Assessing the Effects of Storm Surge Barriers on the Hudson River Estuary

Project Location

Hudson River Estuary, New York

Project Duration

October 15, 2018 to October 14, 2019

Project Lead

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Project Type

Catalyst – Targeted investment for advancing collaborative science

Project Partners

- Consensus Building Institute
- Cornell University Water Resources Institute
- Hudson River Estuary Program
- Hudson River National Estuarine Research Reserve
- New York State Department of Environmental Conservation

Overview

Coastal cities around the country are exploring structural engineering options for defending against extreme storms and the resulting surges of ocean water that cause massive flooding. Storm surge barriers or tide gates can effectively protect harbors and minimize flooding, property damage, and loss of life during large storms. These barriers typically span the opening to a harbor or river mouth and include gates that are only closed when storm surges are expected. However, even when gates are open, the barriers reduce water flow and tidal exchange, which in turn affects water quality and ecological processes. Scientists and engineers are increasingly recognizing the need for broad research initiatives to more fully explore the advantages and disadvantages of large surge barriers.

One such initiative is currently underway in the New York metropolitan area, an area with highly valuable and vulnerable coastal infrastructure. The U.S. Army Corps of Engineers, states of New York and New Jersey, and New York City have partnered to conduct the Harbor and Tributaries Focus Area Feasibility Study to evaluate barriers and other options to manage coastal storm risks. Since a surge barrier could have significant impacts on the Hudson River and surrounding estuary ecosystem, the Hudson River Research Reserve and partners formed a Barrier Benefits and Impacts Workgroup in December 2017, with the goal of helping to review and supplement the Army Corps' feasibility study and Environmental Impact Assessment. This project extends the existing workgroup's effort and facilitates the development of a collaborative research agenda to address current information needs. The project approach is designed to foster close collaboration and information-sharing among scientists and key end users. The project team will conduct modeling and analyses of the physical influences of surge barriers and host a series of workshops to synthesize and share information.

Anticipated Benefits

- Improved understanding of the benefits and impacts of storm surge barriers on the Hudson River and the surrounding estuarine system.
- Enhanced engagement and collaboration among the research community to expand studies of storm surge barriers.

- More scientific input to the Harbor and Tributaries Focus Area Feasibility Study, allowing the Army Corps and its partners to consider a range of costs and benefits of surge barriers.
- Increased coordination and understanding between the scientific community and key end users in the New York metropolitan area, providing a foundation for future collaborative efforts.

Project Approach

An advisory committee is providing input to the project team to ensure that data analyses and workshop plans are responsive to the needs of end users, such as the Army Corps of Engineers and relevant city and state agency offices. The project team is organizing a series of three to four workshops that will focus on framing the group's collective understanding of the benefits and impacts of barriers, highlighting areas for future research or discussion, and catalyzing new collaborative research efforts. In addition to key end users and project advisors, the team is inviting additional experts on estuaries and surge barriers to some of the workshops to help address the specific topics and areas of uncertainty identified in prior meetings. The project team is summarizing workshop presentations and discussions into targeted reports and creating a future scope of work that will outline key research needs and lessons learned from the project.

Concurrently, the team is conducting hydrodynamic modeling and scenario data analyses to better understand the physical and ecological effects of a surge barrier on the Hudson River estuary and provide the Army Corps with information to inform their study. The team has models of tides, wind waves, storm surge, and three-dimensional estuarine circulation, as well as a large database of historical simulations and hypothetical storm simulations and probabilities from a prior risk assessment study, which includes both coastal flooding and inland rain flooding along the Hudson. These modeling tools will be used to address specific questions of interest to end users, such as how different barriers would affect tidal range, salinity, stratification, wave impacts, or rain-driven flooding behind a closed barrier.

Targeted End Users and Anticipated Products

The project advisory committee and workshops are engaging a range of organizations that could use the results in different ways. Targeted end users include non-profit organizations and research institutes invested in this topic, as well as the federal, state, and city offices in New Jersey and New York that have authority to manage coastal storm risks. The project is generating the following products:

- A series of workshops engaging a range of end users and relevant experts;
- Workshop summaries synthesizing current science about barrier benefits and impacts and identifying key remaining research needs;
- A technical report explaining the results of hydrodynamic modeling and scenario data analyses; and
- A future scope of work laying out a three-year plan for conducting a comprehensive assessment of barrier benefits and impacts, as well as specific plans for funding next steps and filling research gaps.

About the Science Collaborative

The National Estuarine Research Reserve System's Science Collaborative supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is managed by the University of Michigan's Water Center through a cooperative agreement with the National Oceanic and Atmospheric Administration (NOAA). Funding for the research reserves and this program comes from NOAA. Learn more at coast.noaa.gov/nerrs or graham.umich.edu/water/nerrs.