Rebuild by Design
▪ Resist ▪ Delay ▪ Store ▪ Discharge
Hudson River
2018 Association of Floodplain Managers Conference
The NJDEP Team

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NJDEP, RBD Environmental Team Leader
Key Stakeholders

City of Hoboken, NJ

City of Jersey City, NJ

Town of Weehawken, NJ

New Jersey Transit

Hudson County, NJ

North Hudson Sewerage Authority
<table>
<thead>
<tr>
<th>The DEWBERRY Team</th>
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<tbody>
<tr>
<td><strong>Dewberry</strong></td>
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<tr>
<td>PRIME CONSULTANT (FEASIBILITY ENGINEERING AND EIS)</td>
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<td>OMA SCAPE</td>
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<tr>
<td>ARCHITECTURE AND URBAN DESIGN</td>
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<td><strong>Boswell Engineering</strong></td>
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<td>LANDSCAPE ARCHITECTURE</td>
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<td><strong>Econsult Solutions</strong></td>
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<td>WATERFRONT INSPECTION</td>
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<td><strong>Fitzgerald &amp; Halliday, Inc.</strong></td>
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<td>ECONOMIC ANALYSIS</td>
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<td>Paul Carpenter Associates, Inc.</td>
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<td>PUBLIC ENGAGEMENT</td>
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<td>AIR QUALITY AND NOISE CONSULTANTS</td>
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<td><strong>CRAIG Drilling Companies, Inc.</strong></td>
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<td>GEOTECHNICAL BORING</td>
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Study Area

Study Area Characteristics

- City of Hoboken and parts of Jersey City and Weehawken

- Size – 1.8 square miles

- Population – 50,000

- Major transportation hub

- High residential density population

- Active recreational waterfront

- Aging infrastructure
WHY DO WE NEED THE PROJECT?

The project area is at risk from storm surge events and heavy rainfall that results in flooding.
Flooding Risks

COASTAL STORM SURGE (HURRICANE SANDY - 2012)

RAINFALL (HURRICANE IRENE - 2011)
Rebuild by Design Vision

A Comprehensive Urban Water Strategy

RESIST

DELAY

STORE

DISCHARGE
Major Constraints

Active Waterfront

Roadways and Bridges

Buildings

Public Safety
Coastal Storm Surge Model Simulation

1% Annual Chance Simulation (100-year)

- Weehawken Cove
- Hoboken Terminal
- Hudson River
- Hoboken
- Jersey City
- Long Slip Canal Filled
### Three “Resist” Alternatives

#### Alternative Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Alt. 1</th>
<th>Alt. 2</th>
<th>Alt. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>3 miles</td>
<td>1.8 miles</td>
<td>1.7 miles</td>
</tr>
<tr>
<td>No. of Gates</td>
<td>29-31</td>
<td>21-25</td>
<td>19-23</td>
</tr>
<tr>
<td>Population Benefits</td>
<td>98%</td>
<td>86%</td>
<td>85%</td>
</tr>
<tr>
<td>Benefit-Cost Ratio</td>
<td>2.21</td>
<td>3.83</td>
<td>3.94</td>
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</table>
## Preferred Alternative

<table>
<thead>
<tr>
<th>ALT-3</th>
<th></th>
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<tbody>
<tr>
<td>- Provides a high degree of flood risk reduction while balancing public input, cost and urban amenities</td>
<td></td>
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<tr>
<td>- Can be constructed with available funds</td>
<td></td>
</tr>
<tr>
<td>- Significantly reduced impact to built environment compared to ALT-1; slightly lower than ALT-2</td>
<td></td>
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<tr>
<td>- Lowest annual maintenance cost</td>
<td></td>
</tr>
<tr>
<td>- Fewest number of gates</td>
<td></td>
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<tr>
<td>- Least impact to waterfront access and views</td>
<td></td>
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</table>
Coastal Storm Surge Model Simulation

1% Annual Chance (100-Year)

Without Project

With Project
Recommended “Resist” Alternative
Existing Drainage System
Ongoing or completed projects

- **H1** Wet Weather Pump Station (Observer Highway)
- **H 5** Wet Weather Pump Station (11th Street)
- City Hall Green Infrastructure Projects
- Southwest Resiliency Park (Block 12)
- Washington Street Rain Gardens

* NAA – No Action Alternative
Delay, Store, Discharge Alternative

Proposed underground detention facilities with green/open space on ground surface with discharge features such as pumps to manage rainfall runoff volume

ROW Green/Gray Infrastructure Practices

- Total of 61 sites to manage street drainage for approx. 13 acres

BASF site

- Manages rainfall runoff for approx. 55 acres

NJ Transit site

- Manages rainfall runoff for approx. 15 acres

Block 10 site

- Manages rainfall runoff for approx. 8 acres

TOTAL BENEFIT – COST RATIO : 2.35
ROW Green and Gray Potential Locations

400+ Potential Locations Identified
Constraints Screening Reduced to 61 Locations
ROW Green and Gray Typical Condition

- AVAILABLE SOIL
- UNDERGROUND TANK
- SEWER LINE
- 1,500 TO 7,000 GAL
- 2'00"
- VARIES
- WEIR WALL

REBUILD BY DESIGN HUDSON RIVER: RESIST DELAY STORE DISCHARGE

Dewberry State of New Jersey Department of Environmental Protection
Parcel Based Stormwater Management System

- Requires separation of storm and sewer system
- Use of a new High Level Storm System to capture and convey rainfall runoff
- Integrates with community benefit features
Stormwater Modeling - Input and Output Parameters

Used FEMA accepted Danish Hydraulic Institute (DHI) MIKE URBAN Model

Major Stormwater Model Inputs
- Pipe, Manholes, Pumps
- Topography
- Rainfall
- DSD Alternatives

MIKE Urban Stormwater Model Simulation Engine
- Flooded Areas
- Animations
- Time Series Plots
- Flow Volumes
Example of High Level Storm Conveyance System

- Block Level Scale H&H 2-D Model
- 1500 + Catchments and 850 + Pipes
- Includes regulators and pumps
- Simulations with Low and High Tide
Comparison of Flooding Areas with 5-Year/Low Tide Baseline Conditions (NAA) and Proposed DSD Alternative.
Comparison of Flooding Areas with 5-Year/High Tide

Baseline Conditions (NAA)

- H5 Pump Station
- Washington Street Rain Gardens
- City Hall GI Project
- Southwest Park
- H1 Pump Station

Proposed DSD Alternative

- BASF Site
- NJ Transit Site
- Block 10 Site

LEGEND

- WET WEATHER PUMP STATION
- DRAINAGE AREA
- ROW GREEN / GREY INFRASTRUCTURE
- ESTIMATED FLOODED AREA
Innovative Integrated Coastal and Stormwater Model Example

Without Project (100-year Coastal Storm Surge)

With Resist Project (100-year Rain + Surge)

Hoboken

Coastal Resist Barrier

GREEN DOTS – MANHOLES
# Model Simulation Results Summary

<table>
<thead>
<tr>
<th>Rainfall Return Period</th>
<th>Tidal Condition</th>
<th>Flooded Areas (acres)</th>
<th>Percent Reduction in Flooded Areas</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>NAA</td>
<td>DSD Alternative</td>
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<tr>
<td>20% annual chance (5-year)</td>
<td>Low</td>
<td>25.5</td>
<td>4.8</td>
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<td></td>
<td>High</td>
<td>48.4</td>
<td>13.0</td>
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<tr>
<td>10% annual chance (10-year)</td>
<td>Low</td>
<td>35.5</td>
<td>10.2</td>
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<td>High</td>
<td>59.7</td>
<td>26.0</td>
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<td>4% annual chance (25-year)</td>
<td>Low</td>
<td>64.5</td>
<td>26.8</td>
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<td></td>
<td>High</td>
<td>95.9</td>
<td>49.1</td>
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<tr>
<td>2% annual chance (50-year)</td>
<td>Low</td>
<td>95.1</td>
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<td>High</td>
<td>122.1</td>
<td>69.9</td>
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<td>1% annual chance (100-year)</td>
<td>Low</td>
<td>147.5</td>
<td>91.7</td>
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<tr>
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<td>High</td>
<td>148.6</td>
<td>93.4</td>
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Flood Risk Reduction Benefits Dependent of Tidal Condition
ROW Green and Gray Typical Condition