

S.0 INTRODUCTION

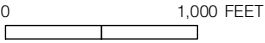
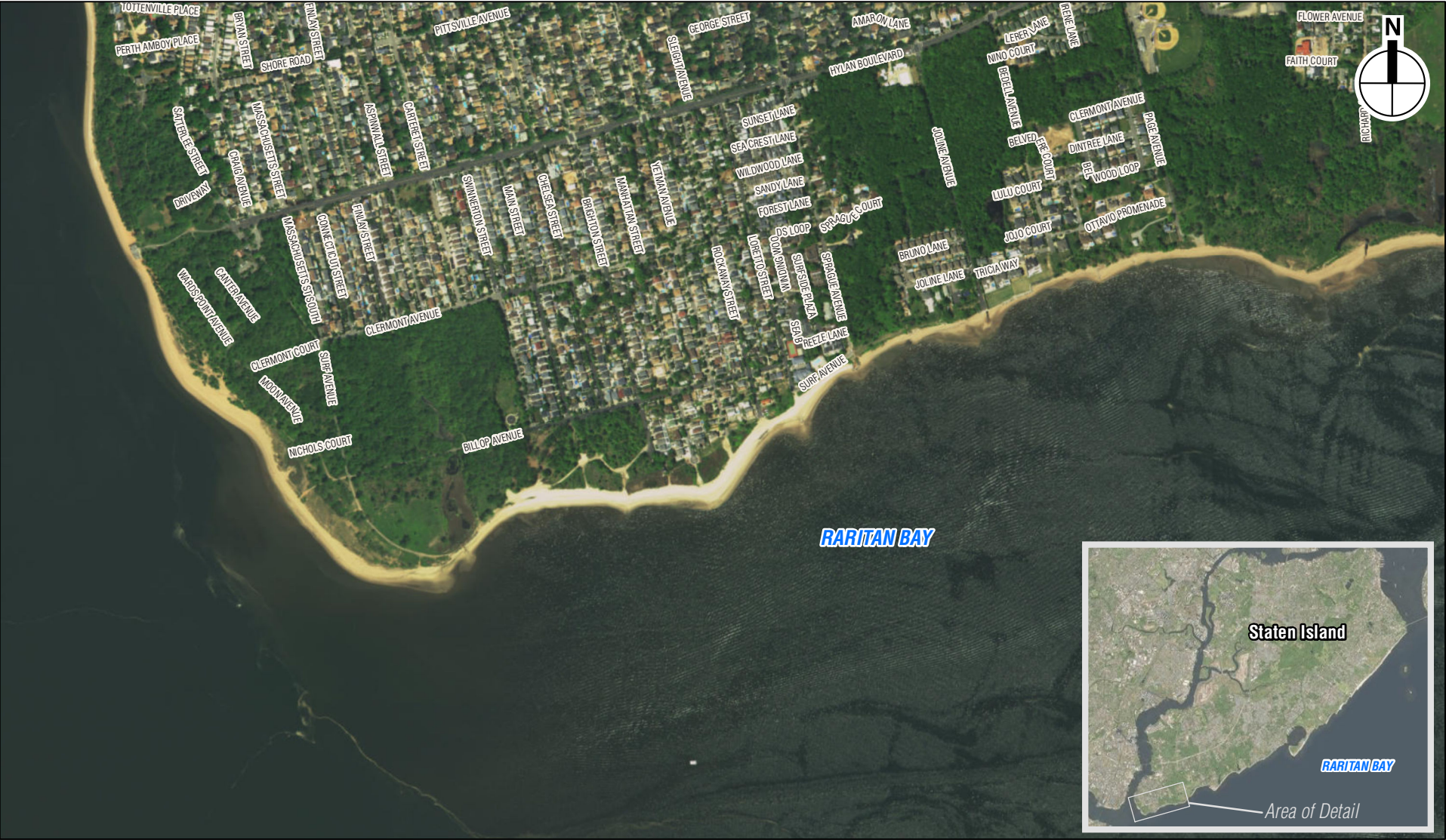
On behalf of Grantee the State of New York, the Governor's Office of Storm Recovery (GOSR), serving under the auspices of the New York State Homes and Community Renewal's Housing Trust Fund Corporation (HTFC), and acting under authority of the U.S. Department of Housing and Urban Development's (HUD) regulations at 24 CFR Part 58, and in cooperation with other involved, cooperating, interested agencies, has prepared this environmental impact statement (EIS) to analyze potential impacts of one or more proposed initiatives (Proposed Actions) intended to enhance coastal and social resiliency along the Tottenville shoreline of the South Shore of Staten Island, NY (see **Figure S-1**).

These initiatives include the Living Breakwaters Project (Breakwaters Project) and Tottenville Shoreline Protection Project (Shoreline Project). The Breakwaters Project and Shoreline Project each have independent utility, but both projects would be located in the same geographic region. The two projects would largely be funded through New York State's Community Development Block Grant-Disaster Recovery (CDBG-DR) grant. The proposed Breakwaters Project, a layered resiliency approach to promote risk reduction through erosion prevention, wave energy attenuation, and enhancement of ecosystems and social resiliency, was awarded \$60 million through HUD's June 2013 Rebuild by Design (RBD) competition. Additional project funding will be leveraged as required by HUD for RBD projects. The proposed Shoreline Project includes a series of shoreline risk reduction measures, including an earthen berm, a hardened hybrid dune/revetment system, eco-revetments, raised edge (revetment with trail), wetland enhancement, and shoreline plantings. Approximately \$9.3 million of CDBG-DR funds from the NY Rising Community Reconstruction Program will be used to implement this project.

In addition to geographic location, the projects share certain synergies in terms of design, as well as purpose and need, and combine to create a layered approach to shoreline resilience within the study area. Thus, there is strong rationale for designing and implementing the Breakwaters and Shoreline Projects through one integrated planning process to improve coastal resiliency along Staten Island's south shoreline. To facilitate a thorough examination of cumulative effects and synergies between the projects, GOSR has determined that they should be analyzed as part of the same environmental review. Additionally, these projects are analyzed individually and in combination as alternative actions that may also advance some of the same coastal resiliency goals and objectives. This analysis will ensure that the actions undertaken will minimize the potential for adverse environmental impacts, to the extent practicable.

S.1 PROJECT AREA AND VICINITY

The Proposed Actions would be undertaken in the Tottenville section of Staten Island, along the neighborhood's southern shoreline and offshore within the waters of Raritan Bay. Tottenville is located at the southwestern tip of Staten Island, and is the southernmost neighborhood in New York City and State. It is bounded by water on three sides, with the Arthur Kill to the west and



north and Raritan Bay to the south. The project area is located in the southwestern corner of Tottenville where these waterways meet (see **Figure S-1**). Land uses in the project area are characterized by a mix of parkland and residential uses, with some privately owned vacant parcels.

S.1.1 RARITAN BAY

Raritan Bay, off the southern and eastern shorelines of Staten Island, is a shallow urban estuary that contains significant habitat for shellfish and marine, estuarine, and anadromous fish. It supports multiple commercial fisheries and recreationally important fish species. The open waters of the bay provide important habitat for overwintering and staging waterfowl and marine mammals can occur in the area.

S.1.2 CONFERENCE HOUSE PARK AND OTHER AREA OPEN SPACES

The largest single land use in the project area is Conference House Park, a 265-acre park under the jurisdiction of the NYC Department of Parks and Recreation (NYC Parks). Extensive natural areas make up the park, including large tracts of maritime forest, creeks and ponds, bluffs, coastal wetlands, and beaches lining the shore. The western portion of Conference House Park contains numerous amenities and attractions, including grassy and densely wooded areas, historic architectural resources, a visitor's center, the Lenape Playground at Swinnerton Street and Billop Avenue, walking and biking paths, hiking trails, and the "South Pole" marking the southernmost point of New York State. The park extends eastward along the shoreline in a narrow expanse that includes beach areas, grassy areas, and look out points from the terminus of certain streets including Manhattan Street and Sprague Avenue. The shoreline is fringed by a sand and cobble beach. A man-made temporary dune, installed following Superstorm Sandy, comprised of sand filled barrier bags provides interim erosion control and coastal flood risk reduction from approximately Swinnerton Street to Sprague Avenue. The area near Page Avenue represents the eastern limits of Conference House Park. West of Page Avenue is a grassy undeveloped site that contains a few trees and a narrow paved street. The site is adjacent to the shoreline at a slightly raised elevation. Prior to Superstorm Sandy, this site contained a two-story house that was owned by NYC Parks. Due to severe structural damage, the house was demolished and the site has remained undeveloped since the building's demolition. East of Page Avenue is a wooded area within the boundaries of Conference House Park with a small parking area adjacent to the waterfront.

Events and organized activities offered at Conference House Park include tours, exhibitions, community events, volunteer programs within the park such as tree plantings and cleanups as well as at the historic houses, beach walks, birding talks and walks, kayaking, outdoor drawing workshops, fishing, family activities, outdoor movies, and citizen science programs.

In addition to Conference House Park, several park uses are present in the eastern portion of the project area. Hybrid Oak Woods Park is located along both sides of Joline Avenue north of Bruno Lane and Tricia Way. This smaller passive park, roughly 10 acres in size, consists of woodlands without any developed park facilities. The Tottenville Pool, another NYC Parks facility, is located north of Hybrid Oak Woods Park along Hylan Boulevard at Joline Avenue. East of Page Avenue, the study area contains extensive wooded lands including the Butler Manor Woods—a component of the Mount Loretto Unique Area—under the jurisdiction of the New York State Department of Environmental Conservation (NYSDEC). Mount Loretto Unique

Area encompasses approximately 18 acres of wetlands within Butler Manor Woods and contains hiking trails.

These open spaces contain upland forest and estuarine and freshwater wetland systems that support numerous species of native plants and animals.

S.1.3 INLAND AREAS

Inland from Conference House Park, the project area is residential in nature, characterized by single-family detached and attached houses. West of Brighton Street, these residential areas are adjacent to a wooded section of Conference House Park primarily along Billop Avenue and Swinnerton Street; east of Brighton Street, residential areas are developed in closer proximity to the shoreline with beach and vegetated upland separating the neighborhood from the waters of Raritan Bay. Since Superstorm Sandy, some homes in this coastal area have been elevated. The blocks between Loretto Street and Sprague Avenue contain several developments consisting of two-family houses and attached single-family houses on small private streets. East of Sprague Avenue to Page Avenue, large vacant or wooded areas are interspersed with tracts of single-family houses including some houses on larger lots. In the area south of Amboy Road, approximately 80 percent of the population own their home. South of Hylan Avenue, owner occupancy is slightly higher at 81.3 percent. The remaining population rent their homes.

S.2 PROJECT BACKGROUND

Staten Island's South Shore was once buffered from wave action by a wide, shallow bathymetric shelf known as the "West Bank." Until the mid-19th century, oyster reefs and then leased oyster beds extended across the shallow waters of Raritan Bay, filtering water, enhancing the biodiversity and quality of the fisheries in the lower harbor and buffering the south shore from erosion-causing wave action. In the 19th and 20th centuries, changes in land use and populations drove widespread decline in water quality, habitat extents and beach widths across the bay, decreasing the quality of the Bay ecosystem and increasing coastal risk to inhabitants and assets along its shoreline.

On October 29, 2012, Superstorm Sandy approached New York City with tropical-storm-force winds. The resultant waves and storm surge battered the city's coastline, causing 44 deaths in New York City—23 of which occurred in Staten Island—the destruction of homes and other buildings, and damage to critical infrastructure. Sandy's effects—including powerful waves and large volumes of water—were particularly intense in neighborhoods across Southern Queens, Southern Brooklyn, and the East and South Shores of Staten Island. According to the New York City Department of Buildings (NYCDOB), these neighborhoods accounted for over 70 percent of the buildings in Sandy-inundated areas that had been seriously damaged or destroyed as of December 2012.

Winds out of the northeast generated powerful waves along the South Shore of Staten Island (which adjoins the waters of Raritan Bay), resulting in significant erosion, including at the area's protective bluffs and along the shoreline areas with already narrow beach conditions. The peak storm tides in Tottenville measured approximately 16 feet, almost five feet higher than at the Battery in Manhattan. Many of the homes that were hit around Tottenville Beach were

destroyed. Tottenville businesses also sustained structural damage, with some emerging from the storm with only wall studs remaining on the first floors.¹

Superstorm Sandy significantly impacted the project area, highlighting existing deficiencies in the project area's resiliency and ability to adequately protect populations and facilities from major coastal storm events.

S.2.1 REBUILDING AND RESILIENCY PLANNING

Following the storm, the City formed the Special Initiative for Rebuilding and Resiliency (SIRR) to analyze the impacts of the storm on the city's buildings, infrastructure, and people; assess climate change risks in the medium term (2020s) and long-term (2050s); and outline strategies for increasing resiliency citywide. *PlaNYC—A Stronger, More Resilient New York*, June 2013, was the result of that effort, and contains Community Rebuilding Resiliency Plans for five particularly vulnerable neighborhoods in NYC, one of which is the East and South Shores of Staten Island. In developing the plan for the East and South Shores, two task forces met regularly and numerous formal and informal working sessions were held, including two public workshops in March 2013. These sessions provided an opportunity to the affected communities to inform SIRR staff of specific priorities and challenges that needed to be addressed. Two key priorities identified were developing coastal and shoreline protections, and ensuring public access to the waterfront.

The Community Rebuilding Resiliency Plan for the East and South Shores of Staten Island outlines specific initiatives to address coastal protection, buildings, critical infrastructure and community and economic recovery. With respect to coastal protection, the City's proposals were based on a multi-faceted analysis which considered the nature and likelihood of coastal hazards, the potential impact of these hazards on the built environment and critical infrastructure, and the likely effectiveness of the proposed measures. In addition, the coastal protection measures were informed by the New York City Department of City Planning's (NYCDCP's) *Urban Waterfront Adaptive Strategies (UWAS)* study, June 2013 (funded by a HUD Sustainable Communities Regional Planning Grant), which examined the underlying geomorphology of the various regions. The study demonstrated that the South Shore of Staten Island is particularly vulnerable to erosion during extreme events, as well as on a day-to-day basis. As described in the *New York City Hazard Mitigation Plan* (2014), "Coastal erosion can cause extensive damage to public and private property because it brings structures closer to the water's edge. If erosion is not mitigated, the structures will become inundated with water, resulting in damage or destruction." This report also notes that along the South Shore of Staten Island, 415 acres and 96 building "centroids" are located within NYSDEC-mapped Coastal Erosion Hazard Areas (CEHAs)².

Based on an evaluation of the City's entire shoreline and categorization of each shoreline reach by its geomorphology and land use, the UWAS study provides a description and an assessment of coastal resiliency measures that would be appropriate for each of the different categories of shoreline evaluated. This study categorizes the Tottenville Shoreline as "Oceanfront Slopes," a typology characterized by glacial till plains and hills, low fetch, medium elevation/medium slopes, unreinforced shorelines, and a mix of sediment types. For this type of reach, strategies

¹ *PlaNYC—A Stronger, More Resilient New York*, June 2013.

² Identification of a building's "centroid" indicates that the majority of the building is located within the CEHA.

that were identified with high “likely applicability” included upland waterfront parks, in-water breakwaters, artificial reefs, and constructed breakwater islands. Shoreline seawalls were also found to have likely applicability, however the study notes that seawalls may disrupt sediment transport and lead to the erosion of beaches.

Based on the work described above, coastal protection initiatives were recommended in the Community Rebuilding Resiliency Plan for the East and South Shores of Staten Island, including along the Tottenville reach. In particular, Coastal Protection Initiative 15 calls for the implementation of a “living shoreline project—likely to consist of oyster reef breakwaters, beach nourishment, and maritime forest enhancements—in areas adjacent to Conference House Park in Tottenville.”

Also included in the Plan are other initiatives proposed for Tottenville, which are in various stages of progress. For example, Coastal Protection Initiative 24 calls for the United States Army Corps of Engineers (USACE) to work with the City to complete its longstanding study for the East and South Shores of Staten Island, Phase 2 of which includes developing a plan for ongoing beach nourishment to restore sand rapidly after extreme weather events.

One New York: The Plan for a Strong and Just City (OneNYC), April 2015, is currently the City’s comprehensive strategy and policy directive to address long-term challenges related to climate change, an evolving economy, and aging infrastructure. OneNYC is overseen and implemented by the Mayor’s Office of Sustainability and the Mayor’s Office of Recovery and Resiliency, and incorporates and expands on all the planning work undertaken in PlanNYC as well as *A Stronger, More Resilient New York*. In particular, the following three initiatives comprise Vision 4: Coastal Defense:

- Initiative 1, Strengthen the city’s coastal defenses: Complete the City’s \$3.7 billion coastal protection plan, a program of infrastructure investments, natural area restoration, and design and governance upgrades of which nearly half is funded.
- Initiative 2, Attract new funds for vital coastal protection projects: Continue to identify and secure new sources of funds for infrastructure to reduce coastal flooding risk.
- Initiative 3, Adopt policies to support coastal protection: Align and adopt policies to support the right investments in coastal protection, and ensure those investments are operated and maintained effectively.

Among its many components, Vision 4 describes investments to improve low-lying shorelines across the city, including in the South Shore of Staten Island. Elements of the proposed Breakwaters and Shoreline Projects are specifically described in the OneNYC planning document as measures to address this policy.

S.2.2 REBUILD BY DESIGN

In June 2013, HUD launched Rebuild by Design, a competition to respond to Superstorm Sandy’s devastation in the northeast region of the United States and promote a design-led approach to pro-active planning for long-term resilience and climate change adaptation. The winning proposals would be implemented using CDBG-DR funding as well as other public and private-sector funding sources. In June 2014, following a year-long research and design process during which the design teams met and collaborated with regional experts, government entities, elected officials, issue-based organizations, local community groups and individuals, HUD announced the winning proposals. The Staten Island Living Breakwaters Project, which proposed a resiliency approach to promote risk reduction through erosion prevention, wave

energy attenuation, and enhancement of ecosystems and social resiliency, was one of the selected projects. As a result, New York State has been allocated \$60 million of CDGB-DR program funds to implement the project along the Tottenville shoreline of the South Shore of Staten Island. With an ecologically enhanced breakwater system to address wave energy and shoreline erosion at Tottenville, this proposal responds to the City's Coastal Protection Initiative 15. Progress on this initiative has been tracked and reported in the OneNYC 2016 Progress Report.

S.2.3 NY RISING COMMUNITY RECONSTRUCTION PROGRAM

The NY Rising Community Reconstruction Program was established by New York State to provide rebuilding and revitalization assistance to communities severely damaged by Superstorm Sandy, Hurricane Irene and Tropical Storm Lee. The Tottenville Shoreline Protection Project was conceived through the NY Rising planning process, and proposes new shoreline protection features as a coastal resiliency strategy for the Tottenville area. New York State proposes to use approximately \$9.3 million of CDBG-DR program funds to implement this project.

S.2.4 HARBOR ESTUARY AND RARITAN BAY PLANNING

Any coastal resiliency strategy proposed for Tottenville should be considered in the context of its location and its consistency with other plans or policies relevant to the area. As described above, the South Shore of Staten Island adjoins the waters of Raritan Bay, which supports a diverse community of aquatic biota, but has also been impacted by upland development and discharges that have resulted in degraded water and habitat quality, as well as sediment contamination. Once home to a rich estuarine environment, robust coastal habitat and vibrant destination for water-based recreation and other activities, the Raritan Bay and South Shore of Staten Island have suffered significant land loss and habitat degradation over the last century.

A Comprehensive Restoration Plan has been developed for the Hudson-Raritan Estuary (HRE CRP) by the USACE and the Port Authority of New York and New Jersey (PANYNJ) to restore and protect habitat within the Hudson-Raritan Estuary. The Plan was developed in partnership with the NY-NJ Harbor & Estuary Program (HEP) with the contribution and collaboration of the U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), NYSDEC, Hudson River Foundation, NY/NJ Baykeeper, and other federal, state (NY and NJ), and city agencies as well as non-governmental organizations and academic and research institutions. The Plan identifies 12 Target Ecosystem Characteristics (TECs), which are used to outline strategies for ecological restoration within the Hudson-River Estuary. These TECs include wetlands; habitat for waterbirds; coastal and maritime forests; oyster reefs; eelgrass beds; shorelines and shallows; habitat for fish, crab, and lobsters; tributary connections; enclosed and confined waters; sediment contamination; public access; and acquisition. The HRE CRP specifically identifies restoration opportunities in many of the TEC categories for the study area. The Living Breakwaters project area is identified in the plan as having high suitability for oyster reef restoration. The final report was released in June 2016.

NYCDP's *New York City Vision 2020: New York City Comprehensive Waterfront Plan* (2011) is another study that provides context for resiliency planning along the Tottenville shoreline. Vision 2020 was prepared in partnership with State and federal agencies, including NYSDEC, the Port Authority of New York and New Jersey and the U.S. Army Corps of Engineers. Among

its many goals are expanded public access to the waterfront and waterways; enhancement of the public experience of the waterways that surround New York—including promoting water recreation and creating the waterfront infrastructure needed for events, cultural activities and educational programs; and identification of strategies to increase the City’s resilience to climate change and sea level rise.

Providing public access along the City’s coastline is also the intent of Policy 8 of the City’s Waterfront Revitalization Program. This policy, along with the goals of Vision 2020, is consistent with the priorities identified by the South Shore community during its engagement with the City following Superstorm Sandy.

S.2.5 RAISE SHORELINES CITYWIDE STUDY

In 2014, the New York City Economic Development Corporation (NYCEDC) announced its intention to study and identify high-risk shorelines citywide that are most vulnerable to sea level rise and erosion, and then prioritize those shorelines for future design and construction of resiliency measures. This study analyzed approximately 43 miles of at-risk shoreline across the five boroughs (including the South Shore of Staten Island) with a goal to evaluate localized measures to reduce coastal risk, make recommendations for resiliency investments, and coordinate with other local coastal protection actions. As part of this coordination, coastal strategy recommendations for the area in Tottenville identified in the *Raise Shorelines Citywide Study* (along the eastern stretch of Conference House Park) have been incorporated into the proposed Shoreline Project. Citywide, the Raise Shorelines budget is \$100 million of which “approximately 30 percent of funding will be used to implement protection initiatives in Southern Staten Island.”³

S.2.6 CITY, STATE, AND FEDERAL AGENCY COORDINATION

As noted in the City’s PlaNYC Progress Report 2014:

In addition to moving forward its own projects, New York City took formal steps to establish a leadership role in advancing coastal protection initiatives. This involved a high level of coordination with federal and state funding and regulatory agencies including USACE, HUD, FEMA and New York State DEC. Leadership has also been established on the City level through the Coastal Protection Working Group, which brings senior level agency designees together to coordinate protection initiatives. In addition, the City has worked closely with the several federal HUD-sponsored Rebuild by Design teams and the State’s New York Rising Community Reconstruction Program to ensure federal and state funded projects through these programs are aligned with and advance the City’s coastal protection priorities.

One such coordinated effort resulted in the March 2015 *Coastal Green Infrastructure Research Plan for New York City*, prepared for NYSDEC, the New England Interstate Water Pollution Control Commission (NEIWPCC) and jointly managed by the Hudson River Estuary Program, NYCDP and New York City Mayor’s Office of Recovery and Resiliency. The plan is intended to aid decision-makers as they evaluate strategies to protect New York Harbor’s future. The

³ <https://www.nycedc.com/sites/default/files/files/rfp/qa-documents/Raise%20Shorelines%20Citywide%20QA%20FINAL.pdf>

research plan examines six coastal green infrastructure strategies (including constructed breakwaters), summarizes the latest scientific understanding of the ecological and risk reduction benefits of these strategies, and describes research needs moving forward. The overall plan is intended to inform planning to protect coastal communities, provide habitat to sustain fisheries, and provide opportunities to connect New Yorkers to their local waterfront.

S.3 PROJECT PURPOSE, NEED, AND OBJECTIVES

The Proposed Actions would reduce the risk of wave action and coastal erosion, address the impacts of coastal flooding, and increase the resiliency of the communities and ecosystems within the project area, thereby protecting critical infrastructure and facilities, residences, businesses, and ecological resources during hurricanes and other severe weather storm events. The Proposed Actions will also enhance aquatic habitats, and foster community education on coastal resiliency. The ability to meet this purpose is discussed in below.

S.3.1 PURPOSE

The purpose of the Proposed Actions is to reduce wave action and coastal erosion along the shoreline in Tottenville, while enhancing ecosystems and shoreline access, use and stewardship. This is consistent with the City's Coastal Protection Initiatives and planning studies for the Tottenville area. The proposed project goals would be achieved using a layered approach that would address wave action, impacts of coastal flooding and event-based (i.e., short-term/storm-related) and gradual (long-term) shoreline erosion, while restoring and enhancing ecosystems, improving waterfront access and engaging with the community through educational and stewardship programs directly related to the coastal resiliency actions. It is highly important that the actions both provide coastal protection and ecological enhancement, and at the same time serve as a means to engage and educate the public on local ecosystems and innovative coastal resiliency strategies in an era increasingly affected by climate change. The coastal structures associated with the Proposed Actions would be designed for a 50-year service life, though the functional life of the projects is anticipated to be longer.

The ability to meet this purpose is measured in terms of the following goals and objectives of the Proposed Actions:

- Risk Reduction
 - Attenuate wave energy;
 - Address both event-based and long-term shoreline erosion / preserve beach width; and
 - Address the impacts of coastal flooding.
- Ecological Enhancement
 - Increase diversity of aquatic habitats consistent with the Hudson-Raritan Estuary plan priorities (e.g., oyster reefs and fish and shellfish habitat).
- Social Resiliency
 - Foster community education on coastal resiliency directly tied to and building off the structural components of this resiliency initiative;
 - Increase physical and visual access to the water's edge;
 - Enhance community stewardship of on-shore and in-water ecosystems; and
 - Increase access to recreational opportunities.

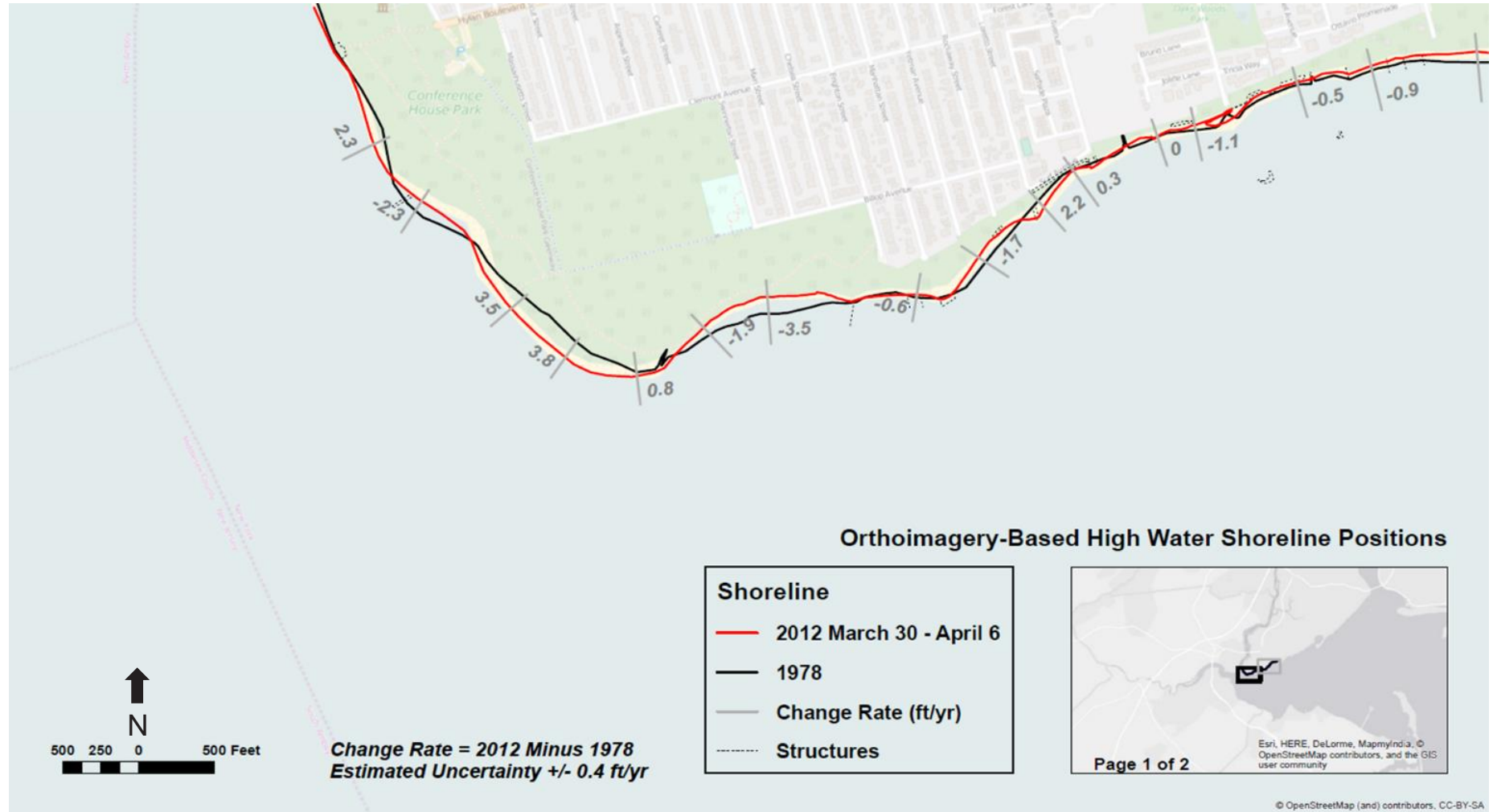
S.3.2 NEED

Staten Island is exposed to extreme wave action and coastal flooding during hurricanes and other severe storm events due to its location at the mouth of the New York Bight, which funnels storm-driven waves into New York Harbor, Raritan Bay, and the shoreline of Staten Island. The Raritan Bay and South Shore of Staten Island was once home to a rich estuarine environment, robust coastal habitat and vibrant destination for water-based recreation and other activities. Over the last century, this area has suffered significant land loss and habitat loss/degradation. As described above, the South Shore of Staten Island is vulnerable to both event-based and gradual coastal erosion and land loss (see **Figure S-2**). The project area has experienced dramatic net erosion between 1978 and 2012. The greatest historic erosion rates were seen in the southern part of the project area in Conference House Park, just north of Wards Point where the erosion rate was over 3 feet per year. In general, while some small areas showed accretion, and some areas eroded less, large parts of the shoreline within the project area were eroded at rates ranging from 1 to over 3 feet (ft) per year (from 1978 to 2012). Some areas of accretion were observed, usually updrift of shoreline structures such as groins or storm sewer outfalls, but higher rates of erosion were generally observed down-drift of such structures. Overall, beaches in the project area have experienced an annual net loss of sediment. Narrow beaches lead to less protection for on-shore assets from wave action and coastal erosion, as well as less space for residents and visitors to enjoy the shoreline experience, and access the shoreline and nearshore waters.

S.4 DESIGN METHODOLOGY

As described above, the Proposed Actions include the implementation of one or more proposed initiatives intended to enhance coastal and social resiliency along the Tottenville shoreline of the South Shore of Staten Island, NY. These initiatives include the Breakwaters Project and Shoreline Project. This section summarizes the design methodology employed to characterize existing and future conditions in the project area and model the effectiveness of the initiatives in meeting the goals and objectives of the Proposed Actions. Future conditions were modeled in consideration of up to 30 inches of sea level rise (consistent with 6 NYCRR Part 490 projections and New York City Panel on Climate Change (NPCC) projections for the 2050s to the 2080s timeframe),⁴ and for varying storm conditions. Modeling efforts were focused on screening and eliminating design scenarios that did not meet the goals and objectives of the Proposed Actions, and advancing feasible project designs that would meet those goals and objectives. The Final Environmental Impact Statement (FEIS) analyzes the preliminary 60 percent design scenario for

⁴ New York State's Community Risk and Resiliency Act (CRRRA) requires that applicants for certain State programs demonstrate that they have taken into account future physical climate risks from storm surges, sea-level rise and flooding, and required the Department of Environmental conservation (NYSDEC) to establish official State sea-level rise projections. In February 2017, NYSDEC adopted a rule (6 NYCRR Part 490) defining the existing projections for use. The 6 NYCRR Part 490 projections for the downstate region are consistent with the New York City Panel on Climate Change's (NPCC) projections for the New York City region. Based on the adopted model projections, 30 inches of sea level-rise could occur by the 2050s under the 'High' scenario, representing the 90th percentile of model projections, by the 2080s within the 'Middle Range' at approximately the 50th percentile of model projections, (as well as by 2100 within the 'Middle Range' at approximately the 40th percentile of model projections). Note that the ranges represent the percentiles of the modeled runs, but do not represent a probability of occurrence.



NOTE: Negative rates indicate erosion, positive rates indicate accretion

the Breakwaters Project and the refined 30 percent design scenario for the Shoreline Project. These are described in detail below under “Alternatives Analyzed in this EIS.”

S.4.1 BREAKWATERS PROJECT

To inform the design and the benefits of the proposed breakwaters system, an understanding of existing wave conditions and shoreline erosion and the response of these conditions to the proposed project were required. Additionally, understanding of the existing hydrodynamics and water circulation patterns and potential changes due to the proposed project were critical to the understanding of any potential water quality effects of the breakwater system. The following evaluations and modeling were performed to characterize baseline wave conditions, shoreline response, currents, and nearfield flows and sediment motion, as well as evaluate various breakwater design alternatives:

Wave Transformation Modeling—Nearshore wave conditions were established by transforming wave conditions from the offshore to the nearshore using the Simulating Waves Nearshore (SWAN) wave transformation model. A baseline wave climate of Raritan Bay was developed to determine historic wave conditions and as input to modeling used to predict breakwater impacts on wave climate and long-term shoreline change. The long-term wave climate was developed by transforming wave hindcast⁵ data from a USACE Wave Information Study station at the entrance of New York Harbor.

Shoreline Change Analysis—In parallel, historic aerial imagery was used to determine how the shoreline has changed over time. Orthoimagery of the shoreline between 1978 and 2012 was used to develop historical shoreline positions and to calibrate the shoreline change model.

Shoreline Change Modeling—Long-term shoreline change modeling used the GENeralized model for SIMulating Shoreline changes (GENESIS) with simulation results calibrated and validated to the historically observed shorelines presented in the Shoreline Change Analysis section. The model was used to screen design scenarios and assess shoreline change impacts.

Design Wave Transformation Near Breakwaters—The transformation of design wave conditions in proximity to the breakwaters during normal tidal conditions and severe storm events was analyzed using the REFraction DIFfraction (REFDIF) wave model on waves from prevailing wave directions. Additionally, a more detailed assessment of the waves in the nearshore region in the lee of the breakwaters was assessed using the nonlinear wave model, FUNWAVE.

Storm Induced Beach Profile Response Modeling—Event-based beach profile change in the project region outside the Shoreline Project was modeled using the Storm-induced BEACH Change (SBEACH) and Cross-SHORE (CSHORE) beach erosion models. SBEACH is a USACE numerical model which simulates beach profile change by predicting beach, berm and dune erosion due to storm waves and water levels. Similarly, CSHORE is a one-dimensional time-averaged nearshore profile model for predictions of cross-shore wave height, water level, wave-induced steady currents, and beach profile evolution. The models use differing approaches to calculate change in the beach profile shapes and CSHORE performed better in the project area based on limited available calibration/verification data.

⁵ Retrospective forecasting of waves using measured wind and wave information.

Nearfield Circulation and Sediment Movement Modeling—Flow and sediment motion around the breakwaters and particularly the reef streets was modeled using the computation fluid dynamics model, FLOW-3D, for various water levels and tidal conditions. This was primarily to aid in the ecological design process, including the configuration of the reef streets (a habitat design element of the Breakwaters Project).

Water Circulation Modeling—Additionally, a hydrodynamic model of tidal circulation in the bay was developed to assess the preliminary potential water quality impacts using the 2D hydrodynamic mode of the Delft3D-FLOW model.

Using these baseline data, modeling was conducted to assess changes in the shoreline position, wave environment, and water circulation in response to the proposed breakwater system. These results were also used to assess the performance of the proposed breakwater layouts and geometries by optimizing their design to achieve the goals of reduced erosion and reduced wave exposure (using a target goal of wave heights of less than 3 feet in the lee of the breakwaters in up to a 100-year storm with 30 inches of sea level rise).

S.4.2 SHORELINE PROJECT

In order to determine potential impacts the Shoreline Project could have on long-term shoreline change in Tottenville, several modeling efforts were undertaken to determine future performance of the four main Proposed Actions elements: the earthen berm, hybrid dune/revetment system, eco-revetments, and raised edge (revetment with trail). Using collected cross-shore transect data, the existing condition of the Tottenville beach at each transect was modeled using USACE's SBEACH model, a numerical model that simulates beach profile change by predicting beach, berm, and dune erosion caused by storm waves and water levels. The condition of the shoreline (overtopping, run-up, and scour) at each transect was simulated under various storm conditions. Each simulation included consideration of sea level rise. Additional models were used to simulate sediment settlement, slope stability, and drainage and seepage patterns at each of the Shoreline Project components.

Wind generated waves are defined by their height, length, and period. The nearshore wave conditions developed for the Breakwaters Project (described above) were found to be appropriate for use as inputs to the numerical models for the Shoreline Project. Additional inputs for SBEACH modeling included information about sediment properties and nearshore topography. Effective grain size was determined using information from grab samples collected as part of the project's sampling program.

S.5 PROJECT ALTERNATIVES

The development and evaluation of project alternatives is central to the National Environmental Policy Act (NEPA) and New York's State Environmental Quality Review Act (SEQRA) processes. This section identifies the alternatives that will be analyzed in this EIS for the build year of 2020 (the year of completion of the project), and discusses alternatives that were considered but eliminated from further study because they do not sufficiently meet the Proposed Actions' purpose and need and were not considered practicable.

S.5.1 ALTERNATIVES ANALYZED IN THIS EIS

ALTERNATIVE 1—NO ACTION ALTERNATIVE

The No Action alternative assumes that no new structural risk reduction projects or marine habitat restoration projects will be implemented in the project area. This alternative also assumes that current trends with respect to coastal conditions at Tottenville—i.e., relating to erosion, wave action, ecosystems, and water quality—will continue. Temporary dunes, constructed by NYC Parks as interim protective measures post-Sandy, are currently in place and would continue to exist under the No Action Alternative. The No Action alternative also presumes that existing strategies to educate New Yorkers and the general public on the risks posed by climate change will remain the same in the study area. In this sense, the No Action Alternative is inconsistent with a number of the public policies which encourage that positive action be taken to improve coastal resiliency and reduce communities' vulnerability to future storm damage.

Under this alternative, there would also be no intervention to create in-water structural habitat, living shorelines, or any other ecological enhancements to in-water and on-shore habitats in the project area, and therefore policy goals relating to environmental improvements to the Staten Island waterfront would not be advanced.

It is expected that land use patterns in the project area would remain unchanged. A number of filings have been approved by NYCDOB for infill housing in the study area; these consist entirely of single-family and two-family housing in portions of the study area that already contain housing. Based on review of databases maintained by NYCDOP and NYCDOB, no major developments or development proposals are expected by the 2020 analysis year. The existing Conference House Park Pavilion is undergoing renovations as a result of storm damage (to be completed in 2018).

The project area has experienced dramatic net erosion between 1978 and 2012. The greatest historic erosion rates were seen in the southern part of the project area in Conference House Park, just north of Wards Point where the erosion rate was over 3 feet per year. In general, while some small areas showed accretion, and some areas eroded less, large parts of the shoreline within the project area were eroded at rates ranging from 1 to over 3 ft per year (from 1978 to 2012). Some areas of accretion were observed, usually updrift of shoreline structures such as groins or storm sewer outfalls, but higher rates of erosion were generally observed down-drift of such structures. Overall, beaches in the project area have experienced an annual net loss of sediment. Narrow beaches lead to less protection for on-shore assets from wave action and coastal erosion, as well as less space for residents and visitors to enjoy the shoreline experience, and access the shoreline and nearshore waters.

These processes would continue in the future under the No Action Alternative, and may increase due to sea level rise and changes in storm frequency and/or intensity. Numeric simulation of shoreline changes using a shoreline response numerical modeling system revealed that in the southwestern portions of the site (southwest of Sprague Avenue) both the overall pattern and rates of shoreline erosion and accretion are likely to continue into the future, including erosion rates of 1.0 to 2.0 feet per year between Loretto Street and Manhattan Street, and between 2.0 and 3.5 feet per year in Conference House Park between Main Street and Wards Point. Northeast of Sprague Avenue, modeling indicates that the general pattern of erosion and accretion will remain the same as those observed historically, though the simulation shows future rates of change slightly lower than those historically observed (see **Figure S-3**).



These erosion rates, combined with projected sea level rise, could eliminate some beach sections and leave others completely inaccessible at high tide, eliminating continuous public access along the shoreline and reducing the protective beach which is first line of defense against erosion and waves.

ALTERNATIVE 2 (PREFERRED ALTERNATIVE)—THE LAYERED TOTTEVILLE SHORELINE RESILIENCY STRATEGY: LIVING BREAKWATERS AND TOTTEVILLE SHORELINE PROTECTION PROJECT (LAYERED STRATEGY)

The Layered Strategy consists of the implementation of two individual projects that, when integrated as one initiative, may provide greater overall coastal risk reduction and promote social resilience (see **Figure S-4**). These projects were developed through separate, but related, planning initiatives arising out of the Superstorm Sandy recovery efforts. Implemented together, the projects would be planned and designed as a single, integrated coastal resiliency strategy for this area. By providing two layers of coastal risk reduction, these components, as further described below, are intended to improve current shoreline erosion conditions, serve to further reduce wave action, provide for ecological enhancement and promote social resiliency.

Modeling efforts for the proposed initiatives were focused on advancing feasible project designs that would meet the goals and objectives of the Proposed Actions. This FEIS analyzes the preliminary 60 percent design scenario for the Breakwaters Project and the refined 30 percent design scenario for the Shoreline Project.

It is anticipated that the State of New York, non-profit organizations and other government agencies involved in the construction and ownership of elements of the Layered Strategy will maintain and operate their respective project components. Through final design, GOSR will develop robust maintenance and operation plans, working collaboratively with appropriate state, city and federal agencies, as well as non-profit organizations.

The individual components of the Layered Strategy are discussed below.



Living Breakwaters Project (Rebuild-by-Design)

As mentioned above, the concept for the Breakwaters Project was developed as part of the HUD sponsored design competition, Rebuild by Design, from 2013 through 2015. The winning proposal included an ecologically enhanced breakwaters system that would span an approximately 13,000 linear foot stretch off the Tottenville shoreline, a community Water Hub on-shore, and programming for stewardship and citizen science. In preparation for the advancement of design, a robust data collection effort was undertaken, including, but not limited to, a bathymetric survey, site-specific sediment sampling, geotechnical boring collection, environmental/habitat surveys, and hydrographic studies. Following detailed analysis of these data and iterative modeling efforts, the design of the system was refined to the 30 percent design scenario (as described in the Draft Environmental Impact Statement (DEIS), and subsequently, the preliminary 60 percent scenario (as described in this FEIS). Throughout the process, the footprint of the breakwaters has reduced significantly, minimizing the potential for impacts, from the original RBD conceptual alignment of 13,000 linear feet of breakwaters, to 3,900 linear feet in the 30 percent design phase, to a total length of 3,200 feet in the preliminary 60 percent design phase. The modeling and analysis performed in the preliminary 60 percent scenario demonstrated that the goals and objectives of the Proposed Actions would be met with this much more targeted system, using groupings of breakwater structures to respond to the changing



FOR ILLUSTRATIVE PURPOSES ONLY

-  Proposed Breakwater Features
-  Proposed Shoreline Project Elements
-  Proposed Shoreline Restoration Area
-  Potential Location of Proposed Water Hub (exact location to be determined)

-  Proposed Floating Dock (associated with Water Hub Potential Locations 1 and 2 only)
-  Potential Water Access

0 2,000 FEET

character of the shoreline, observed shoreline change patterns and the predominant storm wave direction (see **Figures S-5 and S-6**).

The primary Breakwater Project components are described below.

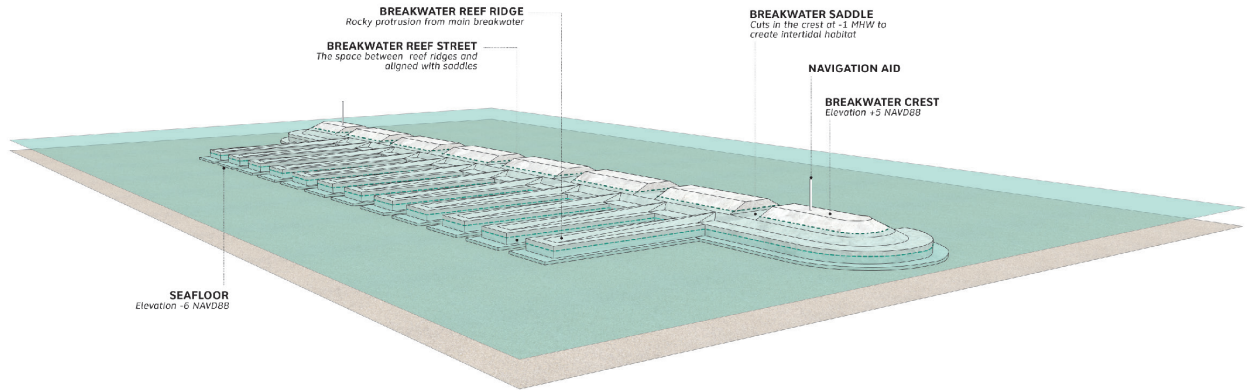
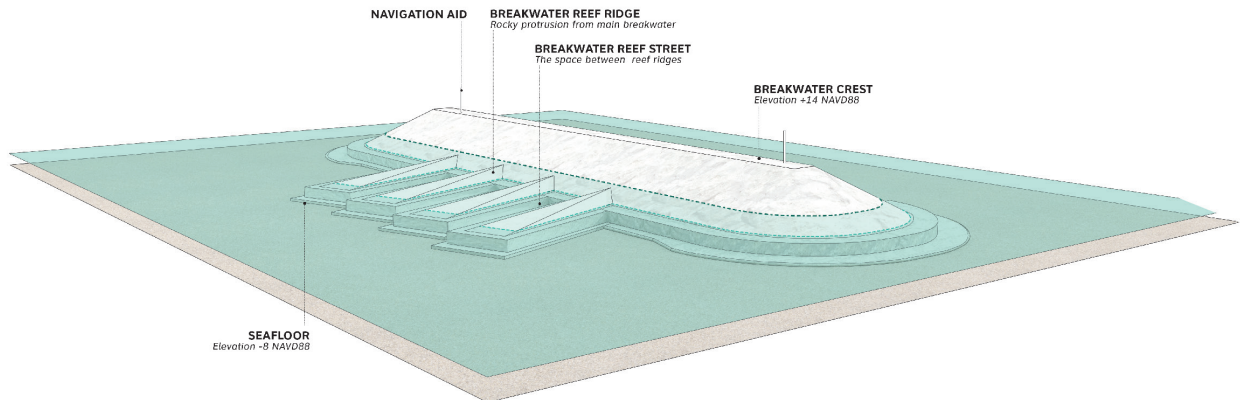
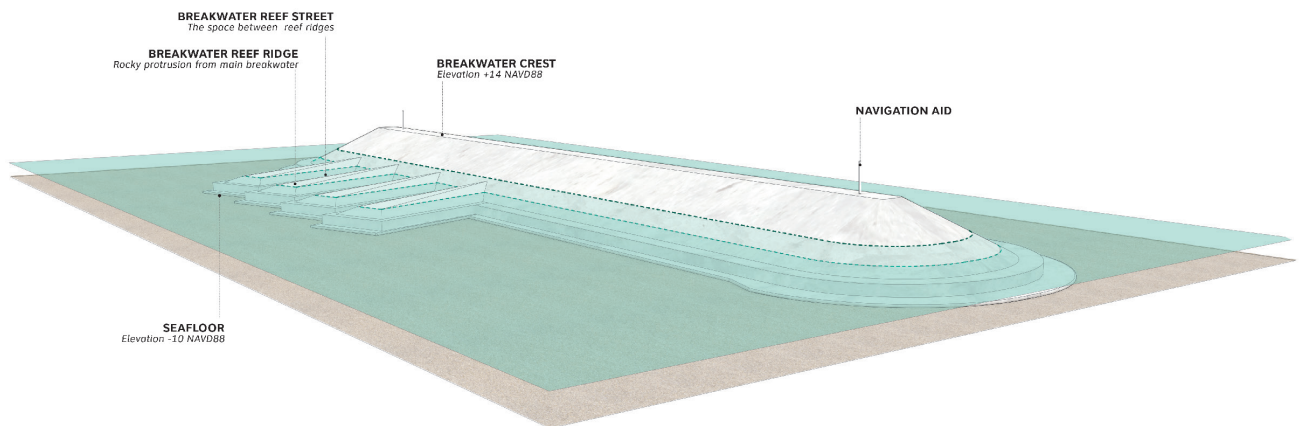
Breakwaters System—One of the key components of the Breakwaters Project is an ecologically enhanced breakwater system designed to reduce wave energy at the shoreline, and prevent or reverse shoreline erosion while creating hard/structured marine habitat. The breakwater system as currently proposed (preliminary 60 percent design) would have nine breakwater segments with a total length of approximately 3,200 linear feet within Raritan Bay and would be located between approximately 790 and 1,170 feet from the shoreline. Additionally, the vast majority of the breakwater structures would be located more than 1,700 feet from the Federal Navigation Channel with the closest breakwater segment located more than 700 feet from the channel. The breakwater structures would occupy approximately 495,900 square feet (approximately 11.4 acres) on the bottom of Raritan Bay and result in the placement of 151,780 CY of rock and ecologically enhanced concrete within Raritan Bay, approximately 115,990 CY of which would be placed below mean high water (MHW). The breakwaters would be positioned and designed to optimize reduction in both wave height and shoreline erosion, while enhancing habitat and minimizing habitat displacement and navigational impacts.

The breakwaters will be rubble mound structures made of a combination of hard stone and biologically enhanced concrete armor units. While materials and the basic construction of the breakwaters will be the same across all segments, three types of breakwaters, defined largely by their differences in crest elevation (in North American Vertical Datum of 1988 [NAVD88]) and overall height, are proposed: Type A, Type B, and Type C (see **Figure S-7**). All would extend some height above MHW. The overall breakwater system layout has been designed to reduce or reverse shoreline erosion along the length of the project area. Breakwater crest elevations, orientation and locations were also based on the relative need for storm wave attenuation at different locations along the shoreline.

Type A breakwaters, or “low crested” breakwaters, have been designed to prevent shoreline erosion but would have minimal impact on wave heights during severe storms. The Type A breakwaters have been designed for locations where the shoreline and assets near it are less vulnerable to storm wave action. Two segments of Type A breakwaters would be installed in the western portion of the project site near Ward’s Point. These breakwaters would have a crest elevation of 5 feet NAVD88 and an overall height of 11 feet and their crests would still remain above MHW with up to 30 inches of sea level rise. Together the two segments would be approximately 900 feet long, and result in the placement of 19,940 CY in the bay, of which 18,840 CY would be below MHW within a 2.8-acre footprint.

Type B and C breakwaters have been designed to reduce risk to the portions of the shoreline most vulnerable to storm wave action. Five segments of Type B breakwaters would be installed; together these segments would be approximately 1,500 feet long, with a crest elevation of 14 feet, an overall height of 20 feet, and result in the placement of approximately 79,870 CY in the bay, of which 57,520 CY would be below MHW within a 5.7-acre footprint. Two Type C breakwaters would be installed offshore in the eastern portion of the project site. Together, these segments would be approximately 800 feet long, with a crest elevation of 14 feet, an overall height of 24 feet, and result in the placement of approximately 51,970 CY within the bay, of which approximately 39,630 CY would be below MHW within a 3.0-acre footprint. Considering up to 30 inches sea level rise, modeling indicates that these breakwaters would be able to reduce wave heights to less than 3 feet in a 100-year storm event (a severe storm of a 1-percent



MAIN BREAKWATER TYPE "A"**MAIN BREAKWATER TYPE "B"****MAIN BREAKWATER TYPE "C"**

Source: SCAPE / Landscape Architecture PLLC

probability in any given year), thereby reducing event-based as well as long-term shoreline erosion and structural damage to assets on shore.

As a system, the breakwaters would be capable of reducing storm wave heights to three feet or less in up to a 100-year storm with 30 inches of sea level rise, reducing storm wave exposure to the southern shore of Staten Island. Wave attenuation provided by the breakwaters on a day-to-day basis would help to maintain beach conditions by reducing long-term beach erosion rates, reducing exposure of shoreline structures to erosion, and encouraging accretion in priority beach zones. The breakwater system would help to minimize the potential for down-drift erosion by holding sand in the system through wave energy reduction along the shoreline. At the western tip of the study area near Ward's Point, the breakwaters would likely reduce sand migration into the Federal Navigation Channel. The breakwaters were also designed to encourage shoreline growth, or accretion, in places where the beach is most narrow, as well as to reverse the pattern of historic landloss, promoting the stabilization or accretion of beach in areas of the greatest observed historic land loss (see **Figure S-8**).

- The proposed breakwater system would increase habitat diversity through the establishment of structural habitat, which is currently limited within Raritan Bay. The breakwater structures have been designed to have varying levels of elevation, inclination, bio-enhancing materials, textures, interstitial spaces, and grain sizes in order to create a diversity of habitat characteristics for aquatic biota. The breakwaters would be primarily constructed as rubble mound (rock) structures with a bedding layer, stone core and outer layers consisting of armor stone or bio-enhancing concrete armor units. In the subtidal and intertidal areas, up to one third of the armor stone would be bio-enhancing concrete units rather than stone, creating an “enhanced” habitat surface. Certain breakwater segments would have a series of rocky protrusions or “reef ridges” that would extend approximately 65 feet seaward, generally perpendicularly from the main breakwater. These reef ridges and the narrow spaces between them, “reef streets,” would add to the diversity of available habitats within the intertidal and subtidal zones, including interstitial spaces between armor units by providing pockets of complexity within the structure. These areas could generate additional opportunities for ecological enhancement (see **Figure S-9**).

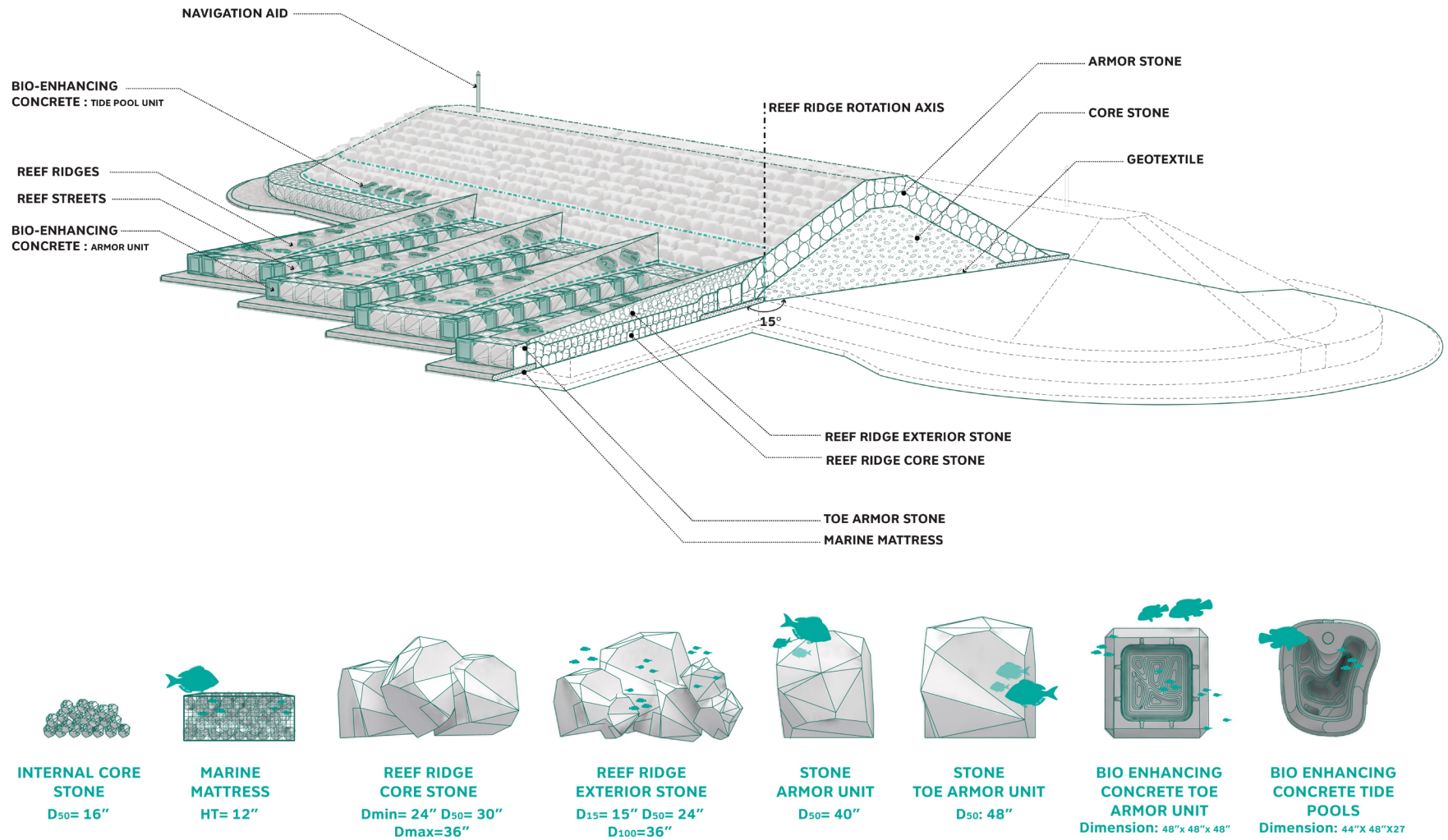
As discussed above, the vast majority of the breakwater structures would be located more than 1,700 feet from the Federal Navigation Channel. The location of the breakwater segments would be marked in accordance with US Coast Guard requirements, and the segments would be spaced far enough apart to avoid interference with recreational boating in Raritan Bay. In addition, the breakwaters would be positioned and marked to ensure they will not interfere with any navigation activities.

Shoreline Restoration—Sand placement to restore the historic shoreline position is being proposed between Loretto Street and Manhattan Street, downdrift (southwest) of the outfall at Loretto Street, where building the beach will have the most benefit in the vicinity of elements of the proposed Shoreline Project (see below), and where the beach is currently narrow and has experienced high rates of historic erosion (around 2.0 ft/year from 1978 to 2012). At the time of sand placement, the proposed area of shoreline restoration would extend along approximately 806 feet of shoreline in an area of approximately 3.1 acres, of which approximately 2.6 acres would be below MHW (+2.08 NAVD88). About 17,404 cubic yards (CY) of sand, approximately 11,637 CY of which would be below MHW, would be placed in this location to establish a wider beach in what is currently a narrow and erosion-prone section of the beach. This 3.1-acre area was selected for one-time shoreline restoration because of high historical and



Shoreline Change with and without
Proposed Actions

Figure S-8



projected erosion rates and narrow beach. The shoreline restoration would extend the beach at +5.0 NAVD88 by approximately 50 feet and then slope downward to meet the existing bathymetry. This one-time placement of sand would approximate the historic 1978 shoreline position, augment the accretion potential that can be provided by the breakwaters and add sediment to the overall system, particularly contributing to one of the narrowest and most erosion-prone areas of beach in the site and generally enhancing overall beach growth potential.

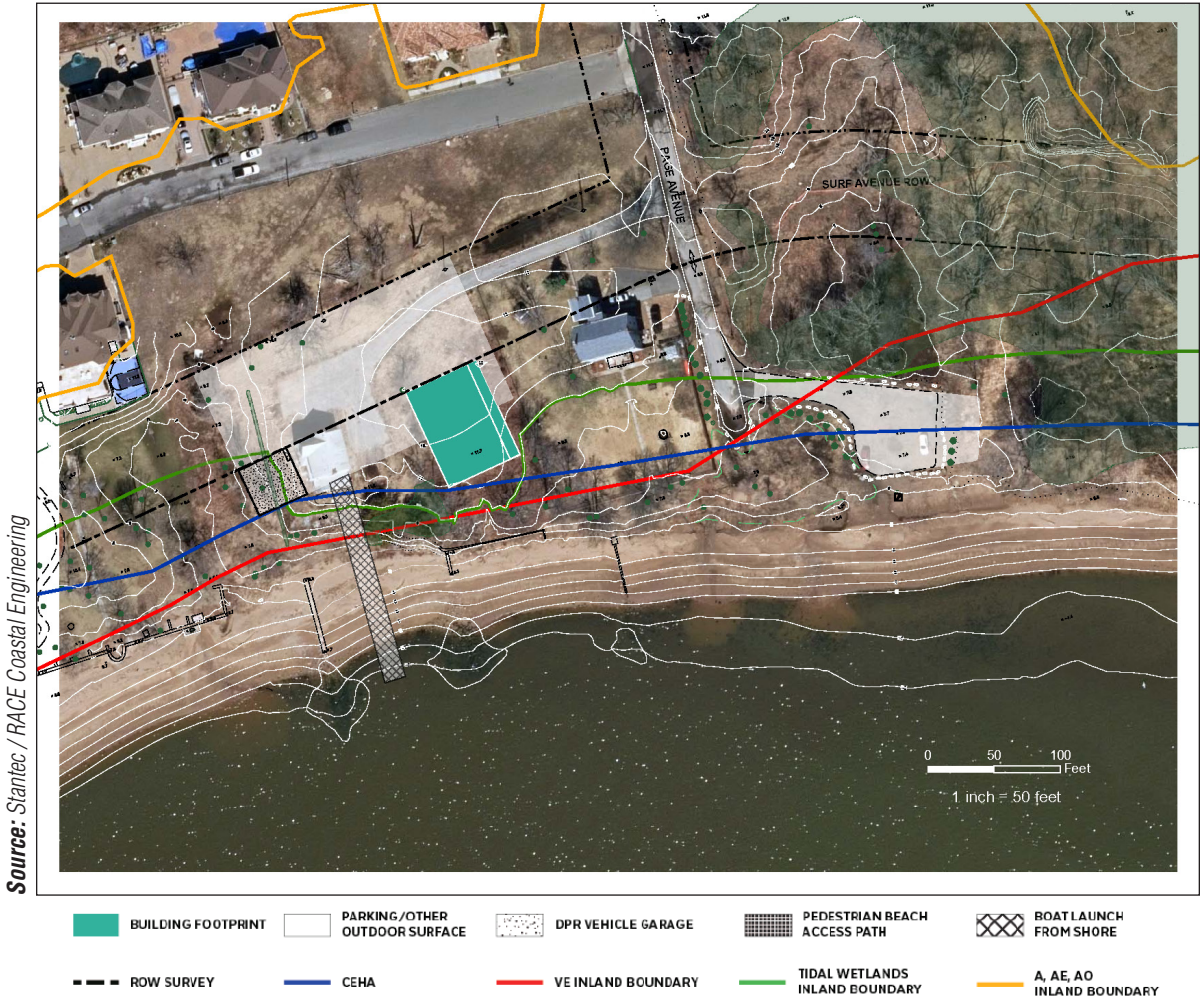
Water Hub—With the goal of promoting social resiliency, a proposed community Water Hub—including associated wayfinding, interpretive signage, and monitoring locations at points along the shoreline—would provide a place for access to the waterfront, orientation, education, information on shoreline resiliency, community gathering space and if located on-shore, potential equipment storage for NYC Parks maintenance. In particular, the Water Hub programming could include classrooms and labs, engaging students in waterfront education, citizen’s science, oyster restoration and reef building, and cultivating long-term estuary stewardship. The educational programming for the Water Hub would directly tie to the in water components, as well as to any shoreline resiliency components of the Proposed Actions. In addition to ecological engagement, the Water Hub facilities and programs are intended to educate residents on the risks and benefits of living in the coastal environment and build awareness, preparedness and stewardship within the community. The Water Hub may also include other elements, such as, exhibition space, maintenance-related storage space and offices, and terrace space.

One of three potential locations under consideration will be selected for siting the Water Hub—Potential Location 1 would be in the vicinity of the southern terminus of Page Avenue (involving the construction of a new structure).⁶ Potential Location 2 would be in the north-western portion of Conference House Park (involving the rehabilitation and adaptive reuse of an existing NYC Parks building). Potential Location 3 would involve a “floating” Water Hub—a vessel operated by a non-profit organization (e.g., BOP). The vessel would visit the breakwater project area for education and monitoring and would be docked at existing facilities in the City.

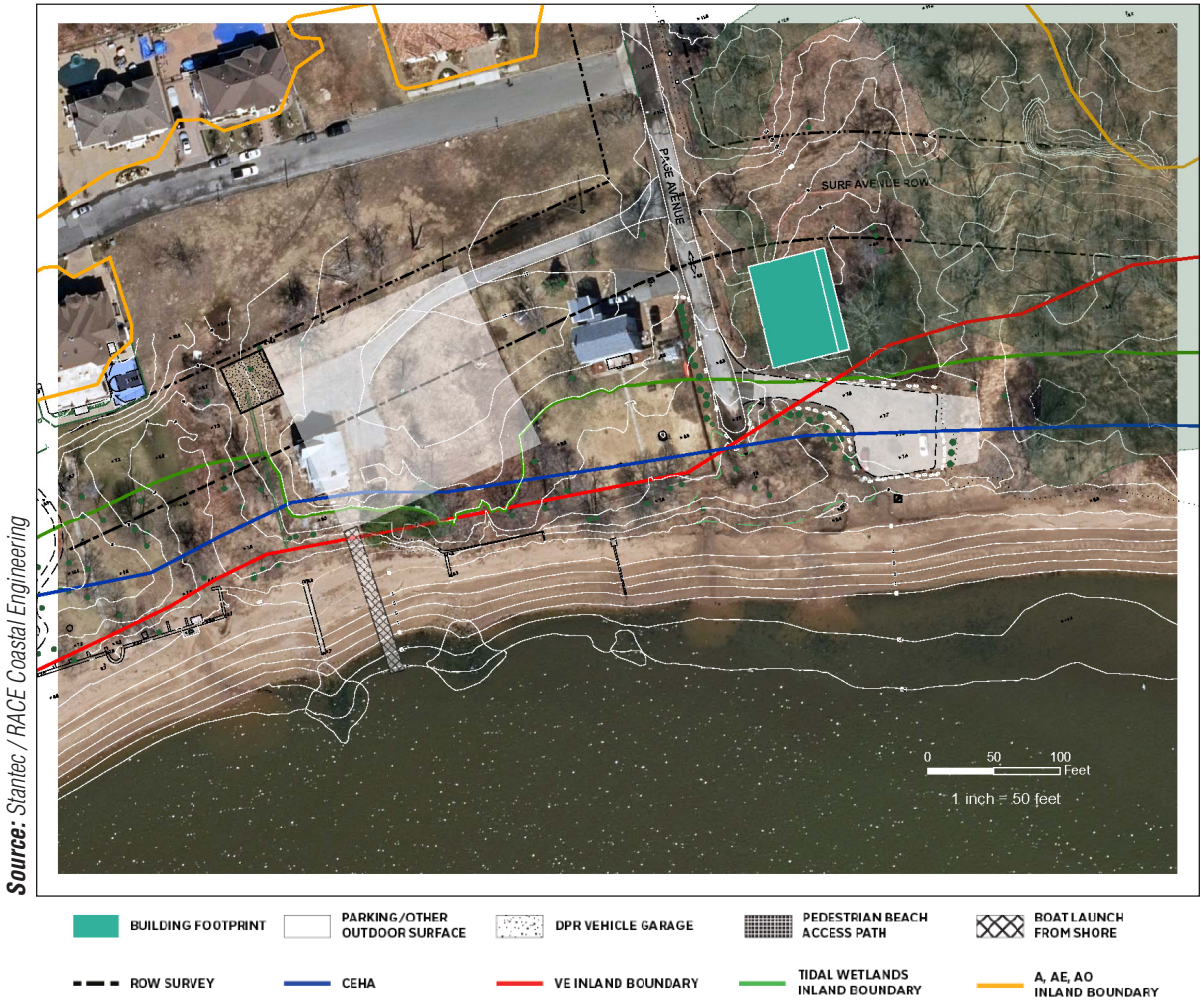
Potential Location 1 (On-Shore):

Potential Location 1 is located in the vicinity of the southern terminus of Page Avenue. At this location, there are two options for the construction of the Water Hub. The first, Page East Option, would locate the proposed Water Hub in an existing Conference House Park parking lot and surrounding wooded area immediately east of Page Avenue. The second, Page West Option, would use a grassy site west of Page Avenue that has previously contained a two-story NYC Parks building (which was demolished in 2016 due to substantial damage caused by Superstorm Sandy) (see **Figures S-10 and S-11**). Although the design is still being developed, the proposed Water Hub structure is anticipated to be small in scale, ranging from approximately 38-feet (potential location west of Page Avenue) to 48-feet (potential location east of Page Avenue) in height, clad in materials to enhance visual connections to the nearby waterfront areas (see

⁶ Since the publication of the DEIS, in response to public comments received during the public review process and additional feasibility considerations, Potential Location 1 for the Water Hub (in the vicinity of the southern terminus of Page Avenue) has been removed from further consideration. However, in the interest of completeness and to ensure a detailed comparative assessment of potential alternatives, this FEIS conservatively retains the analyses that were presented in the DEIS that were associated with this location.



Proposed Water Hub Location 1—
Page West Option
Figure S-10



Proposed Water Hub Location 1—
Page East Option

Figures S-12 and S-13). It would have a rooftop observation deck and solar panels. The proposed Water Hub facility is expected to include an enclosed 5,000-sf building and approximately 35,500 square feet of site improvements that would include landscaping, parking and utility spaces and designated space for the use of NYC Parks vehicles and equipment. The proposed Water Hub would also provide direct on-site waterfront access. It is anticipated that the facility would be used by the New York Harbor Foundation, NYC Parks, and local schools and community groups.

At Potential Location 1, access to the water from the shore would be provided by means of a seasonally deployed temporary floating boat launch. Anchored about a foot above MHW the approximately 8-foot-wide temporary boat launch would extend approximately 210 feet.

The Water Hub site would include parking for visitors, as well as several on-shore and near-shore landscape elements in the area of the proposed Water Hub.

Potential Location 2 (On-Shore):

Potential Location 2 is located in the north-western portion of Conference House Park. At this location, there are two options for the adaptive reuse of existing NYC Parks buildings for Water Hub programming. The first, the Biddle House Option, would locate the programming for the Water Hub within the existing Henry Hogg Biddle House (Biddle House). The Biddle House has been designated a New York City Landmark (NYCL) and in a comment letter dated November 9, 2016, the New York City Landmarks Preservation Commission (LPC) indicated that the house appears eligible for listing on the State/National Register (S/NR-eligible). The second, the Rutan-Beckett House Option, would locate the programming for the Water Hub within the existing Rutan-Beckett House which is located southwest of the Biddle House.

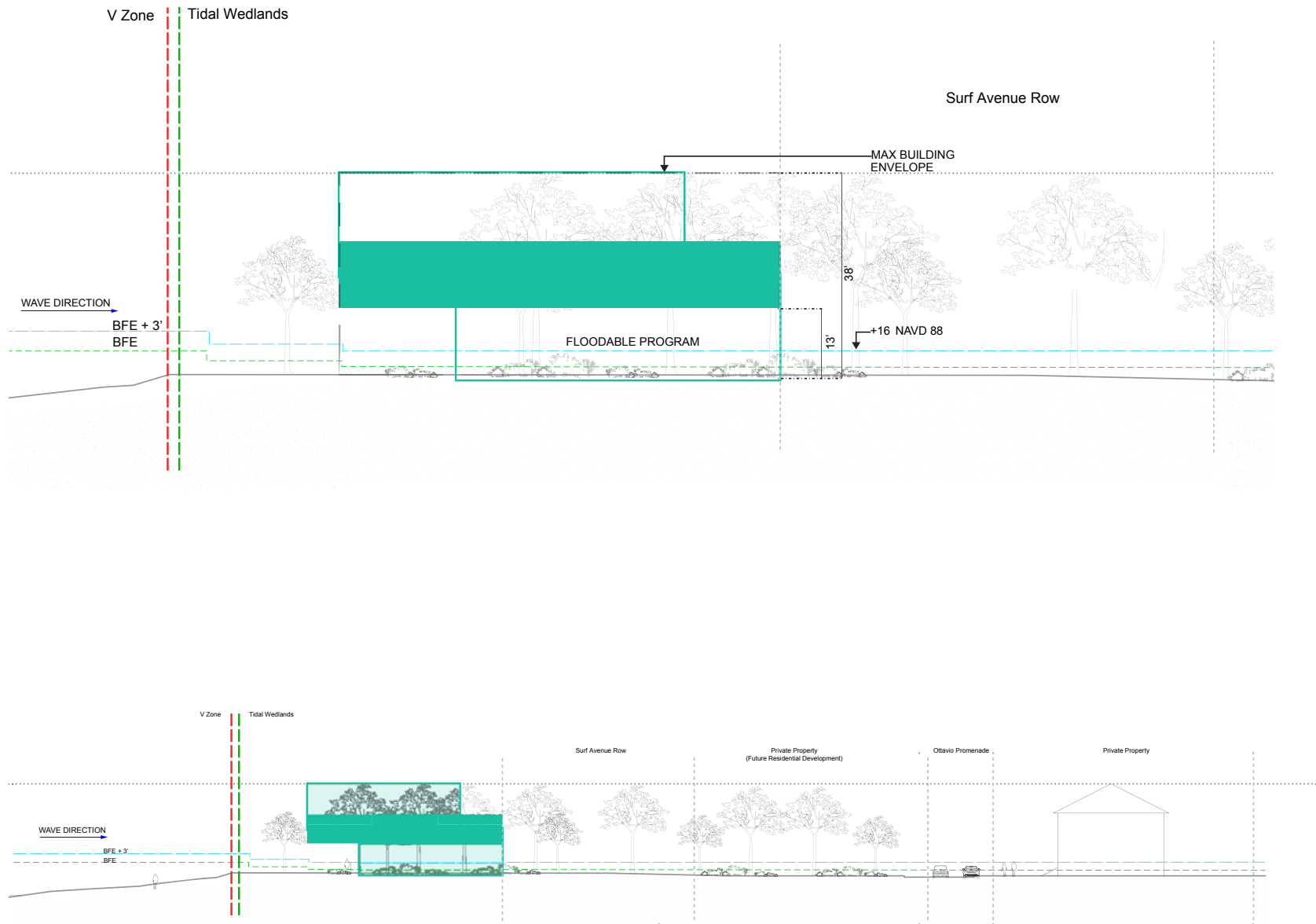
Similar to Potential Location 1, Potential Location 2 would include access to the water. This access would be provided in the area of one of the houses being adaptively reused for Water Hub activities. Water access would be provided with Americans with Disabilities Act (ADA) accessible pathways and ramps from the grounds of the house being adaptively reused to the beach area, and a seasonally deployed temporary floating boat launch to the water (see Figures S-14 and S-15).

Parking for Water Hub activities at Potential Location 2 would be accommodated at the existing Conference House Park Visitor's Center.

Should Water Hub programming be located at Potential Location 2, a small facility to provide seating, wayfinding, interpretive elements and potential storage for kayaks and beach cleaning equipment would be constructed near the terminus of Page Avenue. This structure would be a pavilion, shed or other light structure (approximately 400 sf). This facility may be connected to the City's water supply but would not require sanitation sewer connections. The existing parking facilities at the terminus of Page Avenue would be used to access this facility. Additional wayfinding, interpretive signage, and monitoring locations would be integrated along the length of the shoreline as part of the Water Hub's educational programming.

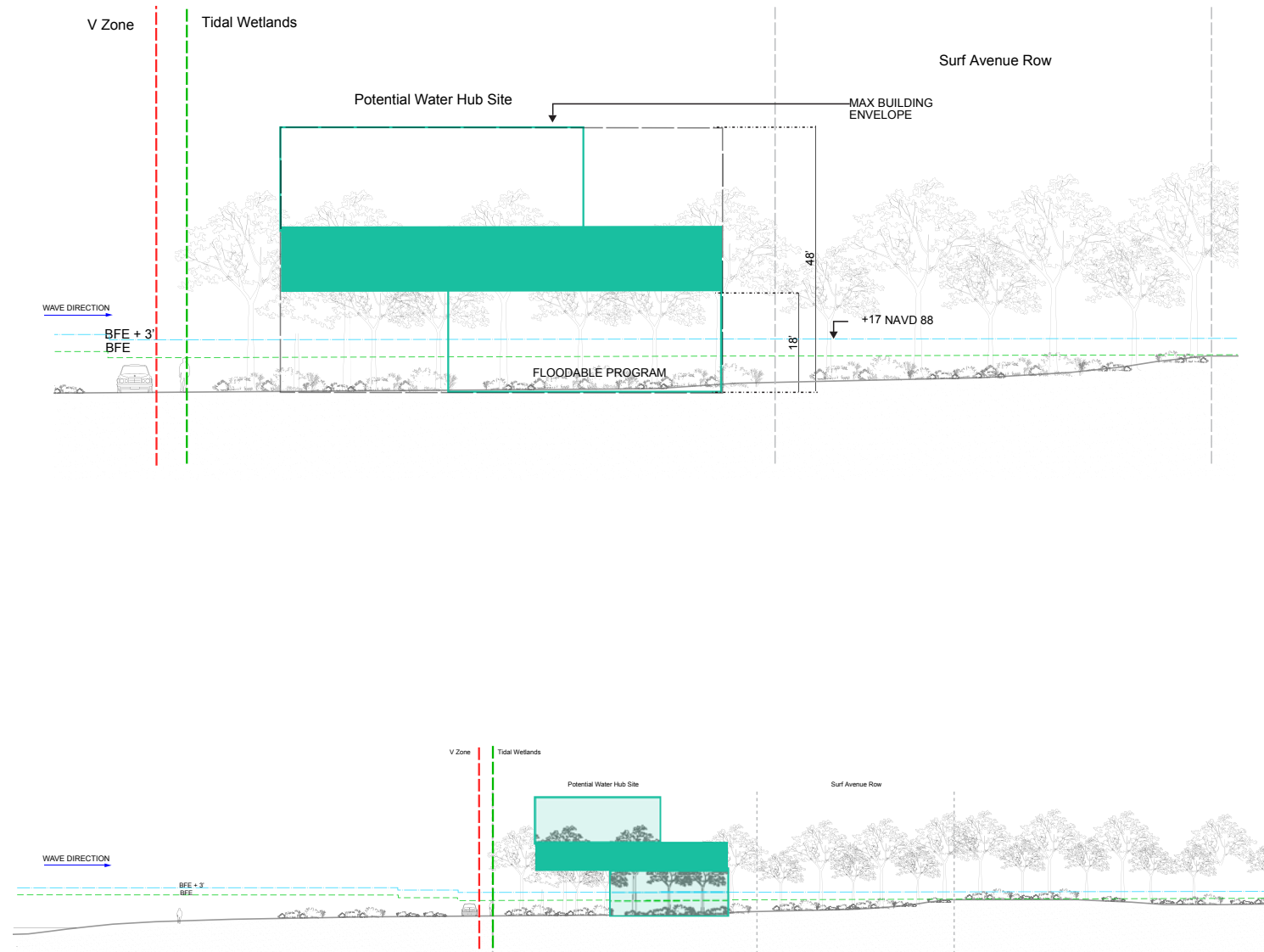
Potential Location 3:

Potential Location 3 would involve a "floating" Water Hub, or vessel operated by a non-profit organization (e.g., BOP). The vessel would be docked at existing facilities in the City (serving local groups and community members when docked locally) and would visit the project area approximately once per week from April through November for student based teaching events, and host community events approximately twice per month. When in the project area, the vessel



Proposed Water Hub Location 1—
Page West Option Sections

Figure S-12

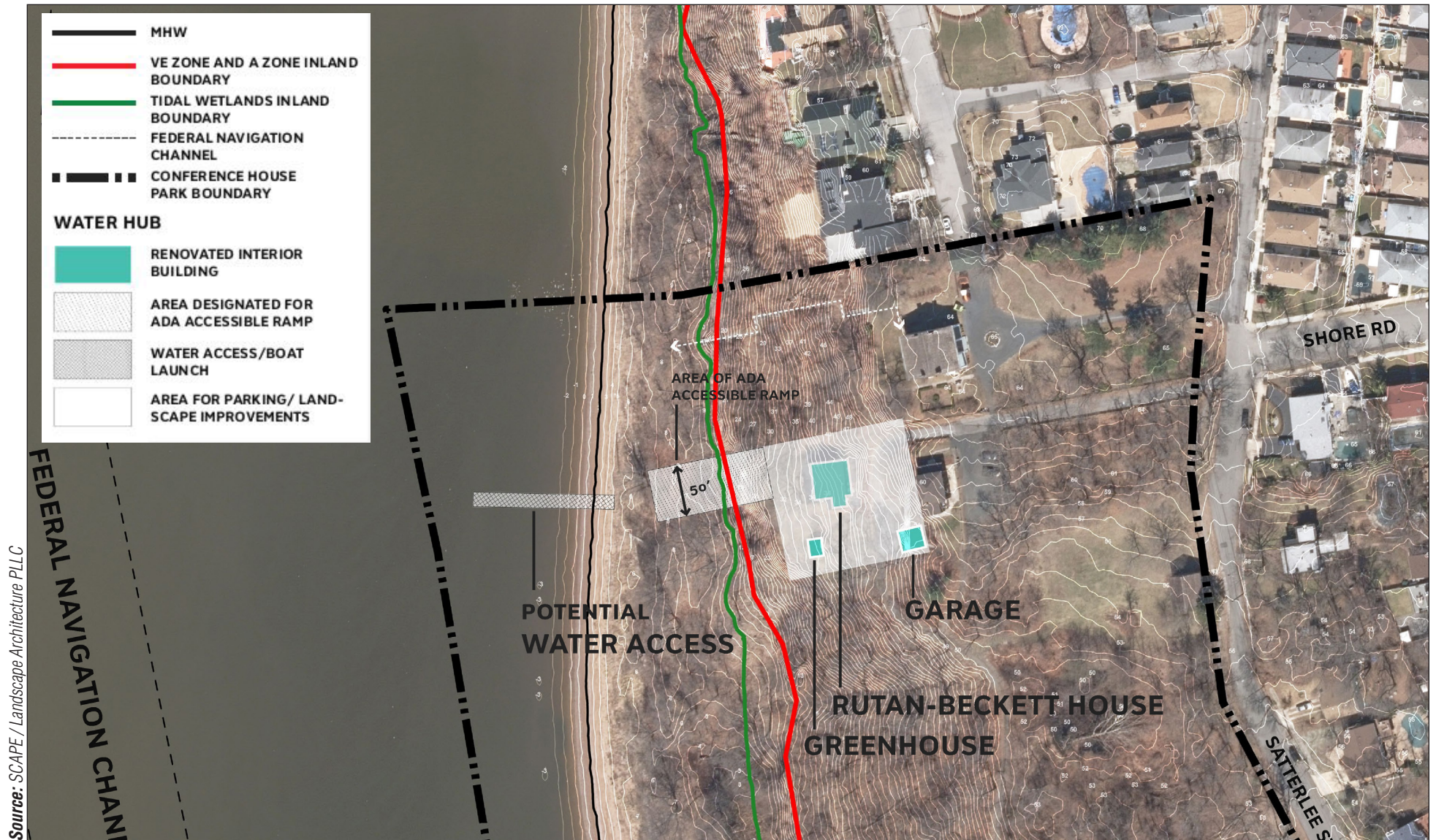


FOR ILLUSTRATIVE PURPOSES ONLY

Proposed Water Hub Location 1—
Page East Option Sections



Proposed Water Hub Location 2—
Biddle House Option
Figure S-14



Proposed Water Hub Location 2—
Rutan-Beckett Option

Figure S-15

would anchor near the breakwater structures for observation/monitoring and education activities. Should Water Hub programming be located at Potential Location 3, wayfinding, interpretive elements, and potential storage for kayaks would be constructed near the terminus of Page Avenue. Additional wayfinding, interpretive signage, and monitoring locations would be integrated along the length of the shoreline as part of the Water Hub's educational programming. No additional parking facilities would be required with this option. Also, because this option does not include an on-shore building for Water Hub programming, a seasonally deployed temporary floating boat launch would not be included as part of the project.

Seasonal Floating Dock—Should Water Hub programming be located at Potential Location 1 or 2, a temporary seasonal floating dock measuring about 30 feet by 50 feet, with a total area of 1,500 square feet, would be installed near the Type C eastern breakwaters segments for observations, monitoring, maintenance and stewardship, including specifically, for vessels operated by project stewards. The floating dock would not be required for Potential Location 3, because education and monitoring activities could occur directly from the vessel or "floating" Water Hub.

Tottenville Shoreline Protection Project (NY Rising Community Reconstruction Program and Raise Shorelines Citywide Study)

The Shoreline Project had its genesis in the New York Rising Community Reconstruction initiative established by Governor's Office of Storm Recovery and was further developed in consultation with NYC Parks. The plan for the East and South Shores of Staten Island included hybrid dunes with a stone core and sand cap, planted for stabilization, from Brighton Street to Joline Avenue, including two beach access points. After evaluating site-specific field data such as site surveys and borings, and in response to public input, it became clear that one coastal strategy did not fit all areas of the shoreline as was originally proposed as part of the New York Rising Community Reconstruction planning process. In some cases, there was not enough space on the beach between the property line of Conference House Park and above mean high water to accommodate the width that a hybrid dune would require (for example, the area where Surf Avenue is built out between Loretto Street and Sprague Avenue). Additionally, in response to public comments during the EIS public scoping process, the area west of Brighton Street to Swinnerton Street was added to the project.

The South Shore of Staten Island was also analyzed as part of NYCEDC's Raise Shorelines Citywide Study with a goal to evaluate localized measures to reduce coastal risk, make recommendations for resiliency investments, and coordinate with other local coastal protection actions. Evaluation of the Tottenville shoreline resulted in recommendations which to the extent relevant, informed elements of the Shoreline Project. In particular, the area between Joline Avenue and Page Avenue was added to the Shoreline Project to address vulnerable coastal conditions identified in the Raise Shorelines Citywide study.

Thus, a comprehensive design was developed to respond to the changing character of the shoreline between approximately Carteret Street and Page Avenue. These include a series of shoreline risk reduction measures, including an earthen berm, a hybrid dune/revetment system, eco-revetments (one section between Brighton Street and Manhattan Street, and one section between Loretto Street and Sprague Avenue), raised edge (revetment with trail), wetland enhancement, and shoreline plantings. ADA-accessible pathways, access points and overlooks would be constructed along the shoreline protection system (see **Figure S-16**). With the exception of a small portion of the Shoreline Project proposed within an unbuilt portion of the

Source: Stantec / RACE Coastal Engineering



NYCDOT Surf Avenue right-of-way, all on-shore project components under Alternative 2 would be constructed within the boundaries of Conference House Park.⁷

The temporary dune system that stretches from approximately Swinnerton Street to Sprague Avenue would be removed and replaced with the Shoreline Project elements proposed for this stretch of the shoreline.

The Shoreline Project has been designed to withstand storm wave action and overtopping of the shoreline structures, and to be resilient to sea level rise of 30 inches, and provide some level of risk reduction from coastal flooding. These on-shore risk-reduction measures would augment the wave attenuation and risk reduction potential provided by the Breakwaters Project.

The primary Shoreline Project components are described below.

Earthen Berm—From approximately Carteret Street to Brighton Street through a wooded portion of Conference House Park, the system would include an earthen berm that would serve as a tie-in to a section of eco-revetment followed by a reinforced, planted hybrid dune/revetment system proposed from approximately Brighton Street to Loretto Street. The proposed earthen berm would be approximately 25 ft wide ranging in height between approximately 1 and 7.5 feet above grade, and extending approximately 948 linear feet. It would extend through the portion of Conference House Park west of Brighton Street which is characterized by a dense successional hardwood forest. The earthen berm is being designed to blend in with the existing landscape (see **Figure S-17**).

Hybrid Dune/Revetment System—The proposed reinforced, planted hybrid dune/revetment system would extend along the shoreline between Manhattan and Loretto Streets, for approximately 937 linear feet. The hybrid dune/revetment system would be at an elevation of approximately 14 feet (approximately 1 foot higher than the exiting temporary dune system, and with a 70- to 90-ft width. The crest of the hybrid dune/revetment would be approximately 10 ft wide. The proposed hybrid dune/revetment system would provide a more gradual transition from upland elements to the shoreline (see **Figure S-18**).

Eco-Revetments

Between Brighton Street and Manhattan Street:

The proposed eco-revetment in this area would extend approximately 338 linear feet between Brighton Street (at the eastern terminus of the earthen berm) to Manhattan Street. This project element would bring the risk reduction system upland of the western portion of the hybrid dune/revetment system described above, along the northern edge of a 0.8-acre delineated wetland. The eco-revetment would comprise a pathway and rip rap with joint plantings, providing continuous access along this stretch of the project area.

Between Loretto Street and Sprague Avenue:

The proposed eco-revetment would extend approximately 396 linear feet between Loretto Street and Sprague Avenue. It would begin at a transition point from the eastern end of the hardened dune system. The eco-revetment would comprise a bioswale (a landscape feature designed to

⁷ As with other areas in Conference House Park where park uses are within the NYCDOT Surf Avenue right-of-way, a memorandum of understanding (MOU) between NYC Parks and NYCDOT will be in place prior to construction to accommodate portions of the Shoreline Project.

Source: Stantec / RACE Coastal Engineering



FOR ILLUSTRATIVE PURPOSES ONLY

Source: Stantec / RACE Coastal Engineering



FOR ILLUSTRATIVE PURPOSES ONLY

remove pollution from surface runoff water), sloped plantings, a pathway (approximately 3.5 feet above the sidewalk), and concrete steps, depending on the location along the shoreline (see **Figure S-19**). A paved sidewalk along Surf Avenue would be developed that would border a five-foot-wide bioswale, separated by a six-inch curb. The top of the eco-revetment would include an eight-foot-wide paved pathway connecting the two access points on either end of the eco-revetment.

Raised Edge (revetment and trail)—In this area the limit of wave action does not extend into the community, and the residential community is less dense near the shoreline. Therefore, the goal for this area is to control erosion while accounting for future sea level rise. Based on the recommendations and design considerations from the study, the Shoreline Project has identified revetments as appropriate strategies along this stretch, which would incorporate a modest rising of the grades at the edge of the beach and would account for projected sea level rise. A proposed waterfront side stone revetment would border an approximately five-foot-wide bioswale and eight-foot-wide raised trail that would begin at Sprague Avenue and extend approximately 2,536 linear feet to approximately 600 feet east of Page Avenue. The proposed trail would be either concrete or asphalt, designed to enhance accessibility to the shoreline (see **Figure S-20**).

Transition nodes would connect certain project elements; these would consist of concrete pavers connected to sidewalks or trails and stairways to allow shoreline access. In the area between Loretto Street and Sprague Avenue, an overlook would be constructed at Loretto Street for the transition of the hybrid dune/revetment system to the eco-revetment and an enhanced overlook would be constructed at Sprague Avenue for the transition of the eco-revetment to the raised edge. Green infrastructure would be implemented wherever possible.

Temporary dunes, constructed by NYC Parks as interim protective measures post-Sandy, are currently in place from approximately Swinnerton Street to Sprague Avenue. These temporary dunes would be replaced with the shoreline elements proposed along this stretch.

S.5.2 ALTERNATIVE 3—BREAKWATERS WITHOUT SHORELINE PROTECTION SYSTEM

Alternative 3 would develop the Breakwaters Project components as described in Alternative 2, including the proposed in-water breakwaters, shoreline restoration, Water Hub elements and accessory boat launch and seasonal floating dock near the breakwaters. None of the Shoreline Project components would be developed under Alternative 3.

As described above for the Layered Strategy, or Alternative 2, the breakwaters system on its own would provide substantial protection against shoreline erosion. The breakwaters system is designed to reduce or reverse the long-term historic erosion observed across the site, and to “grow” the shoreline where the beach is narrowest and where erosion risk threatens to increase the exposure of vulnerable assets to erosion and limit future access to the beach. The breakwaters system would also provide effective wave attenuation as described under Alternative 2. However, the added on-shore risk reduction provided by the Shoreline Project that would augment the wave attenuation potential provided by the Breakwaters Project would not occur under Alternative 3. Additionally, this alternative would not benefit from the potential risk reduction from coastal flooding provided by the Shoreline Project. The ecosystem services benefits provided by structured habitat created by the breakwaters as well as the social and educational benefits provided by the Water Hub would still accrue.



Coastal and Social Resiliency Initiatives for Tottenville Shoreline

Proposed Eco-Revetment
(between Loretto Street and Sprague Avenue)

Figure S-19



S.5.3 ALTERNATIVE 4—SHORELINE PROTECTION SYSTEM WITHOUT BREAKWATERS

Alternative 4 would develop the Shoreline Project components as described in Alternative 2, including the proposed earthen berm, hybrid dune/revetment, eco-revetments and raised edge, wetland enhancement, shoreline plantings, and maritime forest restorations. ADA accessible pathways, access points and overlooks would be constructed along the shoreline protection system. None of the Breakwaters Project components would be developed under Alternative 4.

As described in Alternative 2, the Shoreline Project has been designed to withstand storm wave action and overtopping of the shoreline structures, and to be resilient to sea level rise of 30 inches and provide some level of risk reduction from coastal flooding. However, this alternative would not benefit from the wave attenuation that would be provided off-shore with the Breakwaters Project as with Alternative 2. While meeting some of the goals and objectives of the Proposed Actions, the shoreline erosion goals, as well as the ecological enhancement and social resiliency goals would not be fully met with this alternative.

S.6 POTENTIAL REGULATORY APPROVALS

Implementation of the Proposed Actions may involve federal, state and local approvals, and is subject to NEPA and SEQRA and their implementing regulations. The Federal, State and City agencies that may potentially be involved in the environmental review and permitting process for the Proposed Actions include:

S.6.1 FEDERAL

- United States Department of Housing and Urban Development—Disbursement of funds, administration of CDBG-DR grant to the State of New York; review of Action Plan Amendments.
- United States Army Corps of Engineers—Issuance of permits for discharges of dredged or fill material into Waters of the U.S. (Section 404 of the Clean Water Act [33 USC 1344]); and issuance of permits for structures and work within navigable waters (Section 10 of the Rivers and Harbors Act [33 USC 403]).
- Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service—Advisory agencies to Army Corps of Engineers during permit review focusing on activities that affect wetlands, protected species and Essential Fish Habitat.
- United States Coast Guard—Coordination and authorization regarding marking/lighting for new in-water structures, and placement of construction barges.
- Federal Emergency Management Agency—Review of breakwater and shoreline protection system design with respect to Flood Hazard Areas.

S.6.2 STATE OF NEW YORK

- Governor's Office of Storm Recovery—Acting on behalf of Grantee the State of New York, and under the auspices of the Homes and Community Renewal's Housing Trust Fund Corporation, funding decisions for Proposed Actions and responsibility for environmental review, decision-making, and action under 42 U.S.C. § 5304(g).
- Department of Environmental Conservation—Permits related to activities in tidal wetlands or adjacent areas (Article 25), freshwater wetlands or buffer areas (Article 24), or protection

of waters (Article 15), Water Quality Certification (Section 401); coastal erosion management permit for structures in the Coastal Erosion Hazard Area (CEHA, Article 34), License to Collect, Possess, or Sell for shell fish placement and post-construction biological monitoring, potential Beneficial Use Determination (BUD) relating to potential re-use of excavated fill or material.

- Department of State—Coastal Zone Consistency for Federal direct and funding actions, as well as actions requiring Federal permits.
- Office of General Services—Review of actions involving use of State-owned submerged lands or payment of royalties for materials removed from such lands, as well as possible issuance of a lease, license, and/or easement.
- Office of Parks, Recreation, and Historic Preservation—Advisory role in federal permit review process pursuant to Section 106 of the National Historic Preservation Act (NHPA) with respect to designated and protected properties on the State and National Register and Eligible buildings and places. Assessment of potential submerged cultural resources. Interested party with respect to secondary impacts to natural resources on State-owned lands.

S.6.3 CITY OF NEW YORK

- Department of Parks and Recreation—Jurisdiction for land under water along project area shoreline and upland areas within Conference House Park; as well as review of plans and designs for modifications to parkland, including permits and natural resources oversight in connection with forest/tree protection and protection/restoration of aquatic resources and adjacent wetland maritime shrubland resources.
- Department of Environmental Protection—Possible stormwater management, water and sewer infrastructure, natural resources.
- New York City Planning Commission/Planning Department—Planning and Coastal Zone Consistency decision-making.
- New York City Public Design Commission—Review of art, architecture and landscape features proposed for City-owned property and capital projects.
- Landmarks Preservation Commission—Advisory agency for activities on or near sites of historic or archeological value.
- New York City Department of Buildings—Construction permits.
- New York City Department of Transportation—Current jurisdiction of certain mapped right of ways in project area, possible street and traffic oversight.

S.7 ENVIRONMENTAL REVIEW PROCESS

On behalf of the State of New York, GOSR, acting under the auspices of HTFC, as the Responsible Entity in accordance with 24 CFR 58.2(a)(7) and as the lead agency responsible for environmental review, decision-making, and action under 42 U.S.C. § 5304(g), determined that the Proposed Actions have the potential to result in significant adverse environmental impacts. Therefore, at GOSR's request, HUD issued a Notice of Intent to Prepare an EIS (NOI EIS) to satisfy NEPA procedural requirements in accordance with 24 CFR Part 1502. The NOI EIS was published in the Federal Register on April 20, 2015. The EIS also satisfies the requirements of SEQRA, and GOSR shall serve as lead agency for purposes of SEQRA.

The environmental review process provides a means for decision-makers to systematically consider environmental effects along with other aspects of project planning and design, to evaluate reasonable alternatives, and to identify, and mitigate where practicable, any significant adverse environmental impacts.

S.8 EFFECTS ASSESSMENT

S.8.1 LAND USE, ZONING, AND PUBLIC POLICY

The Proposed Actions would result in the development of new resiliency, educational, and recreational infrastructure in Tottenville, including the following components:

- the construction of an ecologically enhanced breakwater system that would provide coastal risk reduction by reducing wave energy at the shoreline, and reducing or reversing shoreline erosion (under Alternatives 2 and 3);
- the development of either an on-shore Water Hub facility that would be constructed within Conference House Park or a “floating Water Hub” (under Alternatives 2 and 3);
- a one-time addition of new sand for shoreline restoration along approximately 806 feet of shoreline between Manhattan Street and Loretto Streets to build up a particularly narrow, eroded section of the beach (under Alternatives 2 and 3); and
- a series of shoreline risk reduction measures, including an earthen berm, a hybrid dune/revetment system, eco-revetments, and a raised edge (revetment with trail), along with wetland enhancement and planting of native coastal plant species, from approximately Carteret Street to Page Avenue (under Alternatives 2 and 4).

All of these features would constitute compatible uses within Conference House Park and the abutting City street rights-of-way. They would be compliant with local zoning, including special districts, and with all applicable public policies. As a result, the Proposed Actions would not result in any significant impacts to land use, zoning, and public policy in the study area.

Alternative 2, which includes both the Breakwaters Project and Shoreline Project, would reduce risk from coastal erosion and wave action, providing a level of protection to existing land uses in the park and upland residential areas. Likewise, this alternative would be consistent with public policy initiatives to protect the South Shore of Staten Island from coastal erosion and wave action, and would enhance local habitat and ecologies as discussed in federal, State and City plans. This alternative would not result in any adverse changes to land use, zoning, or public policies.

Alternative 3, which includes the Breakwaters Project, would affect land use, zoning, and public policy in much the same way as its individual components would under Alternative 2, although the positive interplay between these elements and the Shoreline Project would be lost.

Alternative 4, which includes the Shoreline Project, would affect land use, zoning, and public policy in much the same way as its individual components would under Alternative 2, although the positive interplay between these elements and the Breakwaters Project would be lost.

S.8.2 SOCIOECONOMIC CONDITIONS

Under the No Action Alternative, no new comprehensive resiliency systems would be implemented in the project area. The study area would continue to experience adverse effects

from wave action and erosion. Economic costs associated with the No Action Alternative would include the direct physical damages associated with wave action and erosion; potential displacement and other human impacts; and loss of service. In addition, the community amenities associated with Alternatives 2 and 3 would not be implemented in the project area.

Alternative 2—The Layered Tottenville Shoreline Resiliency Strategy: Living Breakwaters and Tottenville Shoreline Protection Project—would not result in significant adverse socioeconomic impacts. Under Alternative 2, by 2020 two layers of coastal risk reduction would be implemented and study area residents would be less susceptible to damage by wave action and erosion. The alternative’s wave attenuation and social resiliency measures could lead to an increase in residential property values over time due to the following influences: 1) the project’s improved open spaces and amenities could make the area more desirable as a residential neighborhood; and 2) the reduced risk of property damage from wave action and erosion could increase the desirability of the neighborhood, and could reduce costs associated with investing in resiliency measures at individual properties. However, for the following reasons potential increases in property value attributable to this alternative are not expected to result in significant residential displacement pressures within the study area. First, market conditions already reflect the close proximity of the waterfront as a valuable residential amenity; the Proposed Actions would improve the area’s amenities, but would not introduce a substantial new use that would alter market conditions. In addition, study area property values and rents historically have not discounted value based on the risk posed by major storm events. In this respect, rather than leading to substantial increases in property value and rent, Alternative 2 would be expected to maintain pre-Sandy levels of interest, investment, and property values in the study area. Second, approximately 80 percent of the study area’s households reside in owner-occupied units, and homeowners are not vulnerable to displacement due to rent increases. Of the 20 percent of study area households who rent, most have incomes that suggest they could afford modest rent increases, and study area rents are low relative to other areas in the borough and City, suggesting a small number of residents who would be vulnerable to displacement if rents were to increase. Even if all study area renters vulnerable to displacement from rent increases were to be displaced (which is not expected), the displaced population would represent a very small portion of the overall study area population, and therefore Alternative 2 would not result in displacement that could substantially alter the socioeconomic character of the neighborhood.

With respect to potential indirect business displacement, a vast majority of existing businesses are located outside of the area that would benefit from reduced risk of damage caused by wave action and erosion. Similarly, retail businesses in the study area not located within close proximity to the project area, and would not experience a substantial increase in consumer visits that in turn, could lead to increased rents. Therefore, Alternative 2 does not have the potential to increase commercial rents in a manner that could lead to significant indirect commercial displacement.

Alternative 3 would not result in significant adverse socioeconomic impacts. Under Alternative 3, the Breakwaters Project would be implemented without the Shoreline Project. The socioeconomic study area would receive the resiliency benefits of the proposed breakwaters, shoreline restoration and Water Hub elements, but would not receive the additional resiliency benefits of the Shoreline Project. Residents would benefit from reduced susceptibility to property damage from wave action and erosion, although to a lesser extent than with Alternative 2. As with Alternative 2, residents would benefit from access to an improved public amenity. These benefits could lead to an increase in residential property values over time due to an increase in desirability of the neighborhood, reduction of risk of property damage, and potential

reduction of costs associated with investing in resiliency measures. However, similar to the findings for Alternative 2, potential increases in property values would not result in significant adverse impacts due to indirect residential displacement. Residential rents already reflect the proximity to the waterfront as a residential amenity, and therefore rents would not be expected to substantially increase due to the alternative's improvements. In addition, study area property values and rents historically have not discounted value based on the risk posed by major storm events, and therefore property values did not fully incorporate the risks of personal injury and property damage. In addition, approximately 80 percent of study area residents are homeowners, who are not vulnerable to increases in market rent. Of the 20 percent of study area households who rent, most have incomes that suggest they could afford modest rent increases, and study area rents are low relative to other areas in the borough and City, suggesting a small number of residents who would be vulnerable to displacement if rents were to increase. Even if all study area renters vulnerable to displacement from rent increases were to be displaced (which is not expected), the displaced population would represent a very small portion of the overall study area population, and therefore Alternative 3 would not result in displacement that could substantially alter the socioeconomic character of the neighborhood. In terms of commercial rents, study area commercial businesses are located away from the waterfront where they are at a lower risk of damage or closure due to wave action and erosion. In addition, the commercial businesses are not in a location where they would experience increases in consumer base due to new and improved public amenities.

Alternative 4 would not result in significant adverse socioeconomic impacts. Alternative 4 would implement the Shoreline Project without the Breakwaters Project. The study area would not receive the resiliency benefits from the proposed breakwaters, shoreline restoration and Water Hub elements. However, by 2020, the study area residents would still be less susceptible to damage by wave action and erosion, which could lead to increases in residential property values over time. Similar to Alternatives 2 and 3, potential increases in property value would not result in significant adverse impacts due to indirect residential displacement. Study area rental rates already include the beach as a neighborhood amenity but do not incorporate the risks of personal injury and property damage; in this respect Alternative 4 would not introduce a substantial new use that could affect market rents and would be expected to maintain pre-Sandy levels of interest, investment, and property values in the study area, rather than leading to substantial increases in property value and rent. In addition, approximately 80 percent of the study area population is not vulnerable to rental rate increases because they are homeowners and not renters, and the potentially displaced renter population would represent a very small portion of the overall study area population such that their displacement, were it to occur, would not substantially alter the socioeconomic character of the neighborhood. In terms of indirect commercial displacement, rents would not increase substantially because the study area's commercial properties are located outside of an area most susceptible to damage caused by wave action and erosion. Secondly, retail businesses are over ½-mile inland from the beach, and would not be expected to see an increase in consumer base from increased beach visitors.

ECONOMIC BENEFITS OF CONSTRUCTION

The economic benefits of constructing Alternatives 2 through 4 were estimated using the IMPLAN economic input-output modeling system. Total direct, indirect, and induced employment resulting in New York City from construction is estimated to range between 128 and 392 person-years of employment, depending on the alternative. Total direct, indirect, and induced employee compensation resulting in New York City from construction is estimated to

range from between \$9.71 million and \$29.78 million, depending on the alternative. Total economic activity that would result from construction is estimated to range between \$30.60 million and \$93.82 million in New York City, depending on the alternative. Each alternative would generate additional employment, employee compensation, and economic activity within the broader New York State and National economies.

S.8.3 ENVIRONMENTAL JUSTICE

The Proposed Actions under any of the project alternatives (Alternative 2, Layered Strategy; Alternative 3, Breakwaters Project without Shoreline Project; and Alternative 4, Shoreline Project without Breakwaters Project), would produce beneficial effects for the local community, including reduced wave action and coastal erosion along the shoreline in Tottenville, and enhancement of ecosystems and shoreline access and use. In addition, the Proposed Actions include engaging with the community through educational programs directly related to the coastal resiliency actions. At the same time, the Proposed Actions would not result in any significant adverse impacts that would result in any disproportionately high and adverse effects on minority and low-income populations. Overall, the Proposed Actions would have a positive effect on the neighboring communities by both providing coastal protection and ecological enhancement, and at the same time providing a destination for public education, and increasing awareness of local ecosystems and innovative coastal resiliency strategies in an era increasingly affected by climate change. In addition, the Proposed Actions would be in compliance with all applicable NEPA, HUD, and state regulations related to environmental justice protections. Therefore, there are no environmental justice concerns expected with the Proposed Actions.

S.8.4 HISTORIC AND CULTURAL RESOURCES

ARCHAEOLOGICAL RESOURCES

The proposed project is located in the vicinity of the Ward's Point Archaeological Conservation Area, an archaeological historic district that is listed on the State and National Registers of Historic Places. Pursuant to Section 106 of the NHPA, a Draft Phase 1A Archaeological Documentary Study (Draft Phase 1A) for the Breakwaters and Shoreline areas of potential effect (APEs) was prepared in August 2016. The study documented the development history of the APEs as well as their potential to yield archaeological resources, including both precontact and historic archaeological resources. In addition, the Phase 1A study documented the current conditions of the Breakwaters and Shoreline APEs and summarized previous cultural resource investigations which have been undertaken in the vicinity.

Following the submission of the Draft Phase 1A to the consulting parties, the proposed project design was revised to include an additional potential location for the Water Hub (Potential Location 2) as well as alternate locations for water access points along the shoreline within Conference House Park. A final version of the Phase 1A (Final Phase 1A) was prepared in May 2017 and was submitted to SHPO, LPC, and the Tribal Nations for review and comment.

In two comment letters, both issued on May 30, 2017, LPC concurred with the conclusions and recommendations of the Final Phase 1A study and requested that Phase 1B testing occur after the finalization of project plans in order to better define the scope of archaeological testing. In a comment letter dated June 7, 2017, SHPO also concurred with the conclusions and recommendations of the Final Phase 1A study. Letters of concurrence with the Final Phase 1A

Study were also issued by the Delaware Nation and the Stockbridge Munsee Community on May 30, 2017 and by the Delaware Tribe on June 15, 2017.

All Phase 1B testing within the previously identified areas of archaeological sensitivity would be completed in consultation with SHPO, LPC, and the Tribal Nations. Any additional archaeological investigation or consultation with the consulting parties would be completed pursuant to the terms outlined in the Programmatic Agreement executed in May 2013 among the FEMA, SHPO, the New York State Office of Emergency Management, the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Nation, the Stockbridge-Munsee Community Band of Mohicans, LPC, and ACHP and specifically pursuant to Appendix D to the Programmatic Agreement, which pertains to the CDBG-DR grant program for activities in New York City. Any additional archaeological investigations completed subsequent to the Phase 1B investigation (e.g., a Phase 2 archaeological survey or Phase 3 Data Recovery) would be completed prior to construction in consultation with SHPO, LPC, and the Tribal Nations.

Pursuant to Section 106 and City Environmental Quality Review (CEQR), should significant (e.g., National Register-eligible) archaeological resources be identified in sensitive areas through Phase 1B and Phase 2 archaeological investigations, disturbance or removal of such resources through construction would constitute an adverse effect under Section 106 and a significant adverse impact under CEQR. However, at this time only the *potential* for archaeological resources has been identified in certain locations on the project site. As set forth in the 2014 *CEQR Technical Manual*, a “site’s actual, rather than potential, sensitivity cannot be ascertained without some field testing or excavation.”⁸ Therefore, it is conservatively assumed for purposes of Section 106 and CEQR that the proposed project could *potentially* result in an adverse effects and significant adverse impacts, with the actual presence of any significant resources to be determined through additional archaeological investigations and consultation as set forth in the Programmatic Agreement, described above. However, should no significant archaeological resources be identified through Phase 1B or any subsequent Phase 2 archaeological investigations, and LPC, SHPO and the Tribal Nations concur with the conclusions of those investigations, no *actual* adverse effects or significant adverse impacts would occur.

ARCHITECTURAL RESOURCES

No architectural resources are located in the Breakwaters APE. Therefore, Alternative 2 would not adversely affect any historic architectural resources in the Breakwaters APE.

The two architectural resources in the Water Hub Potential Location 2 APE are the Henry Hogg Biddle House and the Rutan-Beckett House, which are described below. With Alternative 2, if Water Hub Potential Location 2 is selected, one of these two historic architectural resources would be selected—the Biddle House Option or the Rutan-Beckett House Option—and would be rehabilitated and adaptively used. If plans move forward to locate the programming for the Water Hub within one of these two buildings, consultation with the consulting parties would continue to be undertaken pursuant to the terms outlined in the Programmatic Agreement executed in May 2013 among FEMA, SHPO, the New York State Office of Emergency Management, the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Nation, the Stockbridge-Munsee Community Band of Mohicans, LPC, and ACHP and specifically pursuant

⁸ *CEQR Technical Manual* (March 2014): page 9-10
(http://www.nyc.gov/html/oec/downloads/pdf/2014_ceqr_tm/09_Historic_Resources_2014.pdf).

to Appendix D to the Programmatic Agreement, which pertains to the CDBG-DR program for activities in New York City.

Since the DEIS was issued, in comments dated March 27, 2017, SHPO determined that the Henry Hogg Biddle House and the Rutan-Beckett House are both S/NR-eligible. Should either the Biddle House Option or the Rutan-Beckett House Option for the Water Hub Potential Location 2 be selected, consultation with SHPO would continue to be undertaken regarding any proposed alterations to the historic resource. In addition, because the Henry Hogg Biddle House is a NYCL, if the Biddle House Option is selected for the Water Hub, NYC Parks would consult with the LPC under the New York City Landmarks Preservation Law regarding any proposed alterations to this NYCL. LPC would review the proposed alterations and, upon approval, would issue a Binding Commission Report summarizing LPC's findings.

The architectural resources in the Water Hub Potential Location 2 APE and the Indirect Effect APE are located significantly inland, away from the locations of most of the Alternative 2 components of the Shoreline Project. As noted above, should the Water Hub programming be located at either the Biddle House or the Rutan-Beckett House, any alterations to either building would be subject to review and approval by SHPO and the consulting parties, and LPC as appropriate. It is anticipated that any alterations to either historic building would be limited to rehabilitation and adaptive use alterations. In addition, existing intervening landscaping elements and plantings, and the shoreline protection measures of the Shoreline Project further limit any visual or contextual relationships between the architectural resources in the Shoreline APE, the Indirect Effect APE and the locations of the Shoreline Project components.

S.8.5 URBAN DESIGN AND CULTURAL RESOURCES

BREAKWATERS PROJECT AREA

The proposed in-water system in the Breakwaters Project Area as part of Alternatives 2 and 3 would not result in any adverse impacts to urban design components in the Project Areas or in the larger study area.

Two on-shore potential locations are under consideration for the Water Hub (as part of the Breakwaters Project in Alternatives 2 and 3). Potential Location 1 would be in the vicinity of the southern terminus of Page Avenue and would involve the construction of a new, small-scale structure. The new building would be consistent with prior uses on this site and its scale and siting would not adversely affect the urban design of the nearby study area. Further, the redevelopment of the site west of Page Avenue would enhance the context of this part of the study area with a new facility and improvements to waterfront access. Potential Location 2 would locate the Water Hub programming in an existing building in Conference House Park, and therefore, would not adversely affect the urban design of the study area but would enliven this area of the park with new active uses. Both on-shore potential Water Hub locations would provide access to the water. Neither potential Water Hub location would adversely affect views to or from the waterfront. Further, the urban design character of the area near Potential Location 2 in Conference House Park would not change as the programming for the Water Hub would be located within an existing building. Therefore, the proposed Water Hub at either Potential Location 1 or 2 would not result in any significant adverse impacts to urban design characteristics of the Breakwaters Project Area or nearby study area. Should Water Hub programming be located at Potential Location 2, a small structure would be constructed near the terminus of Page Avenue at Potential Location 1. This small facility would be much smaller than

the Water Hub that would be developed at Potential Location 1 and, therefore, also would not result in any adverse urban design impacts. Potential Location 3 would involve a “floating” Water Hub—a vessel that would visit the Breakwater Project Area approximately once per week from April to November for student-based teaching events, and host community events approximately twice per month. The vessel would be docked elsewhere at existing facilities in the City (outside of the project area). This option would not involve a permanent Water Hub facility on shore, and its operations would be consistent with existing maritime operations in the area. With this option, a small structure would be constructed near the terminus of Page Avenue, and a series of wayfinding, interpretive, and monitoring elements would be located along the shoreline. As with Potential Locations 1 and 2, Potential Location 3 also would not result in any adverse urban design impacts.

Views in the Breakwaters Project Area would not be adversely affected as the in-water breakwaters project components would be located in Raritan Bay at a distance from the shoreline and are being designed to be low in scale. Because of distance and the low, linear scale of the breakwaters, and the common color and reflectance (lack of contrast) of the breakwaters to land forms in the distance, the visibility of the breakwaters would be similar to existing views of land masses that can be seen from many on-shore vantage points toward Raritan Bay. While the breakwaters would present a new visual element in these views, changes to these views would be minimal and would not impair the character or quality of locations from which visibility is possible. Nor would the visibility of the breakwaters clearly interfere with or reduce the public’s enjoyment and/or appreciation of Raritan Bay. Therefore, the breakwaters would not result in an adverse visual or aesthetic impact in views toward the waterfront and Raritan Bay, or views to any other aesthetic and visual resources, including historic architectural resources, which would not be adversely affected by the breakwaters due to distance.

Views near Potential Location 1 on Page Avenue would change for viewers closest to the Water Hub; however, the Water Hub is being designed to be contextual to the surrounding area in terms of scale, siting, and material. Views toward the waterfront from nearby vantage points would include the Water Hub at Potential Location 1; however, the building would be consistent with other nearby buildings in terms of scale and siting. Therefore, the Water Hub at Potential Location 1 would not adversely affect views toward the waterfront. Views near Potential Location 2 in Conference House Park, including views to the waterfront, would not change for viewers near the Water Hub as the programming for the Water Hub would be located within an existing building in Conference House Park. Views near Potential Location 3 would include the “floating” Water Hub vessel. The vessel would not adversely affect views toward the waterfront as the vessel would only be intermittently located within the Breakwaters Project Area, and would be similar to other vessels in Raritan Bay. Views toward the waterfront from Potential Location 3 would also be intermittent and would be limited to viewers on the Water Hub vessel toward the waterfront. While close-up views of the breakwaters would be available, the vessel itself would provide educational and monitoring facilities for visitors to the facility. Should Water Hub programming be located at Potential Location 2 or 3, a small facility would be constructed near the terminus of Page Avenue at Potential Location 1. Because this facility would be much smaller than the Water Hub at this location, this small facility also would not adversely impact any existing views or views to any aesthetic or visual resources. In addition to this small structure, a series of wayfinding, interpretive, and monitoring elements would be located along the shoreline. Further, the Water Hub at either Potential Location 1, 2, or 3 would not adversely impact any existing views toward the waterfront and Raritan Bay, or views to any other aesthetic and visual resources, including historic architectural resources.

SHORELINE PROJECT AREA

The four primary components of the Shoreline Project (as part of Alternatives 2 and 4) would result in enhancements to shoreline access through new waterfront access points, overlooks, and walkways that would be consistent with similar existing elements. The continuous walkway that would be created along the waterfront would contribute to the pedestrian experience of the waterfront. The changes to urban design in the Shoreline Project Area would contribute new urban design elements that would create visual interest in areas near the shoreline and would enhance the pedestrian experience of the Shoreline Project Area. Therefore, Alternative 2 would not result in any significant adverse urban design impacts to the Shoreline Project Area or study area.

Views in the Shoreline Project Area would include the proposed changes to the waterfront landscape. The changes to these views would be minimal, and therefore would not result in any significant adverse impacts. The eco-revetments and raised pathways would not result in any adverse impacts to any existing views. Views from the Project Areas and study area would continue to include wide open views of Raritan Bay though some views from vantage points closest to the Project Areas would change, with some views including the distant in-water breakwaters. Other visual resources in the study area would not be affected by the components of Alternative 2 because of distance and intervening building and natural features. The views of residents, pedestrians, motorists, bicyclists, boaters, and users of Conference House Park and study area historic resources would be minimally affected by the components of Alternative 2.

S.8.6 SHADOWS

At Potential Location 1, the Proposed Actions would facilitate the development of an on-shore Water Hub facility (under Alternatives 2 and 3) that would be constructed within Conference House Park at one of two possible sites on either side of the foot of Page Avenue (Page West Option or Page East Option). At either site, the proposed Water Hub would cast new shadow on portions of Conference House Park for the entirety of the four representative analysis days examined in the detailed shadow assessment. However, the relatively small extent of new shadow compared to Conference House Park's total size would not substantially alter the usability of the open space resources. Furthermore, all vegetation that would be affected by new shadow from either location of the proposed Water Hub would continue to receive enough direct sunlight to support plant vitality. Therefore, if the Water Hub were constructed at Potential Location 1, the Proposed Actions would not result in a significant shadows impact on Conference House Park or any other sunlight-sensitive resource.

At Potential Location 2, the Proposed Actions would facilitate the rehabilitation and adaptive reuse of an existing NYC Parks building. Since no new structures over 10 feet in height would be constructed at this location, no significant adverse shadows impacts would occur. A small structure for kayak storage that would be constructed near the terminus of Page Avenue would be smaller in size and height than the Water Hub building analyzed as part of Potential Location 1. Therefore, similar to the conclusions for the analysis at Potential Location 1, the structure for kayak storage would not substantially alter the usability of open space resources, and all vegetation that would be affected by new shadow from the structure would continue to receive enough direct sunlight to support plant vitality. Therefore, if the Water Hub were located at Potential Location 2, with a small structure for kayak storage at Page Avenue, the Proposed Actions would not result in a significant shadows impact on Conference House Park or any other sunlight-sensitive resource.

S.8.7 HAZARDOUS MATERIALS

Although the assessment did not reveal a significant likelihood for subsurface hazardous materials, with the incorporation of standard, appropriate protocols (described under “Construction,” below), no significant adverse impacts related to hazardous materials would result from subsurface disturbance associated with Alternatives 2, 3, and 4. To the extent rehabilitation of existing structures (or excavation) would disturb materials containing asbestos or PCBs or covered with lead-based paint, the potential for impacts will be avoided by licensed environmental professionals conducting these construction activities in compliance with existing regulatory requirements and best practices. These materials would then be abated as required by law prior to the start of construction. Following construction, there would be no further potential for significant adverse impacts.

S.8.8 NATURAL RESOURCES

The Proposed Actions would result in the implementation of one of three alternatives analyzed in this EIS; Alternative 2 includes both the Breakwaters Project and the Shoreline Project; Alternative 3 includes only the Breakwater Project component; and Alternative 4 includes only the Shoreline Project component. A No Action Alternative was also analyzed.

Under the No Action Alternative – no new structural risk reduction or marine habitat restoration projects would be implemented within Raritan Bay off the south shore of Staten Island or along the adjacent shoreline and in the upland areas within Conference House Park. The existing man-made temporary dune system would remain in 2020, the end of the construction period for the Proposed Actions, and would continue to experience intense wave energy and be at risk from storm wave damage. Under this alternative, high rates of erosion would continue in future, further reducing the width of the beach in certain locations. Additionally, strategies to educate the public on risks posed by climate change would remain the same.

Under Alternative 2, the proposed breakwaters system of the Breakwaters Project would be installed within Raritan Bay off the south shore of Staten Island and the Shoreline Project elements and proposed Water Hub elements of the Breakwaters Project would be implemented along the adjacent shoreline and in upland areas almost entirely within Conference House Park.⁹ Only one of three potential Water Hub locations would be selected: two of these potential locations are on-shore within Conference House Park and one of these potential locations is a vessel operated by a non-profit organization that would visit the project area periodically for observation and education with on-shore wayfinding and interpretive elements and kayak storage. The Proposed Actions would not result in significant adverse impacts to terrestrial resources. Temporary impacts resulting from construction of on-shore components, such as vegetation removal, wildlife displacement, and alteration of NYSDEC littoral zone tidal wetlands and the tidal wetland adjacent area (TWAA), and the delineated tidal wetland, would be minimized through the use of erosion and sediment control measures (e.g., silt fencing and hay bales), marsh mats, or low ground-pressure equipment within wetlands, vegetation protection and propagation measures, and compliance with the Stormwater Pollution Protection Plan (SWPPP) prepared for the project as required by New York State Pollutant Discharge

⁹ With the exception of a small portion of the Shoreline Project proposed within an unbuilt portion of the NYCDOT Surf Avenue right-of-way, all on-shore project components would be constructed within the boundaries of Conference House Park.

Elimination System (SPDES) General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity (General Permit). Permanent impacts to the delineated tidal wetland (0.14 acres out of the 0.8-acre delineated wetland due to a portion of the hybrid dune/revetment, and a length of eco-revetment) would be primarily within the portion of the wetland dominated by *Phragmites australis* (phragmites, or common reed). An existing sand bridge and culvert comprising unpermitted fill (approximately 0.01 acres) would be removed in order to construct the eco-revetment which would remove an existing impediment to tidal exchange within the eastern portion of this wetland. With the removal of the sand bridge, the net change in fill within the wetland would be 0.13 acres. While the loss of a portion of the wetland would be an adverse effect, it would be offset by the enhancement of the tidal wetland plant community that would include improved tidal exchange through modification of the inlet to Raritan Bay and removal of the sand bridge, removal of phragmites from within the wetland, and restoration of a native tidal wetland plant community. The portion of the eco-revetment that would be within the wetland would be designed in consultation with NYSDEC and USACE to minimize adverse effects to the tidal wetland.

Protection programs (e.g., transplant, and seed collection and propagation) would be developed in coordination with NYC Parks and New York State Natural Heritage Program (NYSNHP) for populations of the state-listed plant species that would have the potential to be affected by construction of the Shoreline Project: northern gamma grass (endangered), and dune sandspur (threatened). With the implementation of these measures the Proposed Actions would not result in significant adverse impacts to threatened or endangered plant species.

To minimize potential effects to migratory bird species, any tree clearing would be scheduled outside the early May through July primary bird breeding season, to the extent practicable. Should construction activities requiring tree clearing be necessary during April or August (i.e., the beginning and end of the breeding period), active nest surveys would be conducted in coordination with USFWS to support tree cutting during this period. To minimize direct effects to eastern box turtles, any eastern box turtles encountered in the area of disturbance prior to or during the construction of earthen berm and eco-revetment in the vicinity of the delineated wetland would be relocated to an area beyond the silt fencing. With these measures in place, the Proposed Actions would not result in significant adverse impacts to terrestrial wildlife.

Excavation of soils to construct the on-shore components of the Proposed Actions would not have the potential to adversely affect groundwater due to soil contamination. The proposed removal of soil determined to meet the NYSDEC Soil Cleanup Objectives (SCOs) for residential use and for protection of groundwater would not adversely affect groundwater. Groundwater removed during any dewatering activities, if any, would be treated prior to discharge to Raritan Bay. Green infrastructure measures incorporated into the Shoreline Project and the on-shore Water Hub component of the Breakwaters Project at Potential Location 1 would allow runoff to infiltrate into the soil and recharge to groundwater. The landscaped areas within the Shoreline Project and at the on-shore Water Hub locations would be maintained using Integrated Pest Management (IPM) techniques thereby substantially diminishing the need for the use of pesticides and other chemicals and minimizing adverse effects to groundwater quality. Therefore, the Proposed Actions would not result in significant adverse impacts to groundwater.

During placement of the breakwater materials and sand for the shoreline restoration, measures would be implemented to minimize resuspension of bottom sediment. Increases in suspended sediment that would result from in-water construction activities would be temporary and localized, would dissipate upon cessation of the sediment disturbing activities, and would not

result in significant adverse effects to aquatic biota. Fish and mobile benthic invertebrates would be expected to avoid the portions of the bay in which in-water activities would be occurring, moving to similar available habitat nearby. Increased vessel traffic and underwater construction noise would be within the range of typical vessel activity in Raritan Bay and is unlikely to adversely affect aquatic resources. Shading of aquatic habitat due to construction barges would be temporary and would not result in adverse effects to aquatic biota. Unavoidable loss of NYSDEC littoral zone wetlands within the footprint of six breakwater segments and a small portion of a 7th segment (about 7.1 acres) and the portion of shoreline restoration below MHW (2.6 acres) would be small in comparison to the amount of unaffected NYSDEC littoral zone tidal wetlands within Raritan Bay and would not result in significant adverse impacts to the NYSDEC littoral zone wetland resources.

Operation of the Proposed Actions would not result in significant adverse impacts to terrestrial resources and would result in an overall beneficial effect on these resources. Shoreline risk reduction measures combined with the reduced shoreline erosion and wave attenuation afforded by the breakwaters system would increase resiliency of the south shore of Staten Island, and the natural resources therein, to storm events. The Shoreline Project would stabilize and protect the upland shoreline, and would incorporate green infrastructure, such as bioswales, to maintain the protective function of NYSDEC TWAA. On-shore planting with native coastal species would enhance the native coastal habitats available throughout the Shoreline Project and the proposed Water Hub at Potential Location 1 of the Breakwaters Project. Enhancement of the remaining 0.66-acre portion of the approximately 0.8-acre delineated tidal wetland that would not be within the footprint of the Shoreline Project through increased tidal exchange, removal of phragmites and restoration of a native tidal wetland plant community would benefit wetland resources and wildlife that would use this wetland. The 3.1 acres of shoreline restoration, (2.6 acres below MHW) would increase availability of beach habitat for coastal wildlife. The approximately 4.6 acres of native coastal vegetation that would be established within the Shoreline Project would benefit ecological communities and the wildlife that would use these habitats.

The Proposed Actions would result in the placement of floating structures within Raritan Bay only if the Water Hub is sited at Potential Locations 1 and 2. These floating structures would include: an approximately 210-foot-long and 8-foot-wide seasonal boat launch at the Water Hub at Potential Location 1 to facilitate research activities at the breakwaters or a seasonal boat launch to provide water access as part of the Water Hub at Potential Location 2; and a 30- by 50-foot-wide seasonal floating dock near the breakwater segments to facilitate monitoring and research activities as part of the Water Hub at Potential Locations 1 and 2. The width of the boat launches and seasonal floating dock structures would be narrow enough to allow some light to penetrate to the aquatic habitat beneath them during some portion of the day and would not result in significant adverse impacts to aquatic habitat and biota. The Water Hub at Potential Location 3 would be a vessel that would visit the project area and would not require floating structures.

The Proposed Actions would result in the placement of breakwater segments within Raritan Bay. The breakwater system is designed and located to maintain and restore the beach while

minimizing down-drift¹⁰ impacts. The breakwaters would attenuate waves and alter the sediment transport along the shore for this purpose. Local sediment transport rates and accretion would be altered but the natural processes would not be blocked as there would still be sediment transport along the shore and tidal circulation around the breakwaters. The breakwater segments have been designed to minimize changes to tidal flushing and water residence time in order to avoid adverse impacts to water quality. The increased width and stability of the beaches within Conference House Park would improve spawning habitat for horseshoe crabs, provide beach habitat for other organisms while protecting the shoreline against wave action and coastal erosion, and stabilize the NYSDEC littoral zone tidal wetlands and TWAA.

The breakwaters (excluding the shoreline restoration) would convert approximately 11.4 acres of existing sand/gravel bottom habitat and the approximately 115,990 CY of open water habitat below MHW overlying this portion of Raritan Bay to complex hard structure (a habitat that was historically present but currently scarce in Raritan Bay). This area of bottom habitat represents about 2 percent of existing sand/gravel bottom habitat within the approximately 610-acre portion of Raritan Bay within the study area. While the breakwaters would convert a portion of open water to structured habitat, this loss would be small compared to the extensive open water habitat available within the study area and Raritan Bay as a whole. Additionally, the structures would not hinder the movement of fish and other aquatic biota through the water column, nor would they disrupt water circulation in Raritan Bay. Fish and other aquatic biota, including anadromous species and early life stages, would be able to pass (either actively or passively) around the individual breakwater segments at any given time. The conversion of sand and gravel habitat and open water habitat to structure would not occur all at once, but rather sequentially over an 11-month period (6 months in the first year and 5 months in the second year) as the breakwater segments are constructed. This habitat conversion would result in high-relief, complex, rocky reef-like habitat within the breakwater segments. By design, the breakwater system would incorporate ecological enhancements expected to benefit the target species groups identified for the project. The high-relief rocky habitat provided by the breakwaters would be designed to attract and retain habitat-creating benthic invertebrates and shellfish, including bivalves. Ecological design features of the breakwaters (i.e., varying levels of elevation, inclination, bio-enhancing materials, textures, interstitial spaces, water retaining elements, reef streets and rock size variations) would facilitate the recruitment of a rich benthic community of habitat-forming encrusting invertebrates and algae, while also providing suitable sheltering and foraging habitat for fish and benthic invertebrates, including threatened and/or endangered species that could occur in Raritan Bay. Additionally, crevices and void spaces at the interface of the breakwaters segments with the seafloor would be available for use by benthic fish and invertebrate species. In addition to the ecological enhancements, the Proposed Actions would incorporate other measures to minimize potential adverse effects to EFH and other aquatic biota. These include timing the shoreline restoration activities and breakwater construction activities to be outside spawning windows specified by the National Marine Fisheries Service (NMFS) (e.g., horseshoe crab and winter flounder); maintaining at least 2 feet of clearance between the bay bottom and construction vessels or working when tide levels are sufficient to keep construction barges and vessels off the bottom; constructing breakwater segments sequentially such that the

¹⁰ Down-drift erosion—when a headland, inlet, river, bay, canyon, reef or shoal blocks the natural longshore drift of materials, such as sand and gravel, by waves and currents, resulting in accumulation of sediments on the up-drift side, while a depletion of material occurs on the down-drift side (Bruun 1995).

habitat conversion occurs gradually; and incorporating post-construction monitoring and adaptive management.

With respect to aquatic resources, the loss of approximately 3.6 acres of Waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW would result in adverse impacts and would be mitigated pursuant to the Clean Water Act through measures that may include available credits from an approved mitigation bank, and restoration/enhancement of Waters of the U.S. within the Raritan Bay watershed in New York.

The shoreline restoration over time would result in a net gain of intertidal habitat of approximately 0.5 acres and a net loss of subtidal (open water) habitat of approximately 0.5 acres. The conversion of open water habitat would represent a small reduction in this type of habitat in the study area within Raritan Bay, and similar habitat at equivalent water depths would continue to be available in the vicinity.

Under Alternative 3, the Breakwaters Project, including the in-water breakwaters, shoreline restoration, and Water Hub, would be implemented without the Shoreline Project. Under this alternative, the same temporary and permanent impacts to NYSDEC littoral zone tidal wetlands and mapped NWI estuarine wetlands, water quality, sediment quality, and conversion of soft bottom and open water habitat designed to benefit target species through the increased diversity of the high-relief, complex, rocky reef-like habitat of the breakwater segments as Alternative 2 would be expected. However, the NYSDEC TWAA would not be protected against wave energy and erosion and the delineated tidal wetland would not be enhanced through improved tidal flushing. Alternative 3 would reduce wave energy at the shoreline and reduce or reverse shoreline erosion; but the temporary man-made dune would remain the only shoreline risk reduction feature. On-shore habitat would remain fragmented and less suitable for wildlife species that breed or forage on beaches without the Shoreline Project. Overall, Alternative 3 would not obtain the same level of coastal resiliency as Alternative 2.

Under Alternative 4, the Shoreline Project would be developed without the in-water breakwaters structures, the shoreline restoration, or the Water Hub. The earthen berm, hybrid dune/revetment system, wetland enhancement, eco-revetments, and raised edge would be implemented and would result in the same effects as discussed under Alternative 2. This alternative would not result in in conversion of soft bottom sand habitat to high-relief, complex, rocky reef-like habitat. While this alternative would stabilize the upland shoreline, the Shoreline Project structures, NYSDEC TWAA, ecological communities, and wildlife would remain vulnerable to coastal storm surges and the beach communities would be subject to loss due to erosion. Overall, Alternative 4 would not obtain the same level of coastal resiliency as Alternative 2.

S.8.9 FLOODPLAINS AND CEHA

The Proposed Actions would result in the implementation of one of three alternatives analyzed in this EIS; Alternative 2 includes the Breakwaters Project and the Shoreline Project; Alternative 3 includes only the Breakwater Project component; and Alternative 4 includes only the Shoreline Project component. A No Action Alternative, Alternative 1, was also analyzed.

Under the No Action Alternative, no new structural risk reduction projects would be implemented within Raritan Bay off the south shore of Staten Island or along the adjacent shoreline and in the upland areas within Conference House Park. The existing man-made temporary dune system would remain in 2020, the end of the construction period for the Proposed Actions, and would continue to experience intense wave energy and be at risk from

storm wave damage. Under this alternative, high rates of erosion, combined with projected sea level rise, could eliminate some beach sections and leave others completely inaccessible at high tide, eliminating continuous public access along the shoreline and reducing the protective beach, which is the first line of defense against erosion and waves. The risk for flooding within the study area would increase.

Under Alternative 2, the proposed breakwaters system of the Breakwaters Project would be installed within Raritan Bay off the south shore of Staten Island and the Shoreline Project elements and proposed Water Hub element of the Breakwaters Project would be implemented along the adjacent shoreline and in upland areas almost entirely within Conference House Park, or within Raritan Bay in the vicinity of the breakwater segments. Alternative 2 would provide coastal resiliency in vulnerable areas along the Tottenville shoreline. While this Alternative would not prevent flooding from coastal storm events, it would attenuate wave energy and reduce wave heights within the study area, and temporarily delay flooding of inland areas during certain storm events, providing some level of risk reduction to shoreline structures within the 100-year floodplain in and adjacent to the study area. It would not have the potential to result in direct or indirect adverse impacts to the floodplain and is appropriate for siting in the 100-year floodplain; therefore, this Alternative would be consistent with Executive Order (EO) 11988. Additionally, Alternative 2 would not adversely affect the CEHA. Instead, it would result in the enhancement of natural protective features (i.e., additional beach area resulting from the shoreline restoration) within the CEHA Natural Protective Feature Area¹¹ (NPFA), while providing reduced storm surge risk to NPFAs by attenuating wave energy. A Coastal Erosion Management Permit would be required for the Proposed Actions that comprise the Shoreline Project and the shoreline restoration under this Alternative. The Water Hub parking area at Potential Location 1 would be within the CEHA and would require a CEHA variance for permitting.

Under Alternative 3, the Breakwaters Project, including the in-water breakwaters, shoreline restoration, and Water Hub, would be implemented without the Shoreline Project. The storm wave reduction by the breakwaters would be the same as described in Alternative 2; however, this alternative would not have the risk reduction benefits that would be provided by inclusion of the Shoreline Project. This Alternative would also be consistent with EO 11988. The shoreline within the CEHA would be more resilient than it would under the No Action Alternative with the shoreline restoration providing an enhancement to the beach (a natural protective feature) within the CEHA, but would remain more vulnerable to erosion than it would under Alternative 2. The shoreline restoration would require a Coastal Erosion Management Permit. A CEHA variance would be required for the parking area of the Water Hub at Potential Location 1 under this Alternative. Overall, Alternative 3 would provide greater coastal resiliency than the No Action Alternative, but it would be less effective at protecting inland areas against wave energy and therefore be less resilient than Alternative 2.

Under Alternative 4, the Shoreline Project would be developed without the in-water breakwater structures, the shoreline restoration, or the Water Hub. This Alternative would be consistent with EO 11988; however, the Shoreline Project components would be exposed to existing wave energy without the proposed breakwater system. This Alternative would not include shoreline restoration in a narrow and particularly vulnerable to erosion, and thus continuous accessible

¹¹ NPFAs are areas that contain natural features such as beaches, dunes, bluffs, and nearshore areas.

public beach would not remain at high tide in front of the segment of the Shoreline Project from Manhattan Street to Loretto Street, once installed. Alternative 4 would enhance shoreline protective features of the NPFA and reduce risk to event-based wave action and erosion but would not reduce long-term shoreline erosion rates. A Coastal Erosion Management Permit would be required for the Proposed Actions that comprise the Shoreline Project under this Alternative. Overall Alternative 4 would provide greater resiliency than the No Action Alternative, but would not provide the reduction in wave energy and height prior to reaching the shoreline that would occur under Alternative 2.

S.8.10 SEWER AND WATER INFRASTRUCTURE

The Proposed Actions would result in the implementation of one of three alternatives analyzed in this EIS; Alternative 2 includes both the Breakwaters Project and the Shoreline Project; Alternative 3 includes only the Breakwater Project component; and Alternative 4 includes only the Shoreline Project component.

The proposed breakwaters system would be installed within Raritan Bay off the south shore of Staten Island. The Shoreline Project elements, and the proposed shoreline restoration and on-shore Water Hub elements of the Breakwaters Project would be implemented along the shoreline and in upland areas almost entirely within Conference House Park. The study area is within the portion of Staten Island that is partially sewered, with some areas serviced by separate sanitary and storm sewers, and the remaining area served by septic systems for the treatment of sanitary waste.

During the placement of sand for shoreline restoration (an element of the Breakwaters Project), measures would be implemented to protect the existing stormwater outfall in Raritan Bay at the end of Loretto Street. During construction of the Shoreline Project, measures developed in consultation with New York City Department of Environmental Protection (NYCDEP) would be implemented to protect the stormwater outfalls at the end of Loretto Street, Sprague Avenue, Joline Avenue and Bedell Avenue from the physical impact of the additional sand and associated additional loads that would be placed on these outfalls. Additionally, construction of shoreline elements (Shoreline Project and proposed on-shore Water Hub elements) would be undertaken in accordance with erosion and sediment control plans and best management practices (e.g., silt fencing and hay bales) incorporated into the SWPPP prepared for the Proposed Actions under the SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity and would not result in adverse impacts to storm sewers. Therefore, construction of the Proposed Actions would not result in significant adverse impacts to stormwater infrastructure.

Should a sanitary sewer be constructed in Page Avenue, as indicated in the City's approved Drainage Plan by the 2020 build year, the discharge of 1,350 gallons per day (gpd) of sanitary waste from the Proposed Water Hub (if sited at Potential Location 1) as estimated in accordance with the *CEQR Technical Manual*¹² would not be expected to adversely affect the operation of this sanitary sewer. Should a sanitary sewer not be available to receive sanitary waste from the proposed Water Hub at Potential Location 1, similar to other areas within the study area, sanitary waste would be discharged to a septic system designed in accordance with NYCDEP, NYCDOB, New York City Department of Health and Mental Hygiene (DOHMH), NYSDEC, and New York State Department of Health (NYSDOH) requirements and standards. If

¹² *CEQR Technical Manual*, March 2014, p. 13-12.

programming of the Water Hub is sited at Potential Location 2 within an existing NYC Parks building, sanitary waste would be discharged to the existing septic system. As part of the repurposing either NYC Parks structure, the septic system will be evaluated and upgrades made as necessary to accommodate the new use. Water Hub Potential Location 3 would not result in discharge of sanitary waste to any wastewater system within the study area.

The Breakwaters Project has been designed to reduce wave energy at the shoreline, and prevent or reverse shoreline erosion, without adversely affecting tidal flushing within the study area. The Breakwaters Project is not anticipated to interfere in the current functionality of the existing outfalls (maintained by NYCDEP in accordance with current maintenance practices and future practices under the NYC Stormwater Management Program Plan [Draft for public review, April 2018], to be implemented pursuant to NYC's Municipal Separate Storm Sewer Systems [MS4] permit). Therefore, the Proposed Actions are not expected to result in significant adverse impacts to the operation of the stormwater outfalls on Loretto Street, Sprague Avenue, Joline Avenue, and Bedell Avenue due to increased sedimentation of the outfalls.

The Shoreline Project has been designed to reduce risk for the shoreline area of Tottenville from wave action. Comprised of a series of porous structures (earthen berm, eco-revetments, hybrid dune/revetment, and raised edge), the Shoreline Project would allow water to seep through, either from the upland side to the Raritan Bay side, or from the Raritan Bay side to the upland side; the project is not intended to prevent Raritan Bay storm surge from entering the land, nor would it retain water inland.

Risk of exposure to storm surge would occur with or without the implementation of the Shoreline Project. However, with the Shoreline Project, as long as storm surge conditions do not exceed +8.0 feet NAVD88, the structures would serve to delay water inundation to the land side, based on the seepage rate calculated for the structures. Seepage through/under the structures to the land side would continue until reaching the approximate elevation of the water on the Raritan Bay side. Once the water on the bay side would begin to recede back towards MHW, the water on the land side would seep back through to the bay side. For storm surge conditions where Raritan Bay water elevation exceeds +8 feet NAVD88 (i.e., the raised edge structure would be overtopped), the volume of water behind the shoreline structures would remain in place until the water level on the bay side recedes, at which point that water would seep through the structures towards the Bay. The seepage analysis performed for the project conservatively determined that in conditions when storm surge overtops the shoreline system, the maximum amount of freestanding water retained behind the proposed shoreline structures would be approximately 28,500 cubic feet (1,056 cubic yards), and would flow back to the bay side of the project components over a period of approximately 1.5 hours or less. Any stormwater from the land side not currently managed through the City's drainage/stormwater system would seep to the bay side of the Shoreline Project elements over the same incremental drainage time of 1.5 hours or less. Any storm surge water captured by the City's drainage/stormwater system would result in a smaller volume of water on the landside of the shoreline structures that would need to flow through the structure, and the time to drain the retained water would subsequently be reduced.

A preliminary analysis of the site conditions based on best available information indicates that that the majority of the area currently less than +8 NAVD88 would experience similar storm surge retention time under conditions with the Proposed Actions as it does under existing conditions for events that overtop the shoreline protection system. For cases that would not overtop the proposed shoreline protection system but would inundate existing topography, it is anticipated that proposed conditions will lead to overall less retention time. Additional modeling

will be conducted during the detailed design phase in consultation with NYCDEP to ensure the Shoreline Project does not worsen drainage issues associated with storm surge as compared to the existing condition in the area. During extreme surge events, stormwater outfalls along the coastline may experience backflow inundation leading to flooding of inland catch basins. This backflow flooding condition along the shoreline would be experienced with or without the Shoreline Project. Its existence is a feature of the current stormwater infrastructure, which falls outside the scope of this Shoreline Project.

Where stormwater outfalls intercept the Shoreline Project footprint, NYCDEP consultation would be provided to avoid potential impacts to the stormwater infrastructure.

The Shoreline Project has integrated green infrastructure measures such as bioswales into the design for the eco-revetment and the raised edge where possible to minimize potential impacts to storm sewers. Similarly the parking lot design for the Water Hub would incorporate green infrastructure measures. Other green infrastructure measures will be considered, as necessary, as design progresses. With these measures in place, runoff resulting from the Proposed Actions would not have the potential to result in significant adverse impacts the storm sewer collection system.

S.8.11 TRANSPORTATION

The elements of the Shoreline Project (as part of Alternatives 2 and 4) are expected to generate minimal incremental traffic, transit, or pedestrian trips for any peak hour of daily operations during the weekday or weekend day.

Activities associated with the Breakwaters Project (as part of Alternatives 2 and 3), and specifically the proposed Water Hub (at either potential location), would generate transportation-related trips to and from the project site. However, the frequency of Water Hub activities is expected to be sporadic (and spread out among different days of the week and time of the day) and most events would not draw daily patrons. Collectively, activities associated with the Shoreline Project and Breakwaters Project (assuming Potential Location 1) are not expected to generate incremental traffic, transit, or pedestrian trips that would exceed the *CEQR Technical Manual* Level 1 screening analysis thresholds for any peak hour of daily operations during the weekday or weekend day. Additionally, the magnitude of daily trips anticipated on the surrounding transportation network would decrease if the Water Hub is located at Potential Location 2 due to a smaller development program. Therefore, the Proposed Actions are not expected to result in the potential for any significant adverse transportation impacts.

S.8.12 AIR QUALITY

The Proposed Actions would not exceed the respective mobile-source screening thresholds. Therefore, there is no potential for mobile-source impacts from the Proposed Actions.

Under both Alternatives 2 and 3, the proposed development of the Water Hub is below the maximum development size shown in Figures 17-7 and 17-8 of the Air Quality Appendix of the *CEQR Technical Manual* for nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) annual concentrations. In addition, potential concentrations from the proposed Water Hub's heating and hot water systems are less than their respective thresholds. Therefore, there would be no potential for significant adverse air quality impacts from the potential heating and hot water systems.

Alternative 4 would include only the proposed Shoreline Project in place, without the proposed breakwaters, shoreline restoration, or Water Hub elements. Potential air quality impacts under Alternative 4 would be very similar to the potential air quality impacts under Alternative 1 (the No Action alternative). Similar to Alternative 1, under Alternative 4 there would be no potential for significant adverse air quality impacts.

Due to the small size of the heating and hot water system for the proposed Water Hub under Alternatives 2 and 3 as well as the minor vehicle increments associated with the Proposed Actions, emissions are well below the general conformity *de minimis* criteria.

S.8.13 GREENHOUSE GAS EMISSIONS

The greenhouse gas (GHG) emissions from construction of the Proposed Actions were estimated at 18,657, 8,085, and 10,572 metric tons of carbon dioxide equivalent (CO₂e) under Alternatives 2, 3, and 4, respectively. The highest emissions would be from Alternative 2, which includes construction of both projects. Note that the embedded emissions for Alternatives 2 and 3 would be somewhat higher than presented with the inclusion of the proposed Water Hub materials (if located on-shore) which were not estimated explicitly. Since Potential Location 2 involves the rehabilitation and adaptive reuse of an existing New York City Parks building rather than the construction of a new building, and Potential Location 3 involves a “floating” Water Hub, if Potential Location 2 or 3 were selected, the overall construction emissions associated with Alternatives 2 and 3 would be somewhat lower.

Operational emissions would be associated with maintenance activity, power use such as lighting for outdoor space, and building energy emissions (fuel and electricity) for the Water Hub building if located in either Potential Locations 1 or 2, and some emissions from boat operations. If the “floating” Water Hub is selected, (Potential Location 3), there would be no additional building energy emissions, and there would be some emissions from the operation of a larger boat.

The implementation of sustainable design features that would, among other benefits, result in lower GHG emissions would ensure that the Proposed Actions would be consistent with the City and State’s emissions reduction goals and other policies.

S.8.14 CLIMATE CHANGE ADAPTATION AND RESILIENCE

The Proposed Actions would not introduce any adverse impacts in terms of climate resilience. Rather, Alternatives 2, 3, and 4 would improve the resilience of the project area to coastal erosion and the impact of waves during severe coastal storm events. The Water Hub (if located on-shore) would also be designed to be resilient to future flood conditions or located outside of the potential future flood hazard area. Therefore, the Proposed Actions would be consistent with the City and State’s resilience policies. While each component (in-water breakwaters and on-shore measures) would reduce wave height on its own, for Alternatives 3 and 4, the combined benefit of both components under Alternative 2 would be larger than either component on its own.

S.8.15 NOISE

The Proposed Actions, once operational, would not have the potential to result in perceptible increases in noise level at any noise receptor locations resulting from either vehicular traffic associated with the Proposed Actions or mechanical equipment serving the proposed Water Hub

included in Alternatives 2 and 3. Additionally, the proposed Water Hub included in Alternatives 2 and 3, whether it would be located on-shore at Potential Location 1 or Potential Location 2, would be located in an area where noise levels would be in the “acceptable” range according to HUD or *CEQR Technical Manual* noise exposure guidance and consequently would not have the potential to experience a significant adverse noise impact. Alternative 4 would not include any newly introduced noise receptors subject to noise. Consequently, the Proposed Actions would not have the potential to result in any significant adverse noise impacts.

S.8.16 CONSTRUCTION

Under the No Action alternative no new structural risk reduction projects or marine habitat restoration projects will be implemented in the project area. NYC Parks will be reconstructing the Pavilion, located along the shoreline within Conference House Park, which has been closed to the public since 2011 due to weather damage to the roof and deck. Reconstruction began in early 2018 and is anticipated to extend into early 2019.

The Proposed Actions would result in the implementation of one of three alternatives analyzed in this EIS; Alternative 2 includes the Breakwaters Project and the Shoreline Project; Alternative 3 includes only the Breakwater Project component; and Alternative 4 includes only the Shoreline Project component.

LAND USE, NEIGHBORHOOD CHARACTER, SOCIOECONOMIC CONDITIONS, AND OPEN SPACE

Construction under the Proposed Actions—as is the case with most large construction projects—would result in temporary disruptions in the surrounding area. However, while construction activities would be evident to the local community, the temporary nature of construction would not result in any significant impacts on local land use patterns or the character of the nearby area. Construction activities would not block or restrict access to any facilities, affect the operations of any nearby businesses, or obstruct major thoroughfares used by customers or businesses. Therefore, nearby businesses would not be significantly affected by the construction activities under Alternative 2, 3, or 4. Although portions of Conference House Park would temporarily be closed during construction of the on-shore elements of Alternative 2, 3, and 4, access to the waterfront in areas not under construction would continue to be maintained. Construction activities would be phased to minimize the duration of construction at any particular location within Conference House Park. As project components are completed, those sections of the park would be re-opened for use. As such, at any particular time during construction, the majority of Conference House Park and other open space resources in the area would continue to accommodate the largely passive activities displaced from the affected construction areas. Therefore, construction under Alternative 2, 3, or 4 would not result in significant adverse impacts on open space.

HISTORIC AND CULTURAL RESOURCES

Archaeological Resources

The Breakwaters APE, which is located entirely within the Raritan Bay, was determined to have no sensitivity for archaeological resources dating to the historic period and low to moderate sensitivity for precontact archaeological resources at depths between 25 and 35 feet below the bay floor. As such, the Proposed Actions under Alternatives 2 and 3 would not result in impacts to archaeologically sensitive depths. The Phase 1A Archaeological Documentary Study (Phase

1A) concluded that it is not likely that intact archaeological deposits would be within the sandy beaches within the Shoreline APE. However, limited portions of the upland areas were determined to possess moderate sensitivity for precontact archaeological resources and moderate sensitivity for historic period archaeological resources. Finally, upland areas of the Water Hub Potential Location 2 APE were determined to be highly sensitive for precontact and historic period archaeological resources and two areas within the steeply sloped bluffs were also determined to have sensitivity for historic period archaeological resources. A Phase 1B archaeological investigation was recommended for those areas of archaeological sensitivity within the Shoreline APE and the Water Hub Potential Location 2 APE that would be impacted by the proposed project as would be expected under Alternatives 2, 3, and 4.

All Phase 1B testing under Alternatives 2, 3, and 4 within identified areas of archaeological sensitivity would be completed in consultation with SHPO, LPC, and the Tribal Nations. Any additional archaeological investigation or consultation with the consulting parties would be completed pursuant to the terms outlined in the Programmatic Agreement executed in May 2013 among the Federal Emergency Management Agency (FEMA), SHPO, the New York State Office of Emergency Management, the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Nation, the Stockbridge-Munsee Community Band of Mohicans, LPC, and the Advisory Council on Historic Preservation (ACHP) and specifically pursuant to Appendix D to the Programmatic Agreement, which pertains to the CDBG-DR grant program for activities in New York City. Any additional archaeological investigations completed subsequent to the Phase 1B investigation (e.g., a Phase 2 archaeological survey or Phase 3 Data Recovery) would be completed prior to construction in consultation with SHPO, LPC, and the Tribal Nations.

Pursuant to Section 106 of NHPA and CEQR, should significant (e.g., S/NR-eligible) archaeological resources be identified in sensitive areas through Phase 1B and Phase 2 archaeological investigations, disturbance or removal of such resources through construction would constitute an adverse effect under Section 106 of the NHPA and a significant adverse impact under CEQR. However, at this time only the *potential* for archaeological resources has been identified in certain locations on the project site. As set forth in the *CEQR Technical Manual*, a “site’s actual, rather than potential, sensitivity cannot be ascertained without some field testing or excavation.”¹³ Therefore, it is conservatively assumed for purposes of Section 106 and CEQR that the proposed project could *potentially* result in an adverse effects and significant adverse impacts, with the actual presence of any significant resources to be determined through additional archaeological investigations and consultation as set forth in the Programmatic Agreement, described above. However, should no significant archaeological resources be identified through Phase 1B or any subsequent Phase 2 archaeological investigations, and LPC, SHPO and the Tribal Nations concur with the conclusions of those investigations, no *actual* adverse effects or significant adverse impacts would occur.

Architectural Resources

Within the Water Hub Potential Location 2 APE are the Henry Hogg Biddle House (S/NR-eligible, NYCL) and the Rutan-Beckett House (S/NR-eligible).¹⁴ With Alternative 2, if Water

¹³ *CEQR Technical Manual* (March 2014): page 9-10

(http://www.nyc.gov/html/oec/downloads/pdf/2014_ceqr_tm/09_Historic_Resources_2014.pdf).

¹⁴ Since the DEIS was issued, in comments dated March 27, 2017, SHPO determined that the Henry Hogg Biddle House and the Rutan-Beckett House are both S/NR-eligible.

Hub Potential Location 2 is selected, one of these two historic architectural resources would be selected—the Biddle House Option or the Rutan-Beckett House Option—and would be rehabilitated and adaptively used. If plans move forward to locate the programming for the Water Hub at one of these two buildings, consultation with the consulting parties would continue to be undertaken pursuant to the terms outlined in the Programmatic Agreement executed in May 2013 among FEMA, SHPO, the New York State Office of Emergency Management, the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Nation, the Stockbridge-Munsee Community Band of Mohicans, LPC, and ACHP and specifically pursuant to Appendix D to the Programmatic Agreement, which pertains to the CDBG-DR program for activities in New York City.

Should either the Biddle House Option or the Rutan-Beckett House Option for the Water Hub Potential Location 2 be selected, consultation with SHPO would continue to be undertaken regarding any proposed alterations to the historic resource. In addition, because the Henry Hogg Biddle House is a NYCL, if the Biddle House Option is selected for the Water Hub, the NYC Parks would consult with the LPC under the New York City Landmarks Preservation Law regarding any proposed alterations to this NYCL. LPC would review the proposed alterations and, upon approval, would issue a Binding Commission Report summarizing LPC's findings.

VISUAL RESOURCES

Construction equipment such as excavators, loaders, barges, and/or trucks, would be utilized during the construction period under the Proposed Actions and may be visible to the public from certain vantage points. Views towards the waterfront from inland locations on nearby local streets are limited to residents, pedestrians, motorists and bicyclists, due to the narrowness of the streets and intervening natural features, including wooded areas, street trees, and landscaping elements on residential properties. Construction activities would be temporary in nature and would be phased to minimize the duration of construction at any particular location so as to lessen the effects of construction on the surrounding communities. Although the character and quality of views during construction may be modified, such effects would be temporary in any given location. Therefore, construction under Alternative 2, 3, or 4 would not result in significant adverse impacts to visual resources.

HAZARDOUS MATERIALS

Although no significant potential for adverse impacts related to hazardous materials would be anticipated given the longstanding recreational parks use of the project site, the potential would be further minimized by incorporating best practices into the project's construction and incorporating the following protocols into the Proposed Actions (via the construction documents and specifications):

- If evidence of contaminated soil/sand (e.g., stains or odors) is encountered, these materials (and all other materials requiring off-site disposal) would be segregated and disposed of in accordance with applicable federal, state and local regulations. If any underground storage tanks (USTs) are encountered, they would be properly assessed, closed and removed in accordance with state and local regulatory requirements (including NYSDEC tank registration and spill reporting requirements). Any materials intended for off-site disposal would be tested in accordance with the requirements of the receiving facility. Transportation of these materials would be in accordance with federal, state and local requirements covering licensing of haulers and trucks, placarding, truck routes, manifesting, etc.

Coastal and Social Resiliency Initiatives for Tottenville Shoreline DEIS

- Dewatering is not anticipated to be required. Should it be needed, testing would be performed to ensure compliance with proper regulatory discharge requirements (New York City Department of Environmental Protection for discharge to combined sewers or NYSDEC requirements for discharges to surface water either directly or via an outfall). If required by the regulatory permit/approval process, pre-treatment would be conducted prior to the discharge.
- For Potential Location 2 of the Water Hub, rehabilitation plans would follow applicable regulatory requirements to address any ACM, PCB-containing material, or LBP. Similar materials and creosote-treated wood could be encountered during excavation, especially where there were previously structures. Any such materials would be properly characterized, managed and disposed of in accordance with applicable regulations.

With the implementation of these protocols, no significant adverse impacts related to hazardous materials would result from construction activities related to the Proposed Actions.

NATURAL RESOURCES

Alternatives 2, 3, and 4 would not result in significant adverse impacts to terrestrial or aquatic resources. Temporary impacts to water quality, NYSDEC littoral zone tidal wetlands and TWAA due to upland construction activities associated with Alternatives 2, 3, and 4 would be minimized through the use of erosion and sediment control measures (e.g., silt fencing and hay bales) implemented in accordance with the SWPPP prepared for the project as required by SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity. These same erosion and sediment control measures would minimize potential impacts to the delineated wetland, along with the use of marsh mats or low ground-pressure equipment to minimize indirect impacts to the portion of the wetland not directly affected by the construction of the eco-revetment and hybrid dune/revetment, under Alternatives 2 and 4.

For Alternatives 2 and 4, which would result in substantial upland construction activity, including the upland areas where threatened or endangered plant species were observed and where the box turtle (species of section concern) has the potential to occur, protection programs (e.g., transplant, and seed collection and propagation) would be developed in coordination with NYC Parks and NYSNHP for populations of the state-listed plant species that would have the potential to be affected by construction of the Shoreline Project: northern gamma grass (endangered), and dune sandspur (threatened). Additionally, any eastern box turtles encountered in the area of disturbance prior to or during the construction of the earthen berm, eco-revetment, and hybrid dune/revetment would be relocated to an area beyond the silt fencing to avoid direct impacts. Construction of project elements requiring tree clearing (e.g., earthen berm) would be scheduled to occur outside the early May through July primary bird breeding season, to the extent practicable. Should construction activities requiring tree clearing be necessary during April or August (i.e., the beginning and end of the breeding period), GOSR will coordinate with USFWS with respect to conducting active nest surveys that may support tree cutting during this period. These surveys would be focused on the presence of active nests, eggs, or young in trees targeted for removal. In the event that active nests, eggs, or young are not present, GOSR will inform USFWS of the results before commencing any tree cutting. Alternative 3 would have a limited amount of upland disturbance, and therefore limited potential to affected terrestrial threatened or endangered plant species or wildlife of concern. With the implementation of these measures Alternatives 2, 3, and 4 would not result in significant adverse impacts to terrestrial threatened or endangered plant species and species of special concern.

Excavation of soils to construct the on-shore components of Alternatives 2 and 4, including the unpermitted fill determined to meet the NYSDEC SCOs for residential use and protection of groundwater, would not have the potential to adversely affect groundwater due to soil contamination. Groundwater removed during any dewatering activities would be treated prior to discharge to Raritan Bay and would not have the potential to adversely affect water quality. Alternative 3 would only result in limited clearing and upland construction associated with the Water Hub.

During placement of the breakwater materials under Alternatives 2 and 3, measures would be implemented to minimize suspension of bottom sediment. Increases in suspended sediment that would result from in-water construction activities would be minor, temporary, and localized, would dissipate upon cessation of the sediment disturbing activities, and would not adversely affect aquatic biota. Fish, threatened, or endangered species (such as Atlantic sturgeon and sea turtles), and mobile benthic invertebrates would be expected to avoid the portions of the bay in which in-water activities would be occurring, moving to similar available habitat nearby. Increased vessel traffic and underwater construction noise would be within the range of typical vessel activity in Raritan Bay and would not adversely affect aquatic resources. Shading of aquatic habitat due to construction barges would be temporary and would not result in adverse effects to aquatic biota. In order to minimize potential effects to horseshoe crabs due to the shoreline restoration, the placement of sand would be scheduled to avoid the peak spawning season for horseshoe crabs (April 15 through July 15). Construction of the breakwaters and shoreline restoration would also be scheduled to avoid winter flounder spawning (January 1 through May 31). Alternative 4 would not result in any in-water construction activities and would have limited potential to adversely affect water quality and aquatic biota.

TRANSPORTATION, AIR QUALITY, NOISE, AND VIBRATION

Incremental traffic, transit, and pedestrian trips during peak construction activities would not exceed the *CEQR Technical Manual* analysis thresholds for any hour for all three alternatives. Therefore, the Proposed Actions would not result in any significant adverse traffic, parking, transit, or pedestrian impacts during construction for any of the three Alternatives.

Measures would be taken to minimize pollutant emissions during construction in accordance with all applicable laws, regulations, and building codes. These measures would include dust suppression measures, idling restrictions, and the use of ultra-low sulfur diesel (ULSD) fuel and best available technologies (BAT) for equipment at the time of construction. With these measures in place, construction activities associated with the Proposed Actions Alternatives 2, 3, and 4 would not result in any significant adverse local (microscale) and (mesoscale) air quality impacts. The annual emissions generated during the construction activities associated with each of the alternatives would be lower than the *de minimis* rates defined in the general conformity regulations.

Noise resulting from construction associated with the Proposed Actions could result in exceedances of *CEQR Technical Manual* noise impact criteria at beachfront residences between Swinnerton Street and Page Avenue as well as at open spaces such as the Lenape Playground located to the northwest of the earthen berm phase of the Shoreline Project. Exceedances at a single receptor are expected to last for fewer than 6 months, and construction equipment noise levels would decrease as the Shoreline Project progresses throughout the approximately 15 month schedule. Although the exceedances of CEQR noise impact criteria would be noticeable and potentially intrusive at times, due to the limited duration of construction activities associated

with the Proposed Actions, they would not be considered significant adverse construction noise impacts.

Construction associated with the Proposed Actions would not have the potential to produce vibration levels that could result in structural or architectural damage at any receptors near the construction work areas. In terms of potential vibration levels that would be perceptible and annoying, grade-level receptors within approximately 650 feet of pile driving activity would have the potential to experience perceptible and potentially annoying vibration. While vibration resulting from impact pile driving may be perceptible and potentially intrusive, it would be of limited duration as pile driving activities would not last more than approximately two to three months. Because vibration levels associated with construction would not be in the range that could potentially result in damage to adjacent structures, and because levels that would be perceptible would occur intermittently for only a relatively brief period of time, significant adverse impacts from vibrations are not expected to occur as a result of construction associated with the Proposed Actions.

S.8.17 PUBLIC HEALTH

According to the CEQR Technical Manual, public health is the organized effort of society to protect and improve the health and well-being of the general population. The goal of CEQR, with respect to public health, is “to determine whether adverse impacts may occur as a result of a Proposed Action, and if so, to identify measures to mitigate them.” According to the *CEQR Technical Manual*, for most proposed projects, a public health analysis is not necessary. A public health analysis may be warranted if an unmitigated significant adverse impact is identified in the areas of air quality, water quality, hazardous materials, or noise. As described in the relevant analyses summarized above, the Proposed Actions would not result in unmitigated significant adverse impacts in any of the technical areas related to public health. Therefore, the Proposed Actions would not have the potential for significant adverse impacts related to public health.

S.8.18 NEIGHBORHOOD CHARACTER

The study area has diverse characteristics owing to the varied land uses in the vicinity of the project site. Defining features include the following:

- The quiet, residential nature of the built environment.
- The presence of extensive natural areas in Conference House Park, in other parks and privately owned parcels, at the waterfront, and within the waters of Raritan Bay and the Arthur Kill.
- The close interweaving of the community and its natural environment, including upland and wetland areas and the surrounding water bodies.

The Proposed Actions would result in the development of new resiliency, educational, and recreational infrastructure in Tottenville, and would complement and build on the existing character of the Tottenville neighborhood in numerous ways:

- The Shoreline Project and new programming associated with the proposed Water Hub would generate minimal incremental traffic, transit, or pedestrian trips and would not lead to a significant change in the quiet, residential character of the neighborhood.

- The linear components of the Shoreline Project system (earthen berm, hybrid dune/revetment, eco-revetments, raised edge, and overlooks at the transition nodes) would be consistent with the uses already present in Conference House Park. Plantings of native vegetation would complement existing natural features, and access and views to the waterfront would be preserved. Beaches in the neighborhood would be stabilized and, in some areas, grow as a result of these interventions, protecting these existing features from the ongoing erosion that is currently occurring.
- Components of the Proposed Actions have been designed to reinforce the existing relationship between the community and natural areas. A comprehensive trail system for the park would be provided, linking its key elements to the community. The proposed Water Hub would reinforce the community's strong relationship with the natural environment and with Raritan Bay in particular and provide opportunities to learn about the environment and history of the Park and Tottenville. Programming would complement the existing nature-focused activities and events in Conference House Park.
- In addition to being compatible with, complementing, and enhancing neighborhood character as described in the preceding bullets, the resiliency improvements, at the heart of the Proposed Actions protect the existing character of the neighborhood by reducing shoreline erosion and wave action, thereby reducing risk to Conference House Park and the neighborhood as a whole.

Taking into consideration the effects of these Proposed Actions on the contributing features of neighborhood character in Tottenville, Alternative 2 would not have a significant adverse impact on neighborhood character. Rather, it would have a positive impact, reinforcing and protecting the character-defining features of the neighborhood.

The elements of Alternative 3 would affect neighborhood character in much the same way as they would under Alternative 2, although the positive interplay between these elements and the shoreline protection system would be lacking. Like Alternative 2, Alternative 3 would have a positive impact on neighborhood character.

The elements of Alternative 4 would affect neighborhood character in much the same way as they would under Alternative 2, although the positive interplay with the proposed breakwaters, Water Hub and associated landscape enhancements would be lacking. Like Alternative 2, Alternative 4 would have a positive impact on neighborhood character.

S.8.19 MITIGATION AND MINIMIZATION OF IMPACTS

As described in the previous sections, with the exception of a *potential* for a significant adverse archaeological resources impact (to be ascertained during future field testing or excavation), and adverse impacts from the loss of approximately 3.6 acres of Waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW, the Proposed Actions would not result in any significant adverse impacts requiring mitigation. The Proposed Actions would incorporate several measures to minimize, avoid, or mitigate impacts as described below.

HISTORIC AND CULTURAL RESOURCES

Archaeological Resources

Pursuant to Section 106 and CEQR, should significant (e.g., National Register-eligible) archaeological resources be identified in sensitive areas through Phase 1B and Phase 2

archaeological investigations, disturbance or removal of such resources through construction would constitute an adverse effect under Section 106 and a significant adverse impact under CEQR. However, at this time only the *potential* for archaeological resources has been identified in certain locations on the project site. As set forth in the *CEQR Technical Manual*, a “site’s actual, rather than potential, sensitivity cannot be ascertained without some field testing or excavation.”¹⁵ Therefore, it is conservatively assumed for purposes of Section 106 and CEQR that the proposed project could *potentially* result in an adverse effects and significant adverse impacts, with the actual presence of any significant resources to be determined through additional archaeological investigations and consultation as set forth in the Programmatic Agreement. However, should no significant archaeological resources be identified through Phase 1B or any subsequent Phase 2 archaeological investigations, and the LPC, SHPO and the Tribal Nations concur with the conclusions of those investigations, no *actual* adverse effects or significant adverse impacts would occur.

As mandated by Section 106 of the NHPA, the GOSR is participating in an ongoing consultation process with SHPO, LPC, and the Tribal Nations with respect to potential effects on archaeological and architectural resources. As part of this ongoing process, measures have been explored to avoid, minimize, or mitigate any significant adverse effects to archaeological and architectural resources. Development of these measures is set forth in the Programmatic Agreement executed in May 2013 among FEMA, SHPO, the New York State Office of Emergency Management, the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Nation, the Stockbridge-Munsee Community Band of Mohicans, LPC, and ACHP and specifically outlined within Appendix D to the Programmatic Agreement, which pertains to the New York State’s CDBG-DR program for activities in New York City.

The Programmatic Agreement describes the measures to be implemented and the consultation that is required during the project’s design process, to avoid, minimize, or mitigate adverse effects of the project on historic and archaeological resources. GOSR would implement the various provisions of the Programmatic Agreement and would continue to consult with the consulting parties regarding the identification of the potential for the Proposed Actions to impact archaeological resources and GOSR would perform additional archaeological investigations as required. If significant archaeological deposits are identified and impacts on such deposits cannot be avoided, these would be considered unavoidable adverse impacts. GOSR would identify and implement any additional measures that may be required to mitigate adverse effects on archaeological resources in accordance with applicable Project Review provisions in the Programmatic Agreement.

Architectural Resources

None of the project alternatives would result in an adverse effect on any of the architectural resources in the Breakwaters APE, the Shoreline APE, the Water Hub Potential Location 2 APE, or the Indirect Effect APE. Should either the Biddle House Option or the Rutan-Beckett House Option be selected for locating the Water Hub programming, consultation would continue with SHPO, LPC, and the consulting parties regarding any proposed alterations to the historic resource. In addition, because the Henry Hogg Biddle House is a NYCL, if the Biddle House Option is selected for the Water Hub, NYC Parks would consult with LPC under the New York

¹⁵ *CEQR Technical Manual* (March 2014): page 9-10
(http://www.nyc.gov/html/oec/downloads/pdf/2014_ceqr_tm/09_Historic_Resources_2014.pdf).

City Landmarks Preservation Law regarding any proposed alterations to this NYCL. LPC would review the proposed alterations and, upon approval of the proposed alterations, would issue a Binding Commission Report summarizing LPC's findings. As the anticipated alterations to either building would be limited to rehabilitation and adaptive reuse changes, no adverse effects are anticipated.

HAZARDOUS MATERIALS

Although no significant potential for adverse impacts related to hazardous materials would be anticipated given the longstanding recreational parks use of the project site, the potential would be further minimized by incorporating best practices into the project's construction and incorporating the following protocols into the Proposed Actions (via the construction documents and specifications):

- If evidence of contaminated soil/sand (e.g., stains or odors) is encountered, these materials (and all other materials requiring off-site disposal) would be segregated and disposed of in accordance with applicable federal, state and local regulations. If any USTs are encountered, they would be properly assessed, closed and removed in accordance with state and local regulatory requirements (including NYSDEC tank registration and spill reporting requirements). Any materials intended for off-site disposal would be tested in accordance with the requirements of the receiving facility. Transportation of these materials would be in accordance with federal, state and local requirements covering licensing of haulers and trucks, placarding, truck routes, manifesting, etc.
- Dewatering is not anticipated to be required. Should it be needed, testing would be performed to ensure compliance with proper regulatory discharge requirements (NYCDEP for discharge to combined sewers or NYSDEC requirements for discharges to surface water either directly or via an outfall). If required by the regulatory permit/approval process, pre-treatment would be conducted prior to the discharge.
- For Potential Location 2 of the Water Hub, rehabilitation plans would follow applicable regulatory requirements to address any asbestos-containing materials (ACM), polychlorinated biphenyls (PCB)-containing material, or lead-based paint (LBP). Similar materials and creosote-treated wood could be encountered during excavation, especially where there were previously structures. Any such materials would be properly characterized, managed and disposed of in accordance with applicable regulations.

NATURAL RESOURCES

The Proposed Actions would not result in significant adverse impacts to terrestrial natural resources within the study area. The loss of approximately 3.6 acres of waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW would result in adverse impacts. Measures to mitigate this impact, as well as measures incorporated into the Proposed Actions to minimize or avoid adverse impacts to natural resources include:

- Segregating any contaminated soil/or sand, creosote-treated wood or other contaminants encountered during construction and disposing of these materials in accordance with applicable federal, state and local regulations.
- Groundwater recovered during dewatering would be tested and treated in accordance with NYSDEC requirements prior to discharge to Raritan Bay.

Coastal and Social Resiliency Initiatives for Tottenville Shoreline DEIS

- Implementing erosion and sediment control measures and stormwater management measures in accordance with the SWPPP prepared as required under the SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity.
- Incorporating bioswales and other green infrastructure stormwater management measures to allow infiltration of runoff and recharge to groundwater.
- Relocating any eastern box turtles encountered in the area of disturbance prior to or during the construction of earthen berm to an area beyond the silt fencing to avoid direct impacts.
- Scheduling the construction of the project elements requiring tree clearing outside the early May through July primary bird breeding season, to the extent practicable. Should construction activities requiring tree clearing be necessary during April or August (i.e., the beginning and end of the breeding period), GOSR will coordinate with USFWS with respect to conducting active nest surveys that may support tree cutting during this period. These surveys would be focused on the presence of active nests, eggs, or young in trees targeted for removal. In the event that active nests, eggs, or young are not present, GOSR will inform USFWS of the results before commencing any tree cutting.
- Maintaining landscaped areas within the Shoreline Project and at the Water Hub using IPM techniques.
- In the event that piping plovers or other beach-nesting birds are found to nest on the beach, NYC Parks would enact appropriate management and protection protocols.
- In the event that the Proposed Actions result in an increase in red knot along the beach within Conference House Park in response to greater horseshoe crab spawning activity, NYC Parks would enact management and protection protocols in consultation with USFWS and any other relevant regulatory agencies.
- Employing measures to minimize impacts to the 0.8-acre tidal wetland during construction of the Shoreline Project such as marsh mats or low ground-pressure equipment, and installation of erosion and sediment control measures in accordance with the SWPPP.
- In consultation with NYSDEC and USACE, designing the portion of the eco-revetment that crosses through the 0.8-acre tidal wetland to allow access across the wetland while minimizing adverse effects to the tidal wetland.
- Enhance the 0.8-acre tidal wetland through increased tidal exchange with Raritan Bay, removal of the unpermitted sand bridge, removal of phragmites, and re-establishment of native saltmarsh plant species. Existing native salt marsh vegetation that is currently within the wetland would be retained to the extent possible, and individual plants and seeds would be collected for preservation and replanting. Additional native saltmarsh plants would be re-established through seeding or planting plugs to supplement the native saltmarsh vegetation that already occurs in the wetland. Post-construction monitoring would be conducted in accordance with the New York State Salt Marsh Restoration and Monitoring Guidelines.
- Planting native coastal plant species within the Shoreline Project and Water Hub (if located on-shore).
- Developing protection programs (e.g., transplant, and seed collection and propagation) in coordination with NYC Parks and NYSNHP for populations of the state-listed plant species that would have the potential to be affected by construction of the Shoreline Project: northern gamma grass (endangered), and dune sandspur (threatened).

- Designing the Breakwaters Project to reduce wave energy at the shoreline, and reduce, prevent or reverse shoreline erosion, without adversely affecting tidal flushing along the shoreline within the NYSDEC littoral zone tidal wetland.
- Incorporating ecological enhancements into the design of the breakwater segments through the creation of three-dimensional hard/rocky structured reef-like habitat with reef streets and eco-enhanced concrete units that would increase the quantity and diversity of the aquatic habitats available for habitat forming plants and invertebrates found in Raritan Bay.
- Maintaining at least 2 feet of clearance from the bottom of the Bay, or work only at tide levels sufficient to keep construction barges and vessels off the bay.
- Mitigating for the loss of approximately 3.6 acres of Waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW through measures that may include the purchase of available credits from an approved mitigation bank, and restoration/enhancement of Waters of the U.S. within the Raritan Bay watershed in New York.
- Use of best management practices to minimize the release of suspended sediments during sand placement, including placement of the material above MHWS at low tide where possible and using turbidity barriers where feasible.
- Timing the placement of sand for the shoreline restoration to avoid the spawning season for horseshoe crabs (restricted from April 15 through July 15). The material used for restoration would be similar in composition to existing sand substrate at the beach and within Conference House Park.
- Timing the construction of the breakwaters and shoreline restoration to minimize adverse effects to winter flounder early life stages and EFH (restricted from January 1 through May 31).
- Construction of the breakwater segments sequentially, such that only a small footprint of the Bay is affected at a time. As each segment is completed, habitat forming organisms would begin to colonize the structure, providing foraging opportunities for predator species.
- Development of a post-construction monitoring plan and adaptive management plan in consultation with NYSDEC, NMFS, and USACE to assess use of breakwaters segments by target species groups and fish and benthic communities adjacent to the breakwaters structures.
- Development of a post-construction monitoring and adaptive management plan to assess the structural integrity and condition of breakwater structures, their effectiveness at attenuating storm waves and reducing shoreline erosion, along with establishing what corrective measures may be needed should an issue arise and when such corrective measures should be implemented. Future determination of any need for modification(s) to the breakwater structures would be in accordance with the Adaptive Management Plan developed for the project.
-
- To minimize human sea mammal interaction, signage indicating that such interaction is prohibited will be installed near the breakwaters in consultation with State and Federal Agencies.

SEWER AND WATER INFRASTRUCTURE

The Proposed Actions would not result in significant adverse impacts to wastewater and stormwater infrastructure within the study area; therefore, no mitigation is needed for the Proposed Actions. Measures incorporated into the Proposed Actions to minimize adverse impacts to stormwater infrastructure include:

- Implementing erosion and sediment control measures and stormwater management measures in accordance with the SWPPP prepared as required under the SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity.
- Incorporating permeable pathways where practicable and bioswales and other green infrastructure stormwater management measures to allow infiltration of runoff.
- Continuing to coordinate with NYCDEP to ensure the Breakwaters Project does not interfere with the current functionality of the existing outfalls maintained by NYCDEP.
- Incorporating measures to protect the stormwater outfall in Raritan Bay at the end of Loretto Street during the placement of sand for shoreline restoration.
- Incorporating any measures necessary, developed in consultation with NYCDEP, to protect the stormwater outfalls at the end of Loretto Street, Sprague Avenue, Joline Avenue and Bedell Avenue, from the physical impact of the additional fill and associated additional loads that would be placed on these outfalls.

S.8.20 INDIRECT AND CUMULATIVE EFFECTS

INDIRECT EFFECTS

The Proposed Actions would not induce additional growth, or result in other direct impacts to land use, zoning, or public policy. They would occur on land owned by the City (NYC Parks) or New York City Department of Transportation (NYCDOT), and on underwater lands owned by NYC Parks and the State. They would be consistent with the existing passive recreational and educational uses within Conference House Park and within the NYCDOT Surf Avenue right-of-way and would not add new uses, new public water, sanitary or storm sewer infrastructure, would not add new residents or employment that could induce additional development or support uses as retail establishments to serve new residents. Therefore, the Proposed Actions would not have a growth inducing effect.

The Proposed Actions would have the potential to result in enhanced open space resources within Conference House Park and reduce risks of property damage from wave action and erosion but would not be expected to result in increases in property value that would result in significant residential displacement pressures within the vicinity of the project area because market conditions already reflect the close proximity of the waterfront as a valuable residential amenity and historically have not discounted value based on the risk posed by major storm events, therefore pre-Sandy levels of interest and investment would be maintained. Most (approximately 80 percent) of the households in the vicinity of the project area are owner occupied units and the socioeconomic character of the neighborhood would not be substantially altered if a small (renter) portion of the overall study area population were displaced due to increased rents. Because the vast majority of existing businesses are located outside of the area that would benefit from reduced risk of damage caused by wave action, and no retail businesses are located in close proximity to the project area, the Proposed Actions would not have the

potential to result in indirect business displacement or result in a substantial increase in consumer visits that in turn, could lead to increased rents.

The Proposed Actions would not have the potential to result in indirect effects to architectural resources within the Indirect Effect APE as these resources are located significantly away from most of the project components and existing landscaping elements and plantings would further limit any visual or contextual relationships between the architectural resources in the Indirect Effect APE and the project components. Should the proposed Water Hub be located Potential Location 2, rehabilitation and adaptive use alterations of the Biddle House or Rutan-Beckett House would be limited to the interiors of the building and would not, therefore, result in any adverse effects to nearby architectural resources in the Indirect Effect APE.

Construction of the breakwaters (material placement and vessel movement) would result in minor increases in suspended sediment that would be localized and temporary. These indirect effects would not be significant and would not adversely affect other areas of Raritan Bay. Temporary indirect impacts to portions of the 0.8-acre delineated tidal wetland due to the construction of a portion of the hybrid dune/revetment and eco-revetment would be minimized through the use of measures such as marsh mats or low ground-pressure equipment within the wetland, and installation of erosion and sediment control measures in accordance with the SWPPP prepared as required under the SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity. Portions of the wetland disturbed during construction would be restored as necessary (e.g., repair of ruts, stabilization of soil, revegetating). With these measures in place, temporary indirect impacts to wetlands due to construction would not result in significant adverse effects to the delineated wetland. Erosion and sediment control measures (e.g., silt fencing and hay bales) implemented in accordance with SWPPP prepared for the project as required by the SPDES General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity would minimize indirect impacts to Raritan Bay and NYSDEC littoral zone tidal wetlands due to erosion and discharge of sediment during construction of the Shoreline Project.

The breakwater structures in Alternatives 2 and 3 have been designed to minimize changes to tidal flushing and water residence time, and subsequently water quality and aquatic biota, of Raritan Bay within the Project area. The breakwaters will attenuate waves and alter sediment transport along the shore to maintain and restore the beach but would minimize down-drift impacts¹⁶. The spacing, orientation, and design of the breakwaters would minimize the potential indirect and down-drift impacts of altered sedimentation and would not hinder the movement of fish and other aquatic biota through the water column. The breakwaters would not cause erosion or result in increased wave heights on adjacent areas. The breakwaters would result in indirect impacts to the subtidal and intertidal habitats and NYSDEC littoral zone tidal wetlands due to the gradual sedimentation along the shoreline but have been located and spaced so that they would not result in the indirect impact of tombolos (connection to the shore). While they would create small changes in flow around the structures, the breakwaters would not significantly disrupt existing currents in Raritan Bay. Scour at the perimeter of the breakwater structures would be very localized, within 15 feet of the ends of the breakwater. The increased shoreline

¹⁶ Down-drift erosion—when a headland, inlet, river, bay, canyon, reef or shoal blocks the natural longshore drift of materials, such as sand and gravel, by waves and currents, resulting in accumulation of sediments on the up-drift side, while a depletion of material occurs on the down-drift side (Bruun 1995).

stability and accretion provided by Alternatives 2 and 3, including the shoreline restoration between Manhattan Street and Loretto Street, would likely result in a beneficial indirect impact to spawning horseshoe crabs and other organisms that use beach habitat, as well as to people using Conference House Park.

The ecologically enhanced breakwaters would facilitate the recruitment of a rich benthic community of habitat-forming encrusting invertebrates and algae, while providing suitable sheltering and foraging habitat for fish and benthic invertebrates that occur in Raritan Bay, resulting in beneficial impacts to target species groups of Raritan Bay. The Shoreline Project in Alternatives 2 and 4 would not have the potential to result in indirect impacts to natural resources.

The Breakwaters Project is not anticipated to interfere in the current functionality of the existing outfalls (maintained by NYCDEP in accordance with current maintenance practices and future practices under the NYC Stormwater Management Program Plan [Draft for public review, April 2018], to be implemented pursuant to NYC's Municipal Separate Storm Sewer Systems [MS4] permit). Additionally, the Shoreline Project has integrated measures such as bioswales into the design for the eco-revetment and the raised edge where possible to minimize potential impacts to storm sewers. Therefore, Alternatives 2, 3, and 4 would not result in adverse indirect impacts to sewer and water infrastructure.

Collectively, activities associated with the Water Hub and the Shoreline Project are not expected to generate incremental traffic, transit, or pedestrian trips that would result in any significant adverse transportation impacts, direct or indirect, or any associated indirect impacts to air quality.

CUMULATIVE EFFECTS

Projects or actions that represent past, present and reasonably foreseeable future actions and their impacts to environmental, socioeconomic and cultural resources in the future have been evaluated as appropriate and considered in the assessment of the potential impacts from the Proposed Actions in each technical analysis. These actions included past projects such as the establishment of Conference House Park, the Federal Navigation Channel and installation of temporary dunes. Present and future projects included: reconstruction of the Conference House Park Pavilion and maritime forest restoration within Conference House Park; City-wide initiatives such as Vision 2020, New York City's Green Infrastructure Plan, OneNYC and MillionTreesNYC that focus on expanding usage of green infrastructure, reducing stormwater runoff, and increasing public access to the waterfront; regional restoration plans such as the Hudson-Raritan Estuary Comprehensive Restoration Plan, Billion Oyster Project, and New York/New Jersey Baykeeper intended to benefit natural resources of the estuary; and the USACE South Shore of Staten Island Coastal Storm Risk Management project.

The Proposed Actions would have a beneficial effect on Conference House Park as they would reduce the risk of wave action and coastal erosion along Park's shoreline and result in improved amenities along the shoreline. Under Alternatives 2 and 4, the Proposed Actions would remove and replace the temporary dune system. Most of the breakwater structures (Alternatives 2 and 3) would be more than 1,700 feet from the Federal Navigation Channel, with the closest segment within 700 feet, and would not, therefore, have the potential to result in cumulative impacts to the navigation channel.

In general, the present and future actions considered would complement and be consistent with the Proposed Actions, or have the potential to result in positive cumulative impacts. The reconstruction of the Pavilion concurrent with construction activities associated with the Proposed Actions would not have the potential to result in cumulative impacts to open space or wildlife resources due to the distance (at least 0.6 miles) between the Pavilion and the Shoreline Project and Breakwaters Project (at least 0.6 miles), or to transportation, air quality or noise. The limited disturbance (e.g., vegetation clearing and construction of ADA access should the water access in the vicinity of the existing NYC Parks structures be selected) that would result from development of water access for Water Hub Potential Location 2 under Alternatives 2 and 3 would not result in cumulative impacts to open space and wildlife resources within Conference House Park, or result in noise impacts, during the short period of time that these activities may be concurrent with the Pavilion reconstruction. Habitat improvements resulting from regional restoration plans, continued implementation of fisheries management plans would complement the establishment of the ecologically enhanced breakwater structures designed to attract and retain habitat-creating benthic invertebrates and shellfish, including bivalves. The breakwaters would provide complex hard substrate that would serve as refugia and foraging habitat for juvenile fish, consistent with the goals of the HRE-CRP. The breakwaters would offer sheltering and/or foraging habitat for HRE-CRP target species, including black sea bass, striped bass, American eel, and blue crab, and the one-time shoreline restoration could enhance spawning habitat for horseshoe crab. The intertidal and emergent portions of the breakwaters would also provide some habitat for waterbirds. There would be an increase in foraging opportunities for designated EFH species and other organisms due to the establishment of encrusting organisms, macroalgae, and benthic macroinvertebrates on and among the breakwaters, and the survival of these organisms would be aided by the continued improvements in water quality. Stabilization of the shoreline and reduction or reversal of erosion that would result from the Proposed Actions would be consistent with efforts to restore and protect coastal habitats in Raritan Bay (e.g., wetland restoration, coastal forest protection, marsh improvements) and would be in line with the goals of the HRE-CRP. Stabilization of the shoreline and reduction or reversal of erosion that would result from the Proposed Actions would be consistent with efforts to restore and protect coastal habitats in Raritan Bay (e.g., wetland restoration, coastal forest protection, marsh improvements) and would be in line with the goals of the HRE-CRP.

S.8.21 UNAVOIDABLE ADVERSE IMPACTS

As per the *CEQR Technical Manual*, unavoidable adverse impacts occur when significant adverse impacts would be unavoidable if the project is implemented regardless of the mitigation employed (or if mitigation is impossible).

As described in the previous sections above, a *potential* for a significant adverse archaeological resources impact (to be ascertained during future field testing or excavation). If significant archaeological deposits are identified and impacts on such deposits cannot be avoided, these would be considered unavoidable adverse impacts. In addition, the Proposed Actions would result in adverse impacts from the loss of approximately 3.6 acres of Waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW. This adverse impact would be fully mitigated as described above under “Mitigation and Minimization of Impacts,” and therefore would not result in unavoidable adverse impacts.

S.8.22 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction of the Breakwaters Project and Shoreline Project would result in irretrievable loss of materials used for construction (e.g., concrete, rock, and asphalt), energy (gas and electricity), and human effort. Maintenance of the Breakwaters Project and Shoreline Project would similarly result in irretrievable loss of energy and human effort. These resources are considered irretrievably committed because their reuse for some purpose other than the project would be highly unlikely. This commitment of resources and materials has been weighed against the public purpose and need of the Proposed Actions, and would provide various social, environmental and economic benefits. None of these resources are expected to be in short supply and funding has been allocated for the construction and maintenance of this alternative. This alternative would not result in the irretrievable loss of these same resources associated with responding to shoreline erosion problems, and adverse effects due to wave action.

Irretrievable losses include loss of natural resources such as the loss of invertebrates within the 11.4-acre footprint of the breakwater segments, the ecological communities within the footprint of the Shoreline Project comprising 5.1 acres of a combination of the maritime beach and maritime dunes communities, and about 1.0 acre of successional southern hardwoods community, a few trees removed as a result of the Shoreline Project, and up to 19 trees that would be removed for the proposed Water Hub at Potential Location 1, and additional trees that would be removed to provide access to the water that complies with the Americans With Disabilities Act at Potential Location 2. These losses would be offset by the coastal plant species that would be planted within the Shoreline Project. Irretrievable losses would also include any potential effects to nesting success of breeding birds that may occur during construction of the Shoreline Project due to vegetation removal or increased vehicular and human activity during construction.

Irreversible commitment of resources would occur with the loss of approximately 0.14 acres of the 0.8-acre delineated tidal wetland that would be lost for the construction of the eco-revetment between Brighton and Manhattan Streets, and the western end of the proposed hybrid dune/revetment. This irreversible commitment of resources would be offset by the enhancement of the remaining portion of the wetland through increased tidal exchange, removal of the unpermitted sand bridge, removal of phragmites, and re-establishment of native saltmarsh plant species. The loss of approximately 3.6 acres of Waters of the U.S. and associated habitat due to the portion of the breakwaters above MHW would be another irreversible commitment of resources that would be mitigated through measures that may include the purchase of available credits from an approved mitigation bank, and restoration/enhancement of Waters of the U.S. within the Raritan Bay watershed in New York.

For the reasons presented above, the Proposed Actions would not be expected to have any adverse impacts related to irreversible and irretrievable commitment of resources. *