US Army Corps of Engineers®
New York District

# Integrated Hurricane Sandy General Reevaluation Report and Environmental Impact Statement

## Atlantic Coast of New York

## East Rockaway Inlet to Rockaway Inlet and Jamaica Bay

**Appendix D**

**Environmental Compliance**

**Attachment D8**
**Monitoring Plan**

**December 2018**

# TABLE OF CONTENTS

# East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study

## General Reevaluation Report and Environmental Impact Statement

### Physical and Biological Monitoring

# 1 SITE INSPECTION

Site Inspection will be performed for all project elements at each stage of the project (pre-construction, during construction, and post-construction). Prior to initial construction, a thorough site visit will be performed to document pre-construction baseline conditions. Site inspections will be repeated immediately after completion of construction, and seasonally (every three months) for the first year post-construction. Site visits will be performed a minimum of twice a year (March-April and Sept-October time frame) for the second through fourth years post-construction which will coincide with the duration of the first full nourishment cycle. If there are major storms impacting the project area, a post-storm inspection will also be required. Specific items to be part of the site inspection include:

**Shoreline Inspection.** Site visits will document the general condition of all shoreline reaches, and will note observable erosion or accretion of beaches and dunes. Changes to bay shoreline will be observed and documented. Inspections will document any unusual conditions (e.g., erosion escarpment, other evident erosion or accretion that deviates noticeably from design), newly observed phenomena, or incursions into the project that are either natural or man-induced. Brief memoranda of all observations including still photographs will be compiled following each site inspection, distributed to the AMT, and kept as part of the project records. Recommendations will be included for any required maintenance, or more detailed investigation.

**Structure Inspection.** All hard structures included in the project such as the groins, inlet jetties, floodwalls, and bulkheads as well as other shore protection elements will be visually inspected and documented. Structures will be inspected for both condition and functionality. Stone structures will be examined for any settlement, shifting or breakage of stone units, loss of interlocking, scour, overtopping, vandalism, etc. Structure function will be evaluated by examining the nearby beach and shoreline for evidence of impoundment, flanking, change in fill elevation, slope or width, up or downdrift impacts, etc. Recommendations will be made for further investigation or appropriate maintenance actions.

# 2 GEOSPATIAL DATA

## 2.1 Lidar

LIDAR will be acquired preconstruction, and twice each year, concurrent with semi-annual beach profile surveys during years 1- 4 (first nourishment cycle). Following the first nourishment cycle, one post-winter (late February-early March) LIDAR survey per year will be performed at the fourth year after each nourishment cycle. LIDAR will be taken at the time of low tide.

## 2.2 Aerial Photography

If LIDAR is unavailable, aerial photography may be used in place if the following requirements are met. Each over flight mission will be a single flight line with 60% overlap stereo coverage including the entire project area shoreline, including both ocean and bay. Bay shoreline will be included as separate single flight lines where the width of landforms requires more than a single flight line. Aerial coverage of inlets will include complete flood shoal and ebb shoal formations. Color film with a 9-inch x 9-inch format is recommended with a scale such that shoreline features are readily identifiable (e.g. 1 inch = 800 feet). All images shall be georeferenced to New York State Plane Lambert projection, Long Island Zone, NAD83 with units in feet. Digital scans of each 9x9 will be provided at a minimum of 300 dpi resolution.

# 3 SHORELINE CHANGE MONITORING

Mean High Water shorelines will be extracted from spring (late February-early March) LIDAR topography and plotted in overlays to show shoreline evolution over time within the project and immediately up and down drift. Plotting successive shorelines will illustrate the extent of erosion or accretion and will provide a means of measurement of the rate of loss or gain of littoral material. Comparative shoreline plots will be prepared for the entire length of the oceanfront, bay, pond, and island shorelines within the project boundaries. The sediment budget will be updated based on combined shoreline evolution and measured beach profiles.

# 4 WAVE MEASUREMENTS

A directional wave gage will be deployed in waters off of the East Rockaway barrier spit. The gage will be deployed prior to construction and will remain in place for the length of the first nourishment cycle (project years 1-4). The primary purpose of wave measurement is to assist in quantifying the driving forces behind changes to the native and constructed beach, as well as providing records of storm data. Wave gages will also provide information on wave conditions during construction, as well as for user communities such as homeowners, surfers, fishermen, environmental scientists, etc. during the instrument deployment period. Wave height data will be obtained under storm conditions over the deployment period and will be compiled to develop more accurate wave height-frequency relationships.

The wave gages should be deployed in a nearshore water depth of –25 to –35 ft. NAVD and should be cabled to shore. If cabling to shore is precluded, internal recording gages will be utilized. Data will be posted in real time on a project internet site for cabled gages and following data recovery for internal recording gages and archived to a web-accessible database. Both the bulk wave parameters,

mean currents and wave spectra should be displayed and archived in the database, along with links to water level data from nearby USGS tide gages and wind/wave data from NOAA Buoy #44025, as well as other buoys in the vicinity, if any.

Short term collection of near shore data will be utilized to confirm that borrow area dredging is not changing wave patterns or beach erosion.

# 5 BORROW AREA MONITORING

Offshore borrow areas will be monitored to document material removal, and to determine borrow area infilling rates for possible borrow area reuse. As part of construction, pre- and post- dredge hydrographic survey will be taken at the designated borrow areas. Some nearby, similar area outside the designated borrow area will be included in the survey to serve as a control (i.e. to document naturally occurring bottom changes). Computations will be done to verify quantity and location of material removed from the borrow areas during initial construction and renourishment operations. For cost estimating purposes, it is assumed that pre- and post-construction survey of the borrow areas will be included in the construction costs.

Midway through the life of the project, hydrographic surveys will be repeated to determine pattern and depth of material accumulation to date. Vibracores will be taken and subbottom seismic profiling will be performed to obtain sediment layering and grain size distribution curves in the in-filled areas. Thirty (30) cores, twenty feet in length are assumed for cost estimating purposes. The actual number and length will be determined based on bathymetry and subbottom survey results. Vibracore data analysis will include a representative number of material samples taken from each core, determined by an experienced geologist, that will be used to characterize each core and sub area within the borrow region. All lab analyses and operations on cores will be standardized as to description of sediment type and grain size distribution. All surveys will be mapped to indicate spatial changes in the borrow area both horizontally and vertically. Suitability of material taken from the cores as beachfill material will be determined. Areas dredged for initial construction or earlier renourishment operations will be examined for possible reuse in future renourishment cycles based on material suitability and available quantities.

# 6 BEACH PLACEMENT AREAS

Placed beach fill will be monitored to measure its evolution over time. The beach berm and dune will be measured to record characteristics including:

- Berm width and elevation
- Dune crest and base widths and elevations
- Dune ocean side and land side slopes
- Dune baseline

Measurement will be done to aid in determining how the construction profile evolves towards a more stable long-term profile, at what rate erosion or accretion of the advanced nourishment and/or design berm occur, and any changes that occur to the dunes including sand loss or dune growth. Beachfill monitoring will aid in identifying areas of greater than normal erosion (“hot spots”) as well as any

locations that experience sand buildup (accretion). Shoreline updrift and downdrift of the placed fill will be examined for any excessive sand losses or gains due to construction of the project or other causes. Other phenomena including but not limited to beach scarping, offshore bar changes, sand wave migration, overwash, etc. will be documented and quantified. Information gained from beach fill monitoring will be used in design of any future construction activities including renourishment.

Beachfill monitoring is also a critical component in expanding the understanding of coastal processes affecting the project area. Measurements of sand loss and/or gain will allow refinement of local and regional sediment budgets. Greater understanding of coastal processes will allow regional sediment management to be performed effectively. Ultimately, greater understanding of coastal processes will allow more accurate prediction of sediment accumulations and deficits on ocean side shorelines, within the bays, in navigation channels, and in the vicinity of inlets.

## 6.1 Beach Profiles

Beach profiles will be one of the primary measurement techniques for beach fill monitoring. Beach profiles will be surveyed before and after initial construction to establish pre-fill baseline conditions, and conditions immediately following placement. Under the monitoring program beach profiles will be surveyed twice per year throughout the first nourishment cycle (four years). One survey will capture the characteristics of the beach following winter condition, and will be surveyed in late February-early March, before endangered shorebird nesting season. The second survey will capture the characteristics of the summer beach and will be surveyed in September-October, following departure of nesting shorebirds. Following the first nourishment cycle, one post-winter (late February-early March) profile survey per year will be performed at the fourth year after each nourishment cycle. Should the design four-year cycle need adjustment, timing of profile surveys will be adjusted accordingly. Note that endangered plant species (e.g. seabeach amaranth) may also be present, and surveys should be performed in such a way as to not disturb rare plants.

A total of 82 long-range profiles will be surveyed over the entire project area at 1500 ft. spacing in the areas where fill is to be placed, plus 20 additional control profiles in non-fill areas (same as the pre-construction surveys). Profiles shall extend from a location landward of the dune and berm, along a repeatable line normal to the shoreline, and seaward out to closure depth (-31 ft NAVD) or a minimum of 2500 feet in length from the landward starting point. Profiles will be taken from established benchmarks that are documented and recoverable. Each monitoring survey will cover the same profile locations, unless observations of phenomena indicate that a change in profile locations is warranted. Repetitive surveys of profiles will be the basis for estimates of erosion and accretion volumes. Changes observed in beach profiles will help track the movement of placed fill alongshore and offshore.

## 6.2 Beach Sediment Grab Samples

Beach sediment grab samples will be collected concurrently with beach profile measurements on 30 long-range profiles (every fourth long range). Samples will be taken at a minimum of nine (9) locations per profile: the seaward and landward edges of the berm, three subaerial locations (Mean high water, mid-tide level, and mean low water), and at three locations offshore (-7 ft. NAVD or bar crest, -13 ft. NAVD, –19 ft. NAVD, and –31 NAVD). Beach sediment sampling will provide pre- and post- construction grain size distribution data that will allow comparison of native and placed

fill material. Beach sediment sampling during subsequent surveys will aid in determining sediment redistribution after placement.

Beach sediment grab samples will be taken concurrent with the pre- and post-construction profile surveys, to obtain baseline information and a measure of placed material characteristics. Sediment samples will be taken concurrent with profile surveys before each nourishment placement to aid in material compatibility analyses for each nourishment operation.

# 7 GROIN MODIFICATION

LIDAR topography and beach profiles collected during the monitoring program will be used to estimate the effects of groin extension and installation. The information to be analyzed includes initial and annual sand volumes released, updrift and downdrift shoreline impact, and dune and shoreline evolution vicinity of the project site.

# 8 NATURAL AND NATURE BASED FEATURE PLANTINGS

## 8.1 Hydrophytic Vegetation Monitoring Timing and Performance Target

Vegetation would be monitored in both the spring and fall, annually to document conditions that indicate achievement of the performance target of at least 85% coverage of planted vegetation or target hydrophytes. Sampling methods would include random circular plot sampling for woody vegetation and quadrat plot sampling for emergent vegetation.

### 8.1.1 Methods

#### 8.1.1.1 Random Circular Plot Sampling

Protocol would call for typically twenty foot radius plots; however, in areas of high planting density ten foot radius plots may be utilized. Plot locations would be chosen using a simple random sampling procedure. Data recorded at each plot for both herbaceous and woody species include; species name, percent area coverage, and dominance. For woody species, additional data included whether the species was planted or is a recruit, number of live, and number of dead stems, average height, and plant health. Plant health would be rated as “E” representing excellent health (plant is thriving and has little to no signs of herbivory), “G” representing good health (plant is healthy and may have some herbivory), “F” representing fair health (plant is moderately healthy and may have moderate herbivory), and “P” representing poor health (plant is dying and/or has heavy herbivory).

#### 8.1.1.2 Quadrat Sampling

Protocol for emergent vegetation would consist of one square meter quadrat plots along random transects lines no more than 15 meters apart. At each transect, one quadrat will be randomly placed within the low marsh along the transect line and the existing vegetation of the plot will be monitored. Quadrats will be placed on either side (randomly chosen) within one meter of the measuring tape. Once placed, the meter mark on the upper and lower edge of each quadrat will be marked permanently with stakes and recorded on the measuring tape in meters. Plant species, plant height, stem density, flowering density, and percent cover data will be collected within each plot. A narrative

description of plant health will also be collected. The exact location and side the quadrat will be placed on the transect line will be noted with a compass. This will facilitate relocating quadrats on subsequent monitoring visits. Each transect line and 1.0 m2 quadrat will be photographed facing channel-ward at the time of vegetation monitoring. All photographs must be taken at low tide, in the same spot, and at the same height.

#### 8.1.1.3 Adaptive Management

If the restored site is not showing progress to meet the requirements of 85% vegetation cover, additional native vegetation would be planted to meet this goal. If, in the unlikely event, a native, sustainable ecosystem cannot be established within 2 years at the site, changes and modifications to the project site would be initiated immediately by restoration ecologists. A new monitoring plan will be redrawn by USACE to accommodate these changes and monitor the success of the alteration.

After 2 years post-restoration, the monitoring protocol will integrate the standard of 85% vegetative cover with a broad functional assessment focusing on the three ecological parameters listed above. If the restored site fails to meet the requirements of 85% vegetation cover during the first 2 years, the additional native vegetation will be planted to meet this goal. Invasive species will be managed via physical removal and or the use of pesticides.

# 9 BIOLOGICAL MONITORING

## 9.1 Shorebird Species

Presence or absence surveys conduct construction activities near active plover nesting areas only from September 2 through March 31 to avoid the protected shorebird nesting period.

## 9.2 Surf Clams

To ensure that impacts to surf clams are minimized, the borrow areas should be surveyed prior to each dredging cycle and areas of high densities should be avoided. Copies of shellfish survey results should also be provided to us prior to any dredging in the borrow area.