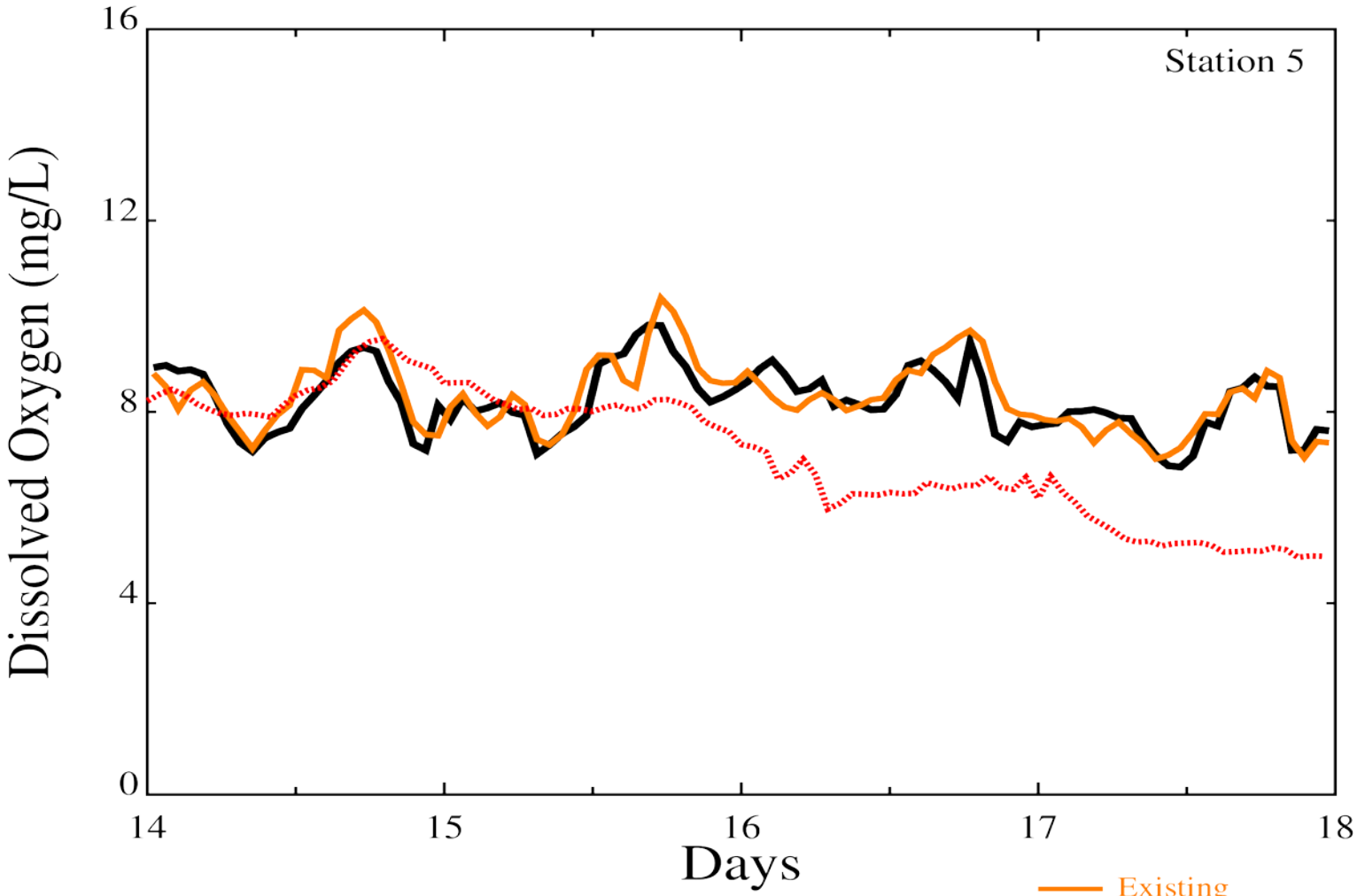


Coney Island Creek

Water Quality Modeling Results Summary

- Tidal flushing is restored after opening of barrier
- DO concentrations decrease rapidly when barrier is closed, but anticipated to rapidly increase with flushing once barrier is open
- Minimizing period when tidal barrier is closed would reduce adverse impacts on water quality
  - Tidal barrier would only be closed under emergency conditions and short duration testing periods
  - Water quality impacts are short term and mostly associated with wet weather discharges when barrier is closed

Water Quality and Ecology Recommendations

- Smaller footprint of barrier would reduce scale of disturbance to ecological resources
- Alignment within interior of Creek is beneficial as mouth of Creek is a more ecologically diverse habitat
  - Ecological conditions decreases further upstream in terms of the substrate, habitat, and relative values of aquatic life
- Wide gate opening is preferable to preserve tidal flushing
- Closing Creek off for wetland creation is not feasible due to drainage and storage considerations

COSTS AND BENEFITS

Parametric Costs for Measures in Coney Island

Flood Protection Measure	Cost per LF (2014 USD)
Bulkhead	8K – 10K
Revetment	4K- 5K
Floodwall	10K – 15K
Levee	4K – 6K
Living Shoreline	6K- 8K
In-water Barrier	300- 500K
Road Gates	10K

Quantifying the Benefits of Flood Protection

Who would be protected?

49,900
RESIDENTS

9,100
SENIORS

29,300
LOW-INCOME RESIDENTS

JOBS FOR
10,000
EMPLOYEES

What would be protected?

5,900
BUILDINGS

21,900
RESIDENTIAL UNITS

73
ACRES OF PARKS &OPEN SPACE

960
BUSINESSES

Outreach and Next Steps

Public Outreach To Date

- <u>April - Community Meeting #1</u>:
  Existing Conditions; Community Needs & Vision

- <u>May – Coney Creek Committee</u>:
  Shoreline Conditions Assessments; Water Quality modeling; Barrier Options; Outreach Planning

- <u>May 30th – It's My Estuary Day</u>:
  Participated in event at Kaiser Park celebrating the relaunch as a Catalyst Site with Partnership for Parks

- <u>July 18th – City of Water Day:</u>
  Participated in event at Kaiser Park to raise awareness about NYC's waterways

Public Outreach To Date

- <u>July 21st – Community Board 13 Committee Presentation:</u>
  Preliminary Findings; Upland Considerations; Outreach and Next Steps for Study

- <u>July 23rd – Coney Creek Committee</u>:
  Preliminary Findings; Upland Considerations; Outreach and Next Steps for Study; Community Meeting Planning

- <u>August 6th - Community Meeting #2:</u>
  Technical Analysis & Preliminary Recommendations; "Kit-of Parts"

Study Next Steps

→ Fall – Coney Creek Committee & Community meeting #3: Share Concept Design options; Refine Vision & Implementation Strategies

→ Advance short-term recommendations

→ Continue evaluation and case-making for long-term flood protection strategies

→ Coordinate study findings and recommendations with key City Agencies and other stakeholders including Coney Creek Committee

→ Refine ecological analyses in coordination with DEP, DEC and DPR

→ Advance Creek study in context of regional resiliency planning for City in coordination with Army Corps

Questions We've Heard

- Are the same areas protected if the barrier is East or West?
- Who would develop and construct the project?
- How is the barrier going to be operated and maintained?
- If the project were to be built, would the sediment contaminants get addressed?
- What role do wetlands or drainage play in the protection of Coney Island?
- Won't a barrier in Coney Island Creek impact tidal flushing?
- Does that red line indicate a wall?
- How do I continue to be involved in the study?

Activity: Break-Out Groups

Discussion: Tool-Kit of Parts for flood protection

Questions:

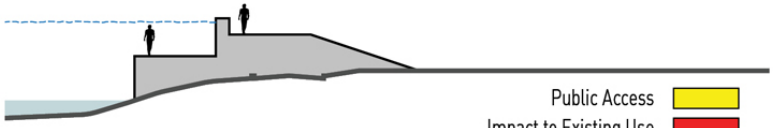
1. What additional questions/clarification does this group have or need?

2. Which tools from “tool kit” do you prefer and why?

3. What would be one key feature/programming element you’d like to see in a resilient Coney Island Creek

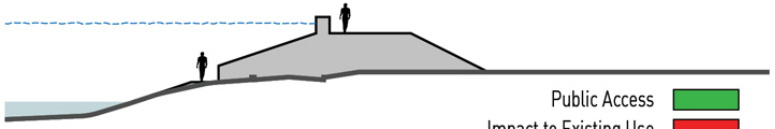
Activity: Flood Protection "Kit of Parts" for Creek

Vertical Wall



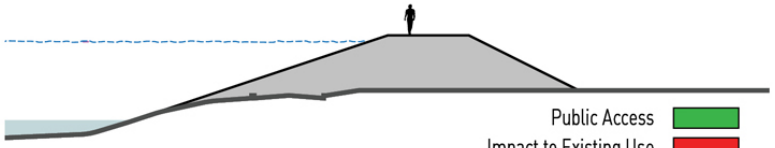
Terraced Vertical Wall

Vertical Structure with Promenade

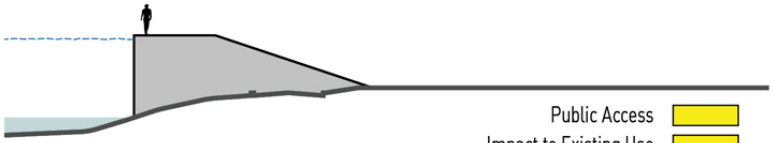


Terraced Levee

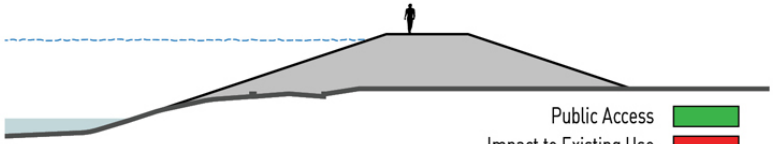
Vertical Bulkhead + Knee Wall / Sloped Back



Levee (2:1 Back Slope)



Vertical Bulkhead / Sloped Back



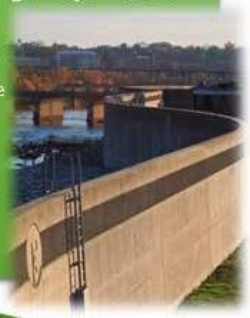
Levee (3:1 Back Slope)

Coastal Structures for Flood Protection

Flood Protection Measures

Floodwalls

- A vertical wall constructed of masonry or concrete to prevent flooding of adjacent land
- Typically does not require a lot of land to implement
- A reinforced concrete core is the principal structural element of the wall
- They can also be aesthetically altered with brick or other elements



Levees

- A man-made mound comprised of compacted soil to hold back water during storm events
- Typically take up more land to implement as wide cross section
- Can be designed to have pedestrian walkways or vehicular access on the crest (the top)

Bulkheads

- A vertical structure designed to protect upland adjacent land from the damages of wave action
- Typically does not require a lot of land to implement
- Also can be used to reinforce or prevent sliding of the soil/land
- Often made of steel, concrete, or timber

Breakwaters

- A man-made, offshore structure aligned parallel to the shore to help dissipate wave energy before the waves come onshore
- While it can help minimize wave heights, it would need to be used in conjunction with other measures to ensure flood protection
- Potential to add to aquatic habitat

Coastal Wetlands

- Comprised of low and high marsh, in large enough quantities they can help dissipate wave energy before the waves come onshore
- Also control erosion of the shoreline and function to capture pollutants in runoff during smaller rainfall events
- They serve as living spaces for birds and fish

Floodgate Typologies for Flood Protection

Floodgates

Tainter Gate

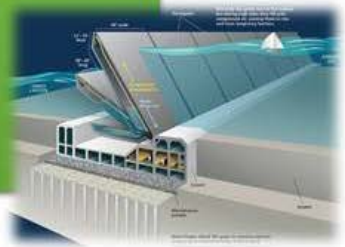
- Radial arm flood gate that controls water flow in a body of water
- Can be opened and closed quickly prior to a storm event
- Remains open during normal weather conditions
- **Known for its use in: Rhode Island**

Barge Gate

- A barge structure is placed into a structural frame prior to a storm event
- Allows the Creek to remain completely open to tidal exchange and navigation when not in use
- Requires manual labor to place barge
- **Known for its use in: New Orleans**

Flip-Up/Buoyant Gate

- Series of bottom-hinged, water-filled gates that are stored underwater and can be raised in the event of a storm
- Can be opened and closed quickly prior to a storm event
- Does not obstruct views, but also difficult to maintain under water
- Not a proven technology in regions where tide gets very high
- **Known for use in: Venice, Italy**



Sector Gate

- Consists of two "leaves" that join at the center of the structure
- Can be opened and closed quickly prior to a storm event
- Require a large on-land footprint in order to store the leaves when not in use
- **Known for use in: The Netherlands**

Questions?