MEASURING SUCCESS

Monitoring natural and nature-based shoreline features in New York State

EXECUTIVE SUMMARY

Prepared For:

NEW YORK STATE OF OPPORTUNITY. NYSERDA

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

NEW YORK STATE OF OPPORTUNITY. Department of State

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With:

Sea Grant New York

cbi Consensus Building Institute

NYC Parks

SCAPE

NY/NJ HARBOR & ESTUARY PROGRAM

ARCADIS Design & Consultancy for natural and built assets

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Forest Service U.S. Department of Agriculture

New York State Water Resources Institute Cornell University

Brooklyn College The City University of New York

Across the state, communities and decision-makers, shoreline managers and stewards recognized a critical lack of data on the relative performance of shoreline management measures, particularly as it relates to natural and nature-based features (NNBF). ***Measuring Success: Monitoring Natural and Nature-based Shoreline Features in New York State*** was a multi-year initiative to develop a state-wide approach to fill that data gap. The result is a monitoring framework, including data collection protocols, to guide consistent data collection on the ecological function, hazard mitigation, structural integrity, and socio-economic outcomes across all tidally-influenced and Great Lakes shoreline features of the state.

WHY A MONITORING FRAMEWORK?

Balancing shoreline management measures for competing coastal uses has been a nationally recognized policy goal since the passage of the Federal Coastal Zone Management Act in 1972. More recently, Hurricanes Irene, Lee and Sandy have spurred widespread interest in the use of NNBF as alternatives to conventional approaches to coastal shoreline management and hazard mitigation in New York State, such as hardened shorelines. NNBF are thought to provide similar hazard mitigation benefits while limiting the negative impacts on shoreline processes, habitats, or communities that Hard Structure Features (HSF) may have. Additionally, NNBF are thought to provide ecological and social benefits not accrued through HSF.

A number of city, state, and federal guidance and planning documents encourage the use of NNBF, where appropriate. In response, experimentation with new and hybrid techniques – such as nature-based features – has begun to proliferate in New York. Nonetheless, widespread adoption of NNBF remains limited, in part due to a lack of data on how such shoreline management measures help meet goals for risk reduction, ecosystem services, and
other services important to decision-makers. Prior to this framework, there was no state-wide system to evaluate the relative performance of different shoreline features. This monitoring framework and associated protocols will guide the collection of consistent performance data that can be compared across regions and feature types. A monitoring framework for shorelines is needed because:

- Decision makers see value in better understanding how natural and nature-based features support resilience and adaptation
- Shoreline managers need to better understand natural and nature-based features, compared to hard structural features, to support resilience and adaptation
- A coherent monitoring framework will enable future evaluation of NNBF and hard structural features by generating comparable data

The **goal** of this project was to develop a coherent framework for shoreline monitoring and data collection that informs more consistent and effective shoreline management decisions in New York State, particularly as it relates to NNBF.

PROJECT OBJECTIVES

+ **Identify key performance and resiliency benefits of NNBF through a stakeholder-driven process**
+ **Develop standardized protocols to generate better comparative data across the diverse shorelines of New York State**
+ **Help decision makers determine which benefits are realized at shoreline sites**

PROJECT OUTPUTS

+ **Performance parameters and indicators**
+ **Protocols for data collection**
+ **Pilot project data (to inform the refinement of monitoring protocols)**
+ **Community network (informed, engaged, connected stakeholders)**
+ **Database (pilot project data storage)**

DESIRED LONG-TERM OUTCOMES

+ **Network of monitoring partners**
+ **Buy-in from agencies/practitioners on the evaluation framework & monitoring protocols**
+ **State-wide uptake/adoption by entities involved with permitting + design + construction**
+ **Increase in in-situ monitoring of features using the protocols**
+ **Collection of long-term relevant data sets**
+ **Coherent + compatible evaluation of shoreline measures**

MEASURES OF SUCCESS

+ **The framework and guidance are accessible, intelligible, and usable by data collectors**
+ **The data collection protocols are cost-effective and relatively simple, but still credible**
+ **The framework and protocols are applicable to and comparable across different types of shorelines**
+ **Number of sites being monitored using framework following the project**
+ **Moderate/high level of satisfaction that the framework will improve planning, design, and permitting process of NNBF**

WHAT CAN BE MONITORED?

The framework is structured around three **resilience services,** the high-level categorization of services and benefits that shoreline management measures may provide. These are:

Ecological Function: the shoreline's contribution to ecological health and function.

Hazard Mitigation & Structural Integrity: the shoreline's ability to mitigate risks and to sustain its performance in the face of hazards.

Socio-Economic Outcomes: the shoreline's influence on community resilience and well-being.

Shoreline managers, stewards, researchers, and others can use the framework and protocols to monitor tidally influenced shorelines across New York State, as well as the Great Lakes, and the full spectrum of management options for such shorelines, including **natural features** (NF), **nature-based features** (NBF), and **hard structural features** (HSF).


salt marsh/emergent wetland


rip-rap sill shoreline


bio enhanced concrete unit

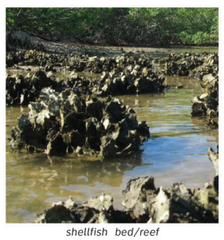

bulkhead


salt marsh/emergent wetland


constructed dune


reef balls


revetment


shellfish bed/reef


living shoreline


bio enhnaced concrete units


groin/jetty

CONTENTS OF THE FRAMEWORK

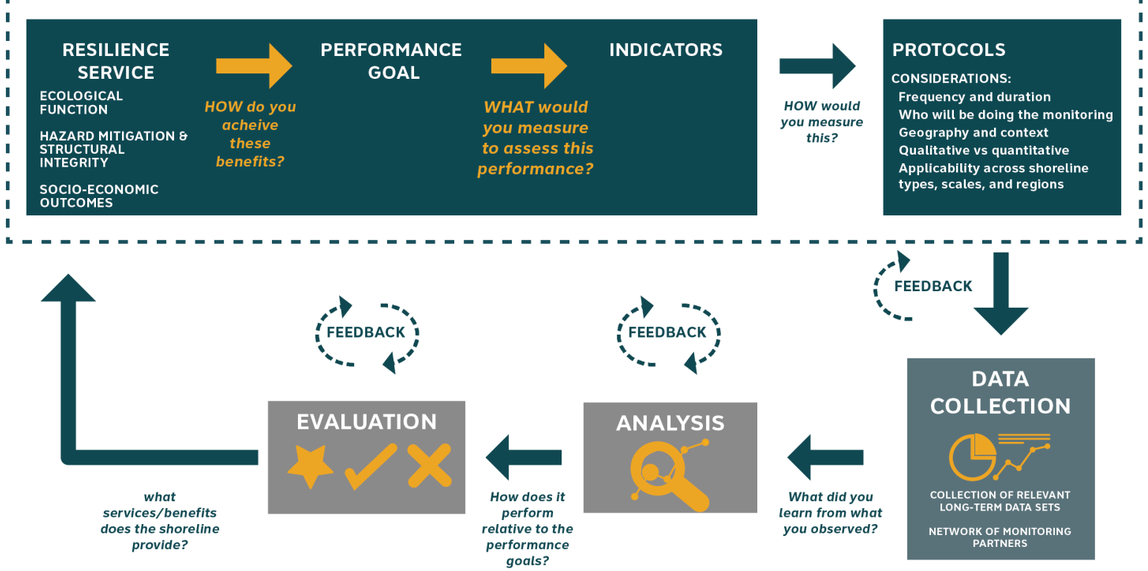
The framework identifies a set of **performance parameters** associated with each resilience service area. A performance parameter is a factor that allows the evaluation of the relative effectiveness of a shoreline management feature in providing a resilience service.

For each parameter, the framework identifies one or more specific **indicators**. An indicator is a measurable or traceable attribute of a shoreline feature that can be used to evaluate status and trends relative to a particular performance parameter.

The framework then matches each indicator with **data collection protocols** that enable users to gather the necessary information to assess the indicators. A protocol describes the specifications for collecting, recording/reporting, and storing data related to the indicators.

Data collected using the protocols are entered into a **database**. Over time as more monitoring is conducted, data can be analyzed to evaluate shoreline performance relative to the established performance parameters both between and among shoreline features. As the framework is implemented across the state, users are encouraged to provide feedback to inform refinement of the framework and evaluation process.

MONITORING FRAMEWORK

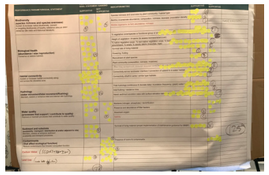


THE FRAMEWORK DEVELOPMENT PROCESS

Measuring Success - Monitoring Natural and Nature-based Shoreline Features in New York State was a multi-year collaborative effort. The process is summarized in the timeline below. The effort was led by the project Core Team who was responsible for coordinating engagement with stakeholders and working groups, collecting and integrating feedback, and producing the final framework, but the effort was only possible because of a much larger group of contributors described below.

Hudson Valley Regional Working Group

New York Harbor Regional Working Group



Long Island Harbor Regional Working Group

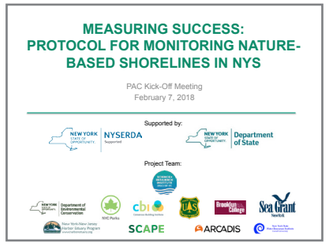
Great Lakes Regional Working Group

Coxsackie, Hudson Valley

Bronx Kill, New York City

Patchogue, Long Island

Sterling Nature Center, Great Lakes



January 1st, 2017
Kickoff Workshop

December, 2017
Preliminary draft of Framework

June 2018
Draft Monitoring Framework Report Publication

July 9th, 2018
Hudson River Staatsburg, NY

July 26th, 2018
New York City Governor's Island, NYC

August 7th, 2018
Long Island Port Jefferson, NY

Sept. 25, 2018
Great Lakes Sterling, NY

May 7 - 24 2019
PAC Virtual Meeting and Review Period (Review revised framework developed by the TWG).

January 3rd, 2019
Regulatory Staff Meeting 1

January 25th, 2019
Regulatory Staff Meeting 2

February 2019
Technical Working Group Re-Engagement Workshop

June 17 - August 31
Data collection at NYC sites

July 11-13, July 17-19
Data collection at Long Island sites

August 5-10
Data collection at Hudson Valley Sites

August 22, 2019
"Lessons Learned" Meeting 1

August 26-31
Data collection at Great Lakes sites

Sept. 11, 2019
"Lessons Learned" Meeting 2

Sept 30, 2019
Final Monitoring Framework

2017

2018

2019

2020

PROBLEM DEFINITION AND PROJECT FRAMING

JAN - DEC 2017

The Core Team framed monitoring goals and reviewed monitoring case studies. They also identified Technical Working Groups (TWG) and a Project Advisory Commitee (PAC) for the project.

PROJECT ADVISORY COMMITTEE
Advised the Core Team by providing feedback and input on the process, content, and products. The PAC consisted of ten members, each with extensive professional expertise in the area of shoreline management.

DRAFT MONITORING AND FRAMEWORK

JAN-JUNE 2018

The Core Team and TWG synthesized literature and analyzed existing monitoring programs to develop the draft monitoring framework

TECHNICAL WORKING GROUP
Assisted and guided the Core Team in the development, prioritization, and refinement of parameters, indicators, and monitoring protocols. Each resilience service area had a corresponding TWG of five to ten members with relevant expertise on existing literature and monitoring practices, developing or implementing monitoring programs, and design, construction, or maintenance of NNBF. Members included design practitioners, public agency representatives, and scientists.

REGIONAL STAKEHOLDER OUTREACH

JULY 2018-JAN 2019

The PAC and stakeholders provided feedback on the draft framework, particularly through ***Regional Working Groups*** *hosted in each of the four coastal regions.*

REGIONAL WORKING GROUPS
Workshops convened once in each of the four regions: Hudson River, New York Harbor, Long Island, and the Great Lakes. Participants included government agencies, non-profit organizations (e.g. stewardship groups), academic institutions, environmental consultants, and private property owners.

REVISED FRAMEWORK

FEB-MAY 2019

The Core Team and TWG updated the framework based on synthesized feedback from the RWGs, Permitters, and PAC, and developed protocols.

PILOT MONITORING

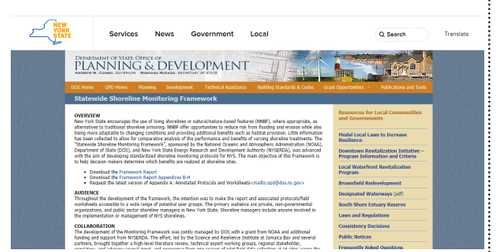
JUNE - SEPT 2019

Monitoring teams tested out protocols at pilot sites through partnerships with local partners and other stewards.

FINALIZED MONITORING FRAMEWORK

OCT 2019- MAY 2020

The Core Team developed a database that will ultimately be used to produce basic reports and trend analysis. Key findings and outcomes were documented and shared with the growing community of interested stakeholders.



May 2020
NYS DOS Monitoring Website Went Live
https://www.dos.ny.gov/opd/monitoring.html

WHAT'S NEXT?

MAY 2020

Download the protocols to start monitoring now!

PILOT MONITORING

Monitoring teams, along with state and regional partners, piloted data collection at shoreline features in Long Island, New York Harbor, Hudson River and Great Lakes. In the New York Harbor region, NYC Parks led the pilot data collection. In the remaining three regions, a team of four researchers based out of the Science and Resilience Institute at Jamaica Bay completed pilot monitoring in collaboration with local partners. In each region, partners selected four sites (one hard structural, two nature-based, one natural feature), totaling 16 sites across the state. Based on the data collection experience, pilot monitoring teams provided feedback to refine protocols and to guide best practices for framework implementation across distinct regions and shoreline types.

Port Bay Barrier East

Port Bay Barrier West

GREAT LAKES

Sterling Nature Center

Widow's Hole

Coxsackie Boat Launch

Cedar Creek Beach Inlet

Sodus Point

Coldspring Foundry Dock

Peekskill Municipal Park

HUDSON VALLEY

Harlem River Park

Bronx Kill

Randall's Island

LONG ISLAND

NEW YORK CITY

Bayswater

Patchogue Shorefront Park

TYPE OF SHORELINE

- Natural
- Nature-Based
- Hard Structure
- Multiple

FINAL MONITORING FRAMEWORK MATRIX

Resilience Service Area	Performance Parameter	Indicators	Associated Protocols	
			Field Protocols	Desktop Protocols
Ecological Function	Biological Health & Biodiversity	Plant species cover, abundance, species richness and composition (including native versus exotic)	Plant species cover, abundance, species richness and composition (including native versus exotic) Establishing Sampling Scheme (including transect locations, etc.)	n/a
		Sessile organisms presence, abundance, (percent) cover, species richness, and composition	Sessile organisms presence, abundance, (percent) cover, species richness, and composition) Establishing Monitoring Scheme (including transect locations, etc.)	n/a
		Distribution and abundance of substrates including wrack, debris, concrete, etc.	Distribution and abundance of substrates including wrack, debris, concrete, etc. Establishing Monitoring Scheme (including transect locations, etc.)	n/a
	Habitat Connectivity	Habitat connectivity to adjacent areas, habitats, land uses in all directions	Site and feature characterization	Site and feature characterization
	Hydrology	Visual evidence of hydrologic alteration	Site and feature characterization *Site photolog (to be developed in future)*	Site and feature characterization
Hazard mitigation and Structural Integrity	Shoreline and topographic change	Change in Feature Position and Elevation	Feature Elevation Feature Aerial Dimension Erosion Measurements and Feature Displacement	Feature definition, location and aerial dimension Shoreline location, intertidal zone definition, and shoreline change
		Change in Shoreline Position (at Feature and/or Updrift / Downdrift)	Feature Aerial Dimension	Shoreline location, intertidal zone definition, and shoreline change
	Coastal Flooding	Change in Wave Conditions	Wave Height and Period Measurement	n/a
		Water Levels	Water Levels and Coastal Flooding	Water Levels and Coastal Flooding
	Structural Integrity	Change in Feature Position and Elevation	Feature Elevation Feature Areal Dimension Erosion Measurements and Feature Displacement Establishing Monitoring Scheme (including transect locations, etc.)	Feature definition, location and areal dimension Shoreline location, intertidal zone definition, and shoreline change
		Visible Scour, Erosion, Escarpments, and/or Material Degradation	Erosion Measurements and Asset Displacement *Site photolog (to be developed in future)*	n/a
		Change in Vegetation, Shellfish, or Other Biomass of Structure	*See biological health and biodiversity protocols*	n/a
Socio Economic Outcomes	Quality of Life	Household Perception of Risk, Neighborhood Satisfaction (general & as it relates to shoreline condition), and Quality of Life	Household Survey	n/a
	Recreation and Cultural Use	Observation and Telling of Recreation and Cultural Shoreline Use	Shoreline Social and Site Assessment	n/a
	Economic Development	Change in Real Estate Value	n/a	Assessing Real Estate Value Impacts Associated with Shoreline Conditions
		Business Activity Index	Business Activity Impacts Shoreline Social and Site Assessment	Assessing Business Activity Impacts Associated with Shoreline Conditions
		# Households and public facilities exposed to (or protected from) flooding or erosion	Household Survey	Damages to Households & Public Facilities (to be developed in future)
	Environmental Justice	Presence/Absence of Potential Environmental Justice Area	n/a	Environmental Justice Index
	Civic Engagement	# People Participating in Stewardship Related to Shoreline	Shoreline Social and Site Assessment	n/a

WHAT DID WE LEARN?

LESSONS LEARNED FROM DATA COLLECTION

With a small team, it is possible to implement most field protocols in one day, but a full assessment requires multiple visits. Dividing tasks across four people, the pilot monitoring team collected all biophysical field data, and completed one social site assessment, in one day. However, a single day of monitoring will not account for daily variability of human use or wave dynamics. For a full assessment, teams will need to revisit a site multiple times per season.

Defining shoreline feature boundaries was one of the most challenging parts of data collection. Historical context (e.g., original plans of a restoration project) can help to delineate site boundaries and set up representative transects that capture the full extent of the feature (i.e. inshore reefs).

Establishing partnerships can facilitate access to public and private lands. Local partners were critical to facilitate introductions and establish new partnerships between monitoring teams and site managers. Before starting fieldwork, partners contacted the site manager for information about access, permit, permissions, etc. As a result of pre-established partnership and facilitated introductions, the selected pilot sites were easily accessible for monitoring.

Based on pilot data collection, the protocols were found to be universally applicable to all regions of the State and shoreline types. Out of the 16 pilot sites, which represented the full spectrum of shoreline types from hard infrastructure to natural features, there was no site where the protocols did not work.

OPPORTUNITIES TO IMPROVE THE FRAMEWORK

Socio-economic outcome indicators add context and depth to shoreline assessment, but come with unique challenges. It was challenging to develop indicators that could distinguish localized, direct impacts of a shoreline feature from broader social and economic changes. Furthermore, the socio-economic parameters span a wide range of disciplines (e.g., sociology, geography, economics) and methodologies (e.g., field observations, surveys, GIS analysis). Further expert review and pilot data collection will be necessary to refine this part of the framework.

Boundaries for surveying households and businesses need to be better defined. Technical Working Groups deliberated on how to delineate a "neighborhood" in the context of shoreline performance, especially across regions with dramatically different population density. Pilot monitoring shed more light on feasibility of protocols across diverse sites. Methods for business and household surveys will need to be updated with definitive guidance on issues stemming from heterogeneity in housing and business density.

STRATEGIES FOR SUSTAINED FRAMEWORK IMPLEMENTATION

Newly permitted projects offer an opportunity to work with willing landowners. Private landowners might support monitoring efforts by volunteering third party access to their property for data collection. Initiating this discussion early in the permitting process could allow for pre-construction data to be collected, and thus strengthen the overall post-construction assessment.

Local stewards or shoreline managers are more likely than others to commit to consistent data collection over multiple years. State and local agencies, non-governmental organizations, or academic institutions can build capacity by collaborating with local groups. These groups will likely have a sustained investment in their site(s), can form lasting local partnerships, and can build institutional knowledge of their site(s) over the course of multiple seasons and years. College classes, graduate programs, and annual internship programs may also provide opportunities for institutionalizing sustained data collection at specific sites.

Training will be a critical component of sustained uptake and quality control. Some skills required to implement the protocols, such as plant identification, elevation surveying, and interviewing, require substantial experience. This expertise is likely found within NGOs and universities, but not necessarily throughout the range of monitoring groups. Protocol training should be provided for data collection teams that lack the prerequisite social and biophysical science expertise.

A central point of contact should be established to answer questions about framework implementation, coordinate training, manage the database, ensure quality control and lead adaptive improvements. The framework is intended to be adaptive to end-user feedback, Incorporating lessons learned to further enhance its utility. While DOS anticipates acting as a central point of contact in the near-term, different entities may lead various future efforts such as training and database revisions. These efforts will need to be coordinated to ensure consistency.

Framework implementation will depend on sustainable mechanisms for funding. Among stakeholders, there was relatively high support for implementing a monitoring program funded by the State. Incentivizing monitoring for new shoreline projects is one potential funding mechanism, but it is highly unlikely to become a permit requirement. As the framework is used by more partners, the aggregated data becomes even more robust and valuable for coastal decision-making and therefore more attractive to funders.

Data management and analysis are critical next steps. Data collected through the framework will be entered into a publicly accessible central database. A first version of the database has been created using Microsoft Access and is populated with data from the 16 pilot sites. Ultimately, data analysis should provide reports that support decision-making in shoreline management and implementation in New York State. It is therefore critical to design useful data outputs. In the next steps, partners should be dedicated to improving data analysis, database management, data storage, and reporting.

Continued stakeholder engagement is essential. The creation of a community network of informed, engaged and connected stakeholders was an integral part of framework development. Feedback and review helped establish confidence in and usability of the monitoring framework, foster strong relationships, and identified potential monitoring partners. Sustaining and growing the network will be critical to maintaining monitoring partnerships, gathering feedback to improve the protocols and database, increasing statewide uptake, and translating data outputs into effective and representative shoreline planning and design.

WHAT'S NEXT?

The current framework reflects a tremendous effort from regional stakeholders, Technical Working Groups, the Project Advisory Committee, and the Core Team, but it is considered a living document; updates and refinements are expected over time . Throughout the course of framework development, stakeholder engagement, and pilot monitoring, and the Core Team gathered key 'lessons learned' and recommendations for the next steps of framework refinement, dissemination, and implementation.

In collaboration with partners, Department of State (DOS) anticipates making refinements and improvements to the framework and protocols over time. DOS supports continued monitoring of natural, nature-based and hard structure features across New York State as data analysis will require additional years of data collection at shoreline sites. Data gathered and analyzed through monitoring over time will provide decision-makers with improved information to better understand what shoreline measures work where, and encourage the use of NNBF where appropriate. DOS also anticipates pursuing opportunities for third parties to monitor projects through robust data collection, and incorporate the framework into publicly sponsored projects across the state.

For more information, and to access the full framework report and monitoring protocol workbook, see the project website: https://www.dos.ny.gov/opd/monitoring.html

To find out more how you can get involved in monitoring, email: opd@dos.ny.gov with the subject line "MONITORING."