

Student Designs of Storm Surge Barriers for the New York Metropolitan Area

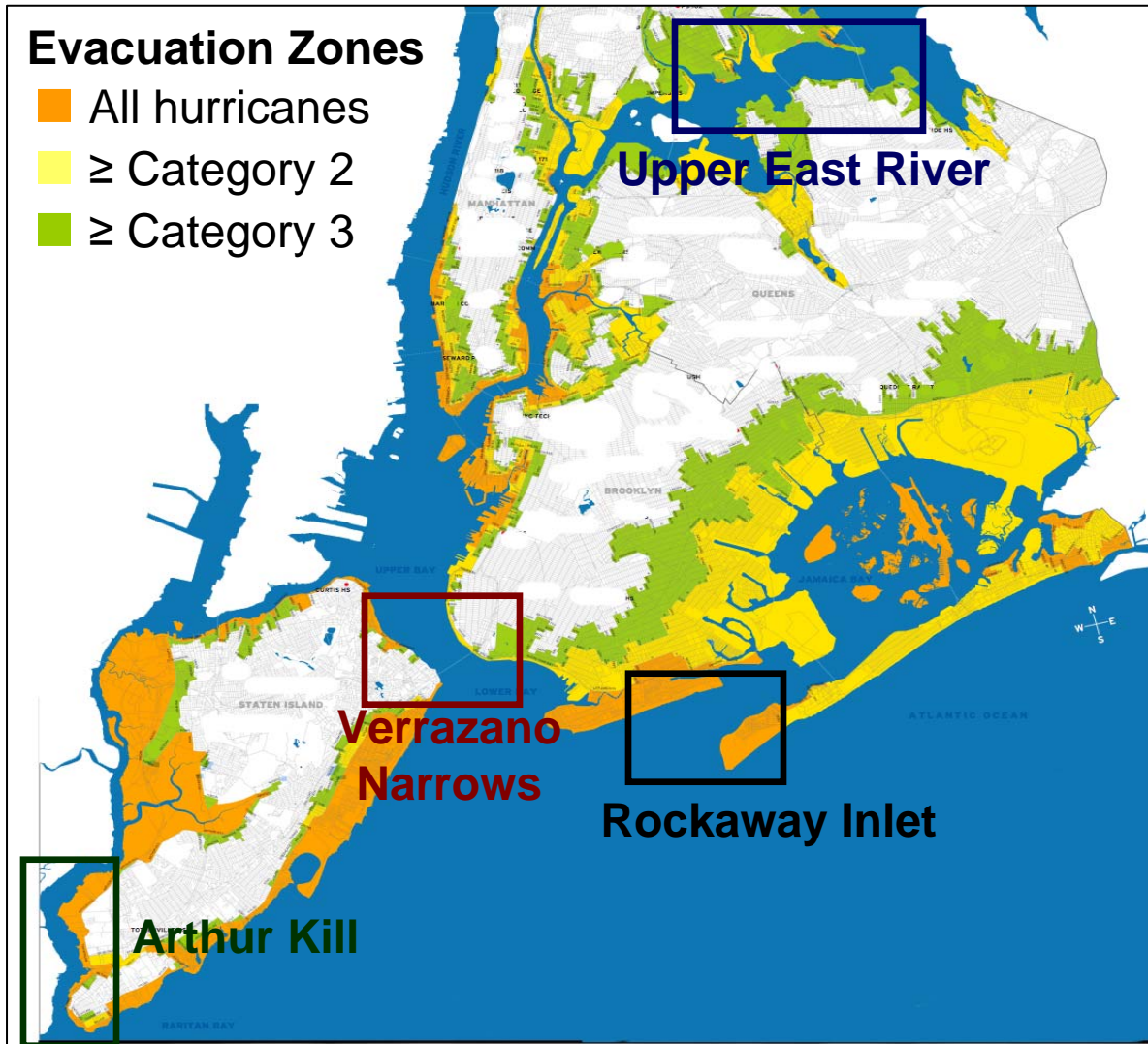
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The Cooper Union

March 31, 2009



The Class

- ◆ Freshmen
- ◆ First semester
- ◆ Technical and non-technical design issues
- ◆ Research and communication skills
- ◆ Teamwork



NYC Office of Emergency Management

The Project

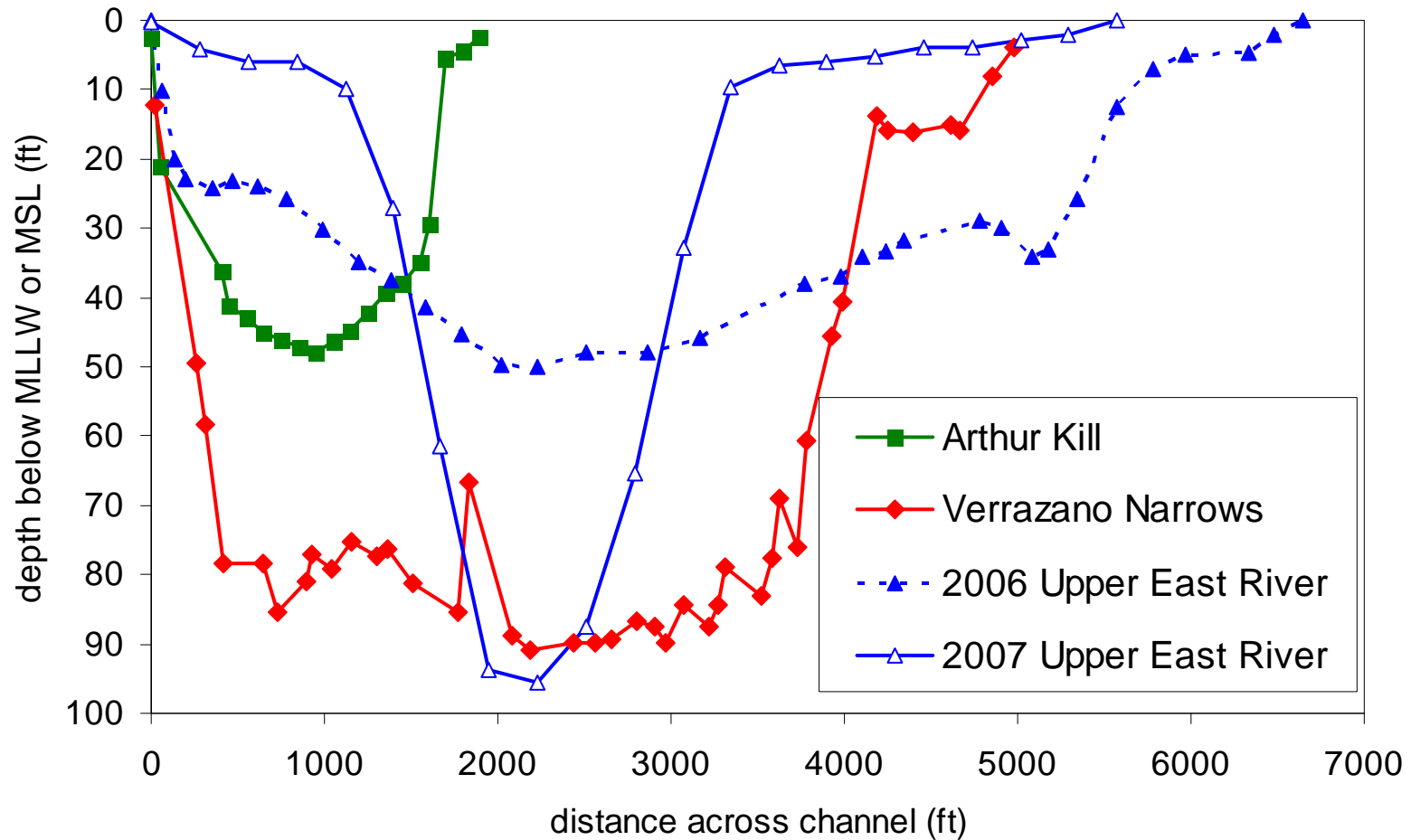
PHASE I

- ◆ Define the problem
- ◆ Research teams:
 - ◆ storm surge predictions
 - ◆ tides, hydrodynamics
 - ◆ navigation
 - ◆ existing barrier designs
- ◆ Midterm presentation

PHASE II

- ◆ Select specific site for barrier
- ◆ Brainstorm designs
- ◆ Alternative comparison
- ◆ “Detailed design”
 - ◆ Geometrically correct
 - ◆ Constructable
 - ◆ Operable
- ◆ Final report and presentation

Cross Sections

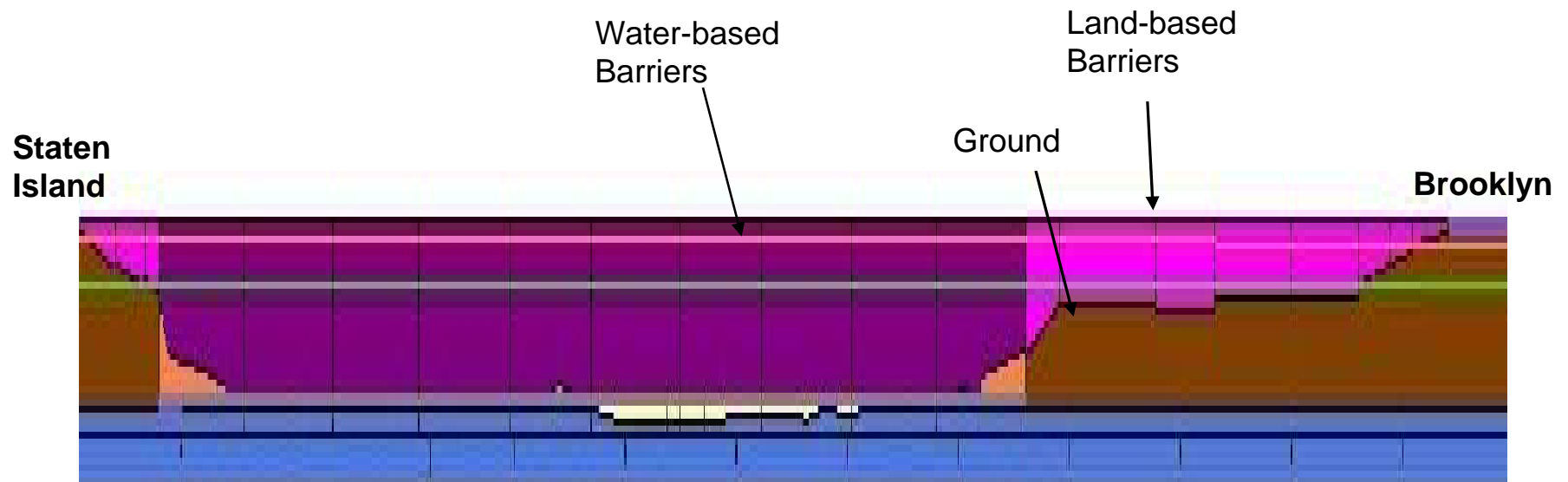


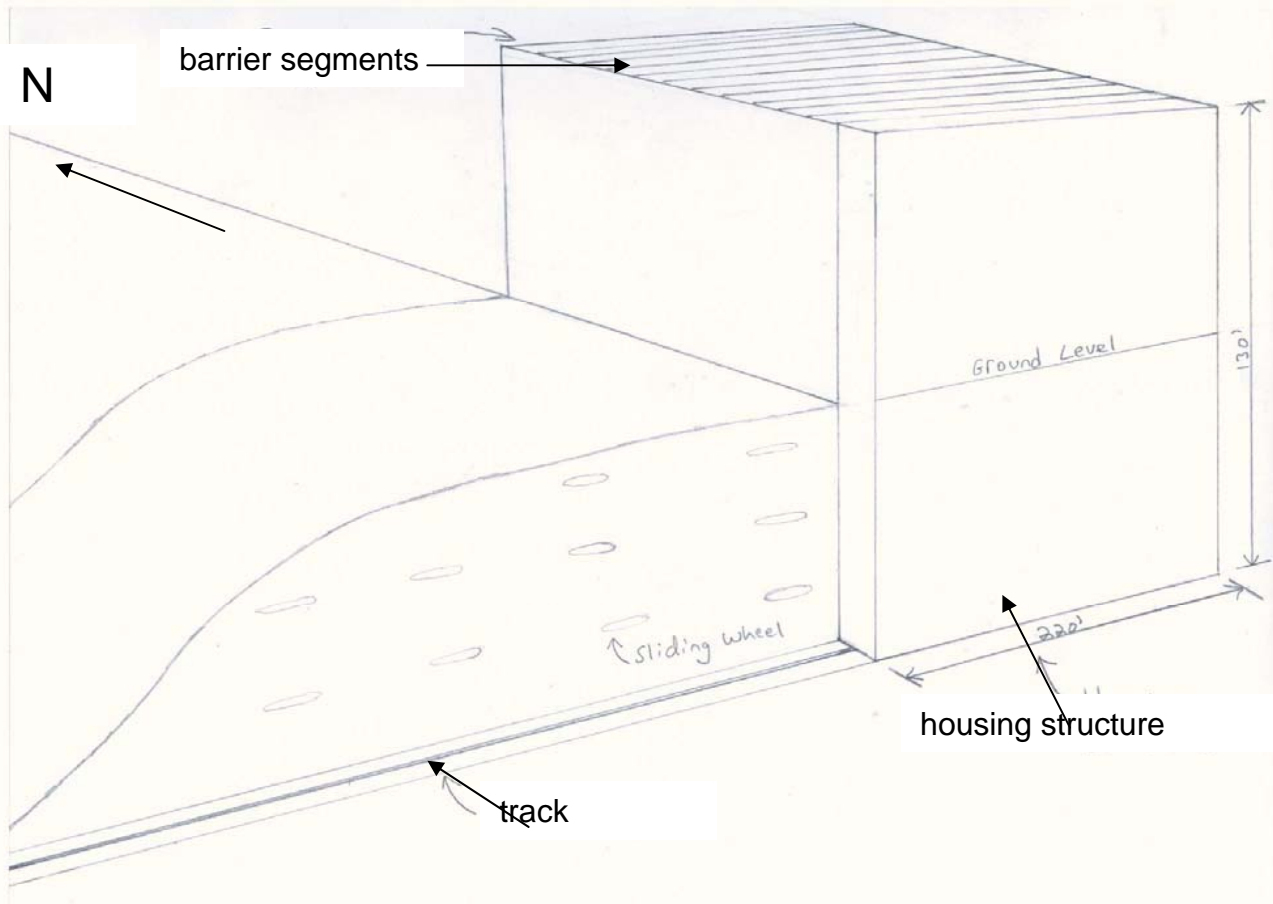
Verrazano Narrows

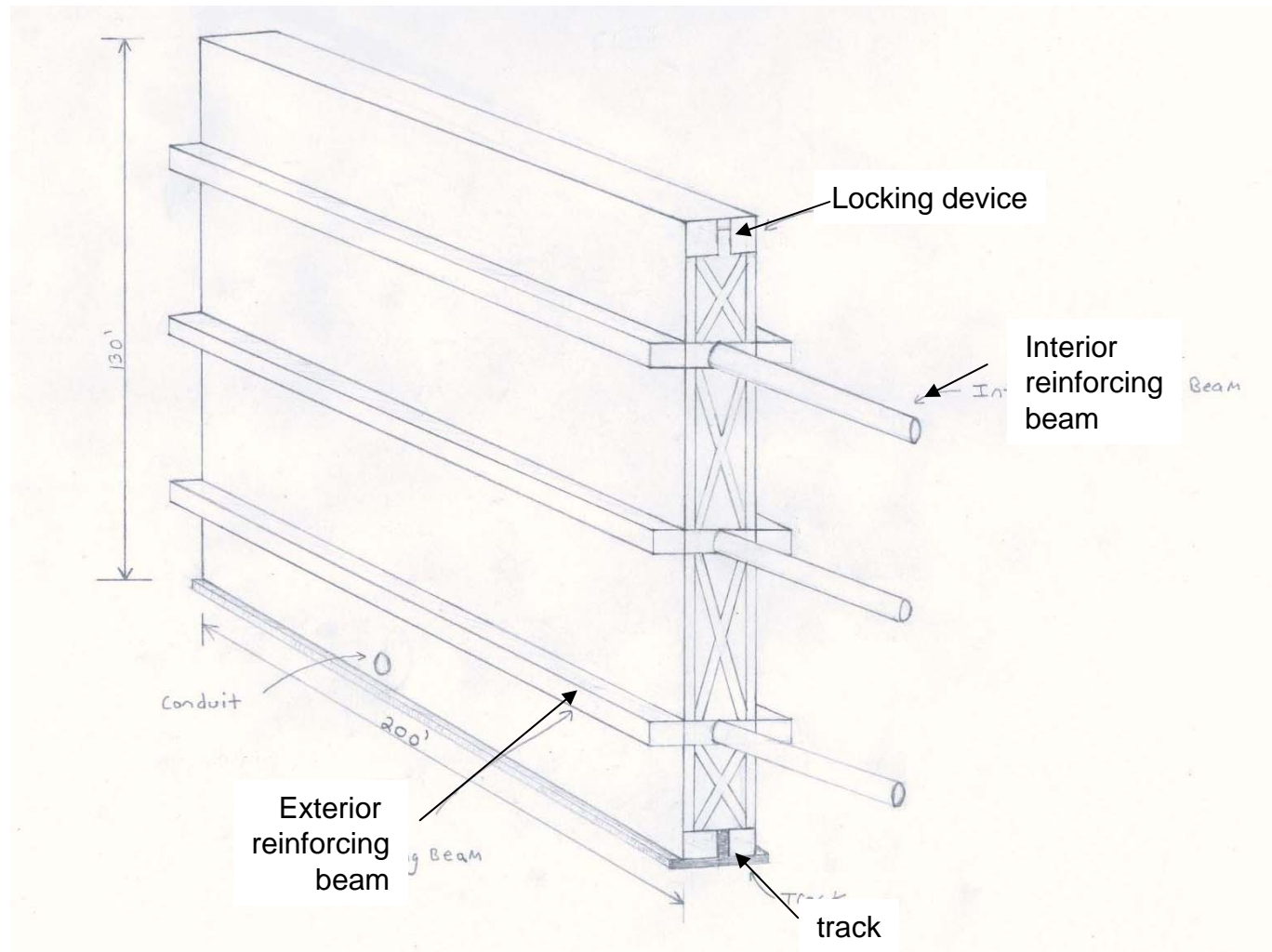
- ◆ 1 mile wide, 90 ft deep
- ◆ 27 ft storm surge
- ◆ Locate barrier 1500 ft north of bridge

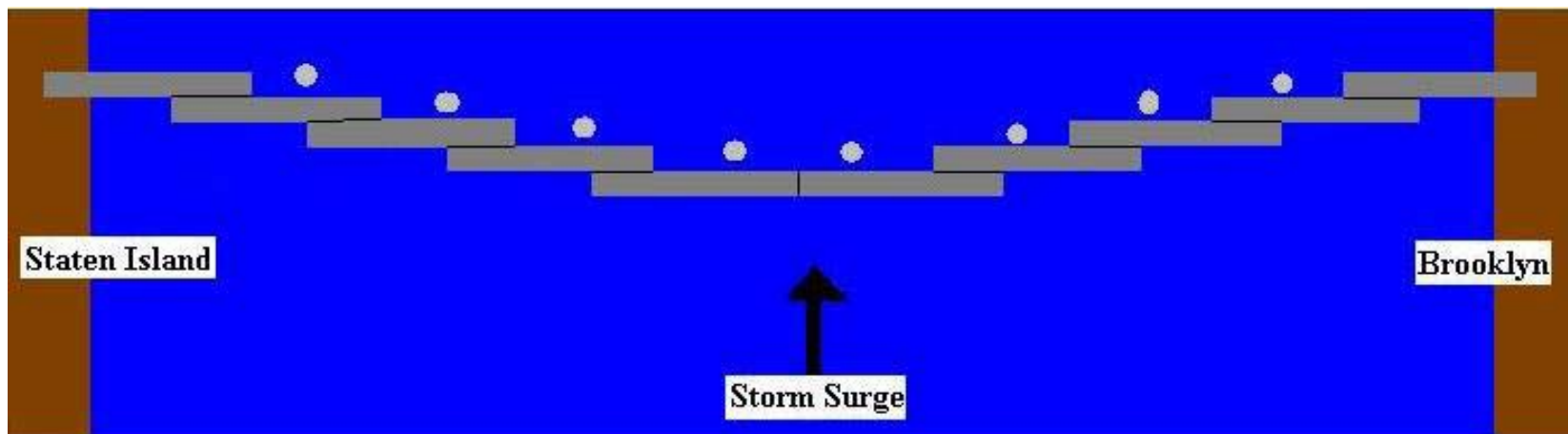
Sliding Segment Barrier

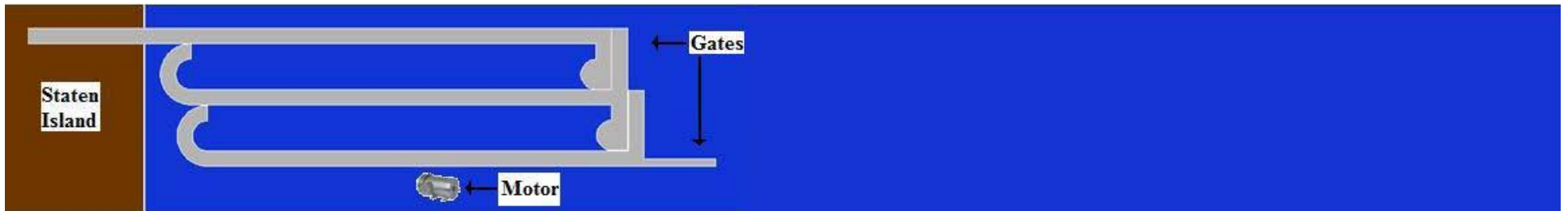
- ◆ Store vertical plates near shore
- ◆ Slide across channel on tracks



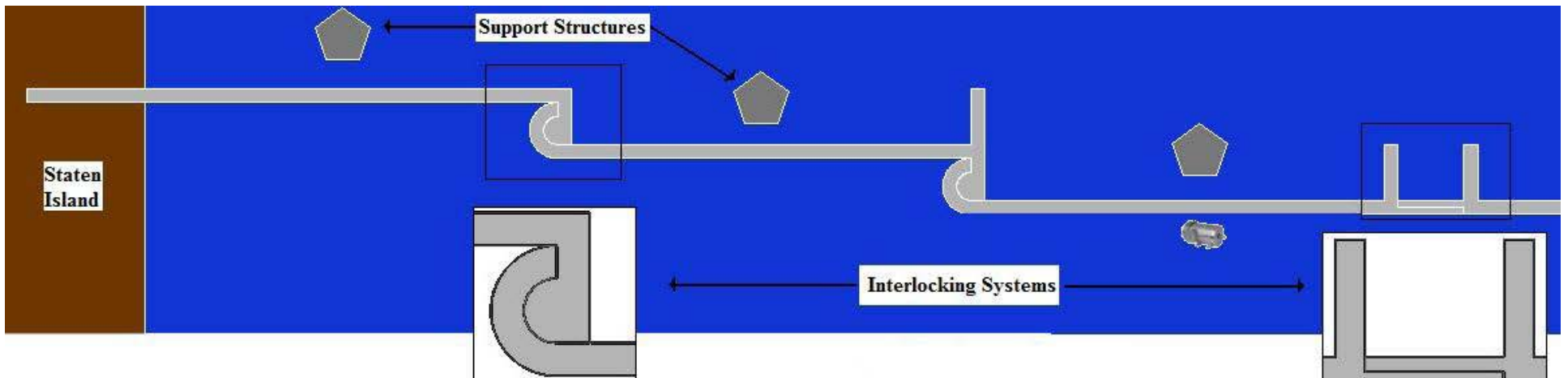








stored gates

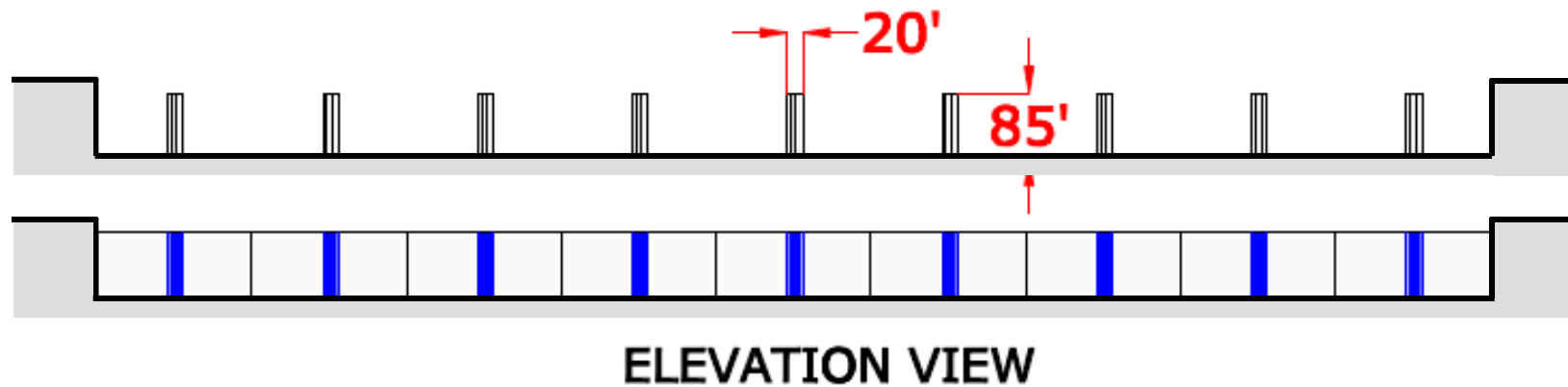
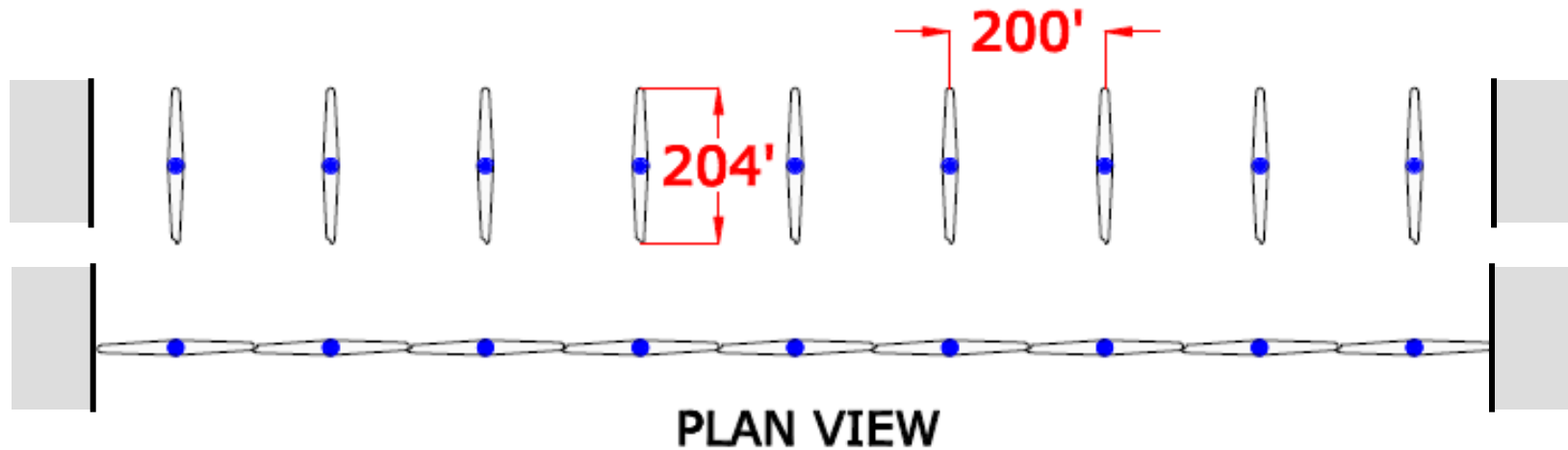


deployed gates

Arthur Kill

- ◆ 1800 ft wide, 50 ft maximum depth
- ◆ 27 ft storm surge
- ◆ Locate barrier 6500 ft south of Outerbridge Crossing

Butterfly Valve Design





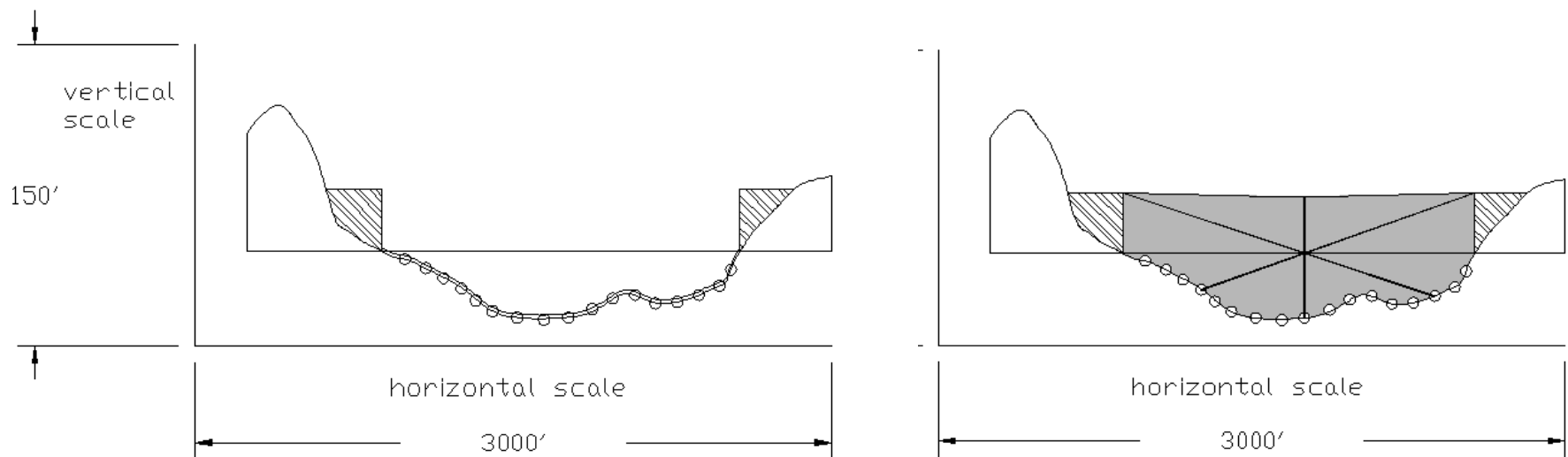
Arthur Kill 2007



Arthur Kill 2007

Fabric Barrier Design

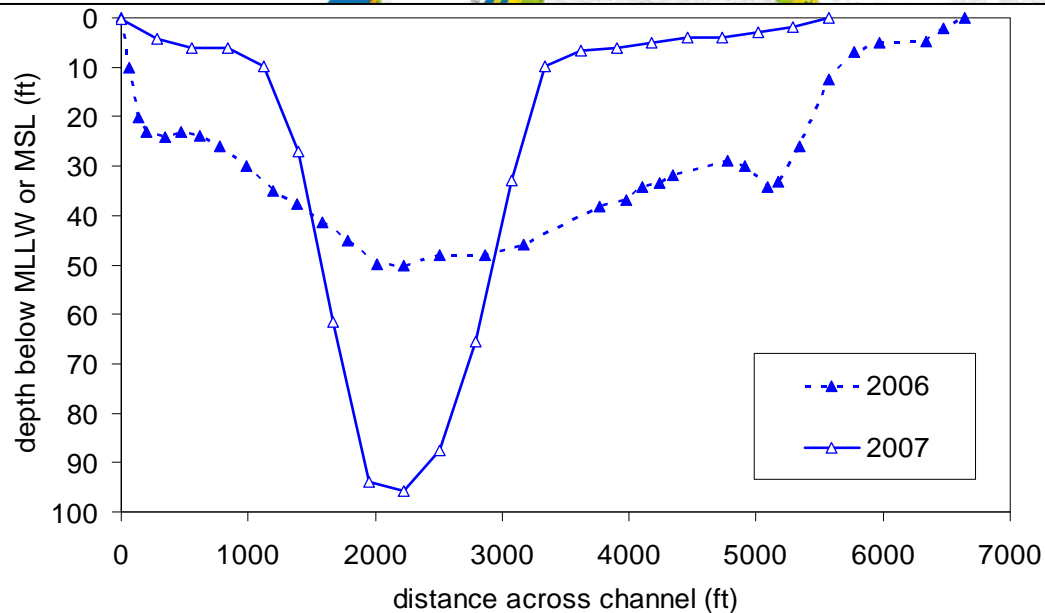
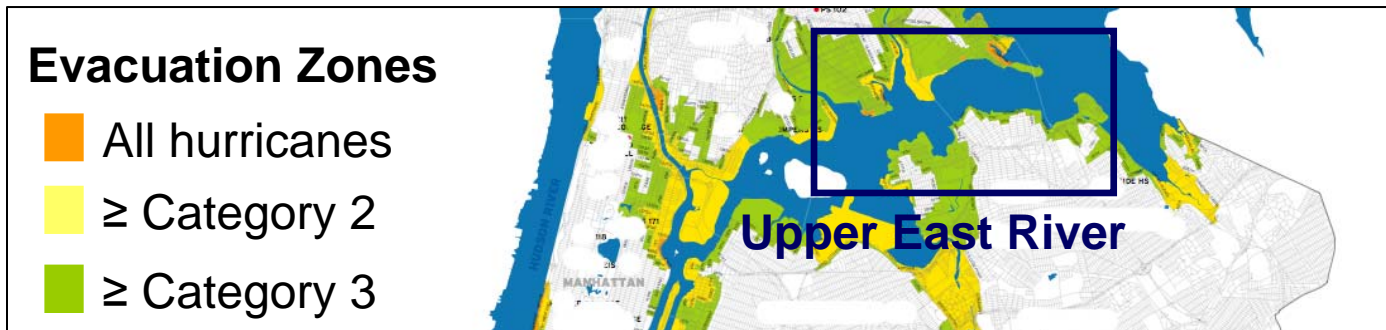
- ◆ Store in trough on channel bottom
- ◆ Raise with pulleys and winches



Pivoting Bridge Barrier Design

- ◆ Plan view conforms to channel geometry
- ◆ Pivot to vertical position to block channel

Upper East River



Some Design Ideas

- ◆ Drum gate (Thames) in center with lift gates (Netherlands) on sides
- ◆ Drum gates with nested radial gates
- ◆ Arch dam with “notches” for navigation, moveable curved metal gates
- ◆ Pivoting arched plates that conform to bathymetry

Rockaway – South Shore



Rockaway – South Shore



South Shore

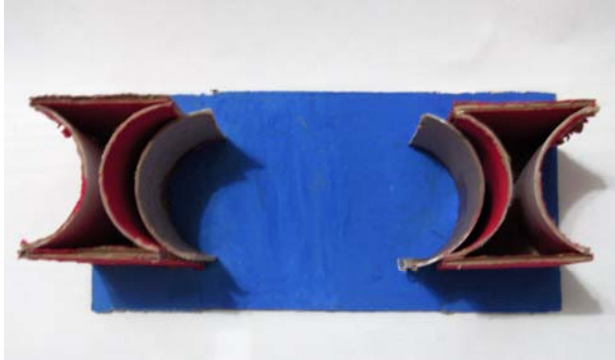
ASCE Met Section Infrastructure Group Seminar 2009

Longitudinal Barrier

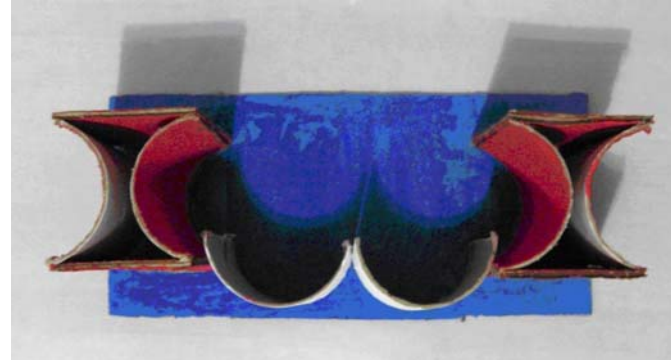
- ◆ 2006 – underwater plates (Venice) with cloth barriers at alignment changes
- ◆ 2007 – pivoting boardwalk along length of Rockaway peninsula

Inlet Barrier

- ◆ Piers support a bridge and house horizontal radial gates



gates open



gates closed

Summary

- ◆ Fast-paced course
- ◆ Addressed environmental, political, social and economic issues
- ◆ Design focus was geometry and operability
- ◆ These students graduate in 2010 and 2011

