Addressing Climate Vulnerability in the NY-NJ Harbor Estuary

Robert Pirani NY-NJ Harbor & Estuary Program Hudson River Foundation October 2018

NY-NJ HEP CLIMATE VULNERABILITY ASSESSMENT

NEW YORK / NEW JERSEY HARBOR & ESTUARY PROGRAM

Climate Change

And its Impact on the NY-NJ Harbor & Estuary Program

Average Statewide Annual Temperature of New Jersey, 1900 - 2017



56° Annual Median Temperature, F



FIGURE 3: Rutgers Climate Institute, State of the Climate: New Jersey, 2017



HUDSON

Three Key Risks

- Maladaptive human responses to climate change can impair water quality, damage habitat, and reduce public access
- Sea level rise will reduce wetland and other coastal habitat
- Increases in temperature may exacerbate dissolved oxygen problems (and otherwise impact estuarine ecology)



MEASURING SUCCESS: MONITORING NATURAL & NATURE-BASED SHORELINES IN NEW YORK STATE



Photos: NYC Parks and NYS DEC



beach done



rip-rop sill shoreline



bio enhanced concrete unit.



valknead



salt marsh/emergent wotiend



constructed dune



reef balls



revetment



A

living shoreline



bis enhanced concrete units



Natural Features Nature-Based Features Ecologically-Enhanced Hard Structural Features Hard Structural Features

Project Objectives

- A. Identify key performance and resiliency benefits of NNBFs through a stakeholderdriven process.
- B. Develop standardized protocols to generate better comparative data across the diverse shorelines of New York State.
- C. Help decision makers determine whether benefits are realized at shoreline sites.

The Monitoring Framework



How do you achieve these benefits? What would you measure / observe to assess this performance? How would you go about measuring / observing / documenting this?

GOALS + METRICS

SHORELINE FEATURES

ECOLOGICAL FUNCTION NATURAL FEATURES (N) **Bio-Diversity + SpeciesRichness** Native Habitats/Native Species Shoals/Mudflats Shellfish beds/Reefs Habitat Connectivity Submerged Aquatic Vegetation Hydrology/Hydrologic Function + Tidal Hydrology Tidal Wetlands/Salt Marsh Bluff Sediment Availability/Transport/Distribution Beach/Beach Berm Persistence of Ecological Function Over Time Dune Water Quality **NATURE-BASED FEATURES (NB)** Living Shoreline **Constructed Shellfish Beds/Reefs Beach Nourishment** HAZARD MITIGATION Constructed Dune Erosion/Land Loss Coastal Flooding: Storm Surge/Water Levels/WaveHeights Structural Integrity of Material (Living/Non-living) ECOLOGICALLY ENHANCED HARD Adaptability to Changes in Environment/Climate **STRUCTURAL FEATURES (EEF)** Presence of Contaminants or Contamination Eco-Enhanced Bulkheads Ability to Sustain Hazard Mitigation Over Time XXXXXXXXXX HARD STRUCTURAL FEATURES (HSF) SOCIO-ECONOMIC OUTCOMES Groin/Jetty Human Health, Safety + Wellness Revetment Bulkhead Property + InfrastructureValue Levee Economic Resilience/Livlihood Opportunites: Community Competence, Powerment + Engagement

*example features used

xxxxxxxxx

PERFORMANCE GOALS/PARAMETERS

FOR SHORELINE FEATURE RESTORE/ENHANCE/MAINTAIN/REDUCE

COST + CONSTRUCTION + MAINTENANCE Construction Costs Maintenance + Operation Costs Timeline Size Lifecycle Costs

INDICATORS OF PERFORMANCE



SHORELINE HORIZONTAL CHANGE OR CHANGE RATE

LOSS OR GAIN OF SEDIMENT IN ADJACENT AREAS

STRUCTURAL DEGRADATION

WAVE HEIGHTS INCOMING + BEHIND VEGETATION/STRUCTURE

CHANGE IN WATER ELEVATION + STORMFLOOD BEHIND FEATURE

MOVEMENT · VERTICAL SETTLEMENT

LOSS OF VEGETATION, SHELLFISH, OR OTHER BIOMASS STRUCTURE

NUMBER OF HOUSEHOLDS IN AREAAFFECTED

NUMBER OF HOUSEHOLDS EXPOSED TO FLOODING (WITH / WITHOUT)

NUMBER OF PROPERTIES BENEFITING FROMIMPROVEMENT

INCREASE OF PROPERTY VALUE

REDUCTION IN MILES OF/COST OF DAMAGES

Preliminary Evaluation of Physical Influences of Storm Surge Barriers on the Hudson – Raritan Estuary



Control Grid



NYHOPS model grid/ domain

Total cross-sectional area at inlet between Rockaways and Sandy Hook in NYHOPS is 80000 m².

sECOM Case A: Porosity 80%



10m high blockages to cells in ungated, closed areas of barrier.

sECOM Case B: Porosity 62%



IN WAHARE OR SESTOR ROY OF GOR AMOSTRIBUTION

sECOM Case C: Porosity 44%



IN WAHAFE OR SESTOR ROY OF GOR AMOSTRIBUTION

sECOM Case D: Porosity 34%



sECOM Case E: Porosity 15%



Conclusions and Future Study

- Lower porosity leads to:
 - Greater stratification and salt intrusion, likely due to weaker currents and mixing
 - Stratification increases most prominent on spring tides
 - Salt intrusion variability is reduced
- A baseline for more in-depth physical studies or for interdisciplinary studies
 - Hudson River Fund Call for Proposals
 - Oct 12 Seminar: Preliminary Evaluation of the Physical Influences of Storm Surge Barriers on the Hudson River Estuary - Philip M. Orton and David K. Ralston





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