Utility Considerations with the Proposed NJ Back Bays Storm Surge Barrier Systems

NJWEA AAEES Workshop
9th May 2022
Charles Schelpe – Jacobs Global Technology Lead - Flood Infrastructure
Lessons Learned - Multiple Threats Occur Simultaneously

Water Elevation at Tip of Manhattan

Mantoloking
USACE North Atlantic Coast Comprehensive Study (NACCS)

NACCS:

- Addresses the legislative direction for a comprehensive plan to address vulnerable coastal communities
- Formalized and consistent approach/framework for more detailed, site-specific coastal evaluations
- Integrates state-of-the-science techniques and collaboration
- Equips and links a broad audience and all levels of government with data, tools, and other stakeholders to make INFORMED coastal risk management decisions

NACCS is Not:

- A decision document authorizing design and construction
- A NEPA document evaluating impacts of any specific solution
- A USACE-only application

Reference: www.nad.usace.army.mil/CompStudy
USACE New Jersey Back Bays Study - Tentatively Selected Plan

Tentatively Selected Plan Includes:

- Storm surge barriers (SSB) or inlet closures at Manasquan Inlet, Barnegat Inlet, and Great Egg Harbor Inlet
- Cross-bay barriers (CBB) or interior bay closures at Absecon Boulevard, and southern Ocean City; and
- Elevation and floodproofing of 18,800 structures.
- Perimeter measures including floodwalls, levees and seawalls which tie SSBs and CBBs into adjacent higher ground.

Projected Costs:

- Construction cost = $16.07B
- Annual Operation, Maintenance, Repair, Replacement and Rehabilitation = $196M

Schedule:

- Construction start ~2030

What Does This Mean To Utilities in the Back Bays Planning Area?

- What are the threats and risks, where, and when?
- How much risk tolerance is acceptable?
- What has been done and what remains to be done to address the risks?

**To do?**

Assess likelihood and consequences of impacts over time w/o and w/ the Back Bays plan implementation in mind

Consequence categories based on types of loss that utilities may experience

- Business Impacts
- Equipment Damage
- Source/Receiving Water Impacts
- Environmental Impacts

Monetize Levels of Consequence

Consider Time to Implementation – what may happen from now to then?

What’s the Backup Plan?
Storm Surge Increasing in Height and Space with Sea Level Rise

Sea Level Trends at Atlantic City

Source: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8534720
Projected Sea Level Rise at Atlantic City

NJ Storm Surge Barrier System Considerations
What is a Storm Surge Barrier System?
Where are the Proposed Storm Surge Barriers in New Jersey?

- Manasquan Inlet
- Barnegat Inlet
- Great Egg Harbor Inlet
What Utility Infrastructure Could be Affected?

- Water & wastewater treatment plants
- Pump stations
- Sewer collection systems
- Water distribution systems
- Stormwater systems
- Power stations, sub-stations
- Access routes
- Evacuation routes
What Utilities Will Be Behind the Barriers?
What Do Utilities Need to Consider?

- Closure level of the system
- Frequency of closure
- Navigation requirements
- Environmental requirements
- Climate change/ sea level rise
- Time for a barrier system implementation
- Water quality
- Secondary surge
- Upstream flood storage
- Opportunities – service crossings
Case Study:
St. Petersburg Barrier System
Location

Neva Bay

Gulf of Finland
The Barrier System

- Integrated flood protection system
  - Barrier embankment
  - Main navigation opening (C1)
  - Secondary navigation opening (C2)
  - Sea sluice structures (B1-6)
  - Control center building
Main Navigation Opening (C1)

- Length: 273 m
- Navigation width 200 m (660 ft)
- Depth : 16 m (0 ft)
- 2 Floating sector gates
- Tunnel under the structure
- Floating sector gate leaf: weight 2938 tons, length 120 m, height 22 m
- Gate arms: weight 1800 tons, length 115.5 m, max. width 58.7 m, height: 3.1 to 7.7 m
Secondary Navigation Opening (C2) - Design Aspects

- Navigation width 117.3m (391 ft)
- Navigation depth: 7m (23 ft)
- Height: 11.6m (39 ft)
- Gate Weight: 2377t
- Steel gate stored below concrete floor
- Draw bridge (16m above water, can be raised by additional 9m in 3 minutes)
6 complexes of radial gates (64 gates, 24m (80 ft) wide)
Each complex about 250m wide with 10 gates (deep and shallow water complexes)
Threshold depth: 2.5 / 5m
Gate height: 4.5 / 6.5m
Gate weight: 280 – 305t
Road bridge on top
Weight to penetrate ice
Embankment - Design Aspects

- Earth embankments (top level 6.8m BC)
- 23.4km (14.5 miles)
- Crest width 36m
- Base width 100 – 160m
- Rock Armor (dynamic loading design based on accepting certain level of maintenance)
Closure Scenarios

Closure scenarios for whole barrier system to get insight into hydraulic design conditions

Figure 2: Closing sequence I

Figure 3: Closing sequence II

Figure 4: Closing sequence III
**Operational Closure**

Requirements Set by the Designer:

- **pre-warning**: 1 day before flood waves arrives in Kronstadt → alert responsible organisations

- **early warning**: 8 hours ahead → announce Alert State 1, start preparations for closing (pre-heating, clearing ice, testing systems)

- **final warning**: 2 hours ahead → decision to close, announce Alert State 0, stop navigation, start closing procedure (press the button)
Operational Closure

Operational Forecast System:
- Use of accurate and most recent meteorological data and predictions
- Regular refreshment of predictions with measurements (6-hour cycle)
- Reliable also in winter (ice cover)
- Prediction of water levels (accuracy of final prediction: 10 – 20 cm)
- Prediction of wave heights
- Detailed prediction of effects of closing the gates, and effects of wind on water levels in Neva Bay

Decision Support System:
- Built around the forecast system
- Objectives:
  - to determine optimum timing and sequence of closing and opening the gates
  - to keep water levels in SPB below critical level (1.60 m BC)
  - to keep water levels in the Neva Bay near the Barrier sufficiently high (not to exceed the design head difference: 3.55 m)
Thank You

Utility Considerations with the Proposed NJ Back Bays Storm Surge Barrier Systems
Charles Schelpe – Jacobs Global Technology Lead - Flood Infrastructure