Rahway River Basin, New Jersey
Coastal Storm Risk Management Feasibility Study

Appendix A.10: Mitigation, Monitoring and Adaptive Management Plan

1.0 **Introduction**

The U.S. Army Corps of Engineers (Corps), New York District (District) in partnership with the New Jersey Department of Environmental Protection (NJDEP) has developed feasibility level plans to provide coastal storm risk for the City of Rahway, the Borough of Carteret, and the Township of Woodbridge, Union and Middlesex Counties, New Jersey.

In accordance with the Council of Environmental Quality National Environmental Policy Act (NEPA) regulation, mitigation includes (a) avoiding the impact by not taking a certain action or parts of an action; (b) minimizing the impact by limiting the degree of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating or restoring the effected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; (e) compensating for the impact by replacing or providing substitute resources or environments.

This document outlines the feasibility level Mitigation, Monitoring and Adaptive Management Plan for the Rahway Tidal Coastal Storm Risk Management study, and only addresses the compensatory mitigation method. The other forms of mitigation (e.g. avoidance, minimization, reduction of impact) are addressed within the integrated Feasibility Report/Environmental Assessment.

This plan identifies and describes the mitigation, monitoring and adaptive management activities proposed and the estimated cost of the effort. The general purpose of this plan is to provide a systematic approach for improving resource management outcomes and a structured process for recommending decisions, with an emphasis on uncertainty to improve management. More specifically, the plan will:

- Establish the method for determining mitigation requirements.
- Establish the framework for effective monitoring, assessment of monitoring data and decision making for implementation of adaptive management activities in the project area.
- Provide the process for identifying adaptive management actions in the project.
- Establish decision criteria for vegetation and wildlife evaluation and modification of adaptive management activities.

1.1 Recommended Plan Description

The Recommended Plan consists of a floodwall/levee system along the right bank (from a downstream viewpoint) of the Rahway River and nonstructural measures in the 10-year floodplain that will manage coastal storm risk for the 1% event. The levee is 2,520 ft long with a 12 ft top width and one vertical to three horizontal (3:1) side slopes. The average height is approximately 10.2 ft. The flood wall is 1,968 ft long. Approximately 112 structures within the 10-yr floodplain will be treated with nonstructural measures to manage flood risk to the 100-yr storm plus one foot.

1.2 Recommended Plan Impacts and Compensatory Mitigation Requirements

The Recommended Plan will permanently impact approximately a total of 2.99 acres of wetlands and 100 linear feet equaling to 0.05 acres of open water and 0.07 acres of mudflat of a small tidal tributary to the Rahway River. The specific wetland habitat types that will be permanently impacted include 1.29 acres of low marsh, 1.13 acres of phragmites dominated high marsh, and 0.57 acres of scrub shrub wetland.

Corps guidance requires a cost effectiveness analysis and an incremental cost analysis for recommended environmental restoration and mitigation plans. As coordinated within the

HQUSACE, the use of ratios for impacts under one acre is acceptable due to potential model imprecision with small impact amounts. Therefore, only a feasibility level functional assessment and cost estimate/incremental cost analysis (CE/ICA) was performed to identify the freshwater riverine and riparian zone compensatory mitigation requirements.

Based on the CE/ICA analysis, the restoration of 1.13 acres of high marsh and 1.29 acres of low marsh was identified as the most cost effective plan. Details of the CE/ICA analysis is documented in Appendix A.9.

As the scrub shrub wetland and tidal channel impacts are under one acre, as coordinated within the Corps Headquarters, the District will follow the NJDEP criteria of requiring a 2:1 ratio to restore a total of 1.14 acres of scrub shrub wetland and 200 linear ft equaling to 0.10 acres of open water and 0.14 acres of mudflat.

The plan will be then reviewed and revised as needed during the Preconstruction Engineering Design Phase (PED) as specific design details are made available.

1.3 Mitigation Guidelines

1.3.1 Federal Mitigation Guidelines

The following documents provide distinct Corps policy and guidance pertinent to developing this monitoring and adaptive management plan:

- CECW-PC 31 August 2009 Memo: Implementation Guidance for Section 2036(a) of the Water Resources Development Act of 2007 (WRDA 07) – Mitigation for Fish and Wildlife and Wetlands Losses" – requires: 1) monitoring until successful, 2) criteria for determining ecological success, 3) a description of available lands for mitigation and the basis for the determination of availability, 4) the development of contingency plans/adaptive management plans, 5) identification of the entity responsible for monitoring; and 6) establish a consultation process with appropriate Federal and State agencies in determining the success of mitigation.
- ER 1105-2-100 dated 22 April 2000, Planning Guidance Notebook, Section C-3 e. Mitigation Planning and Recommendations
- Compensatory Mitigation for Losses of Aquatic Resources; Final Rule; Federal Register, Volume 73, No. 70, April 10, 2008.
- Water Resource Reform and Development Act (WRRDA) 2014, Section 1040 Fish and Wildlife Mitigation.
- Water Infrastructure Improvements for the Nation Act (WIIN Act) 2016, Sections 1162 Fish and Wildlife Mitigation, and 1163 Wetlands Mitigation. Implementation Guidance has not been issued by USACE HQ.
- CECW-P 02 February 2018 Memo Implementation Guidance for Section 1162 of the Water Resources Development Act of 2016 (WRDA 2016)- Fish and Wildlife Mitigation. Section 1162 authorizes the use of Preconstruction, Engineering Design funds to satisfy mitigation requirements through 3rd party arrangements or acquire lands for mitigation requirements.
- 16 November 2017 Memorandum for the Commanding General of the U.S. Army Corps of Engineers - Implementation Guidance for Section 1163 of the Water Resources Development Act of 2016 (WRDA 2916), Wetlands Mitigation. Rescinds CECW-P 06 November 2008 Memorandum Implementation Guidance for WRDA 2007 – Section 2036(c). Establishes the following criteria for the use of mitigation banks and in-lieu fee credits as a mitigation alternative: a) demonstration of an approved mitigation banking instrument; b) the mitigation bank and/or in-lieu fee program operates within the service

area of the impact; c) completion of a functional analysis of the potential credits using the approved Corps of Engineers certified habitat assessment model specific to the region; d) demonstration that the statutory (and regulatory) mitigation requirements, including monitoring or demonstrating mitigation success have been met; and e) purchase of credits prior to award of a construction contract for the project.

Corps regulations stipulate that the recommended plan must contain sufficient mitigation measures to ensure that the plan selected will have no more than negligible net adverse impacts on fish and wildlife resources, including impacts of the mitigation measures themselves. Regarding wetlands, however, the guidance contains very specific requirements that the District "ensure that adverse impacts to wetland resources are fully mitigated...as required to clearly demonstrate efforts made to meet the Administration's goal of no net loss of wetlands" as determined by a habitat functional assessment

1.3.1.1 *Federal Mitigation Hierarchy*

The Mitigation Rules' preference hierarchy for types of wetland mitigation is as follows:

- The purchase of wetland credits from an approved wetland mitigation bank
- In-Lieu fee program credits (monetary contribution)
- On-site and in-kind restoration, enhancement, establishment or preservation.
- Off-site and/or out of kind restoration, enhancement, establishment or preservation.

Under the Corps Civil Works guidance and Mitigation Rule, restoration should be the first method considered for an on-site and in-kind mitigation.

1.4 State Mitigation Guidelines

The state of New Jersey assumed responsibility for administering the 404 authority in 1993. The following documents provide New Jersey policy and guidance that are pertinent to developing this monitoring and adaptive management plan:

- New Jersey Freshwater Wetlands Protection Act (NJFWPA), N.J.S.A. 13:9B; Freshwater Protection Act Rules N.J.A.C. 7:7A: Outlines requirements for compliance with Sections 401 and 404 of Clean Water Act. As the Rahway River is a delegable waterway, the NJFWPA applies.
- N.J.A.C. Coastal Zone Management Rules: Establishes compliance and mitigation requirements related to Sections 401 and 404 of the Clean Water Act for tidal wetland and open water resources.

1.4.1.1 *State Mitigation Hierarchy*

Mitigation hierarchy for intertidal and subtidal shallows and tidal water as outlined in Subchapter 17 of the Coastal Zone Management Rules is as follows:

1. Creation of intertidal, subtidal or tidal waters on site where filling occurred;
2. Off-site creation within same estuary as site or through purchase of in-kind credits from a mitigation bank;
3. Restoration, creation, or enhancement of a wetland within same estuary as site of filling or through purchase of out-of kind credits from a mitigation bank in service area;
4. Upland preservation;
5. In-lieu fee payment via monetary contribution to the New Jersey Mitigation Council/Wetland Mitigation Fund; and
6. Land donation in accordance with Freshwater Wetland Act Rules.

Subchapter 17 of the CZM Rules requires a 1:1 ratio for the on site creation of intertidal, subtidal or tidal waters. It also requires a 1:1 mitigation ratio for the off-site creation of intertidal, subtidal or tidal waters.

Mitigation hierarchy for freshwater wetland impacts less than 1.5 acres as outlined in the Freshwater Wetlands Act Rules is as follows:

1. Purchase from a NJDEP approved wetland mitigation bank in the same Hydrologic Unit Code 11 (HUC-11) as the disturbance;
2. Purchase credits from a bank in an adjacent HUC-11 as disturbance and within same watershed management area as disturbance;
3. Purchase of credits in same watershed management area as the disturbance ;
4. On-site or off-site creation, restoration or enhancement;
5. In-lieu fee payment via monetary contribution to the Mitigation Council/Wetland Mitigation Fund;
6. Upland preservation; and
7. Land donation.

The NJDEP Freshwater Wetlands Protection Act Rules require a mitigation ratio of 2:1 for wetland restoration or creation, and a minimum mitigation ratio of a 3:1 for wetland enhancement. The purchase of wetland mitigation credits is based on a 1:1 mitigation ratio.

1.5 Roles and Responsibilities

The New York District will be responsible for the proposed mitigation construction and monitoring until the initial success criteria as defined in Sections 3.1 – 3.3 are met. Initial construction and monitoring will be funded in accordance with all applicable cost-share agreements with the non-federal sponsor.

It should be noted that the state might require mitigation beyond what has been determined to be appropriate by the functional assessment analysis due to their use of a ratio based mitigation approach. In event this occurs, the non-federal sponsor will be required to pay the for the mitigation costs that exceed what is necessary to meet the federal requirements.

The New York District will monitor (on a cost-shared basis) the completed mitigation to determine whether additional construction, invasive plant species control, and/or plantings are necessary to achieve initial success criteria. If, during the monitoring period the mitigation is failing to meet the success criteria, the District will consult with the NJDEP to determine the appropriate management or remedial actions required to achieve ecological success. The non-federal sponsor will perform any additional monitoring of the site as part of their O&M obligations once the District has determined that the mitigation goals are met.

The New York District will retain the final decision on whether or not the project's required mitigation benefits are being achieved and whether or not remedial actions are required. If additional site modifications are deemed necessary to achieve ecological success, the District will implement the appropriate measures in accordance with the adaptive management plan. The adaptive management measures will be subject to cost-sharing requirements, availability of funding, and current budgetary and other guidance.

2.0 **Habitat Mitigation Alternatives**

2.1 Wetland Mitigation Banks and In-lieu Fee Programs

Based on a review of the State of New Jersey Approved Wetlands Mitigation Banks List (dated 24 March 2017), there are currently no state approved wetland mitigation banks currently operating in either the HUC-11 area where the Recommended Plan is located or within the same Watershed Management Area. The District may reevaluate the availability of mitigation credits during the Preconstruction Engineering Design Phase when permits are acquired.

In addition, there are no privately operated In-lieu Fee Programs within the state. The state operates its own In-lieu Fee Program through its Wetland Mitigation Fund. However, as noted in Section 1.2.1.1, this option is lower in the mitigation hierarchy structure than on-site restoration, of which opportunities exist within the proposed levee project area. Therefore, as an authority responsible for administering Section 404 of the Clean Water Act, it is unlikely that the state would approve a monetary contribution.

2.2 On-Site Wetland Mitigation

A portion of the proposed levee is located within the upper boundaries of a 23 acre wetland complex within the western portion of Joseph Medwick Memorial Park. Habitat types found within the complex include approximately 15 acres of low marsh, six acres of phragmites dominated high marsh, 0.68 acres of interior wetlands dominated by phragmites, and 1.34 acres of deciduous scrub shrub wetland. The wetland complex also includes Casey's Creek, a tidally influenced tributary to the Rahway River and several other smaller, manmade and natural channels.

The six acres of phragmites dominated high marsh will be evaluated for the potential restoration of 1.29 acres of low marsh system and 1.13 acres of high marsh. In addition, there is a 0.68 acre stand of phragmites that will be evaluated for the potential restoration of deciduous scrub shrub wetland.

The District completed a 14 acre low marsh restoration project in 2007 in the southern end of Medwick Park. The District completed a 14 acre tidal marsh wetland mitigation within the Joseph Medwick Memorial Park in 2007 to compensate for wetland impacts associated with the Arthur Kill Channel deepening related to the overall New York/New Jersey Harbor deepening project. This site will be used as a reference site during development of plans in the Preconstruction Engineering Design Phase once the project is authorized and appropriated for construction.

2.2.1 Evaluation of Planned Wetlands Assessment

The District used the Evaluation of Planned Wetlands (EPW) model to assess the functional value of the wetlands impacted and determine mitigation needs.

The EPW model was approved for regional use by the Corps Ecosystem Restoration Planning Center of Expertise in July 2016. In accordance with the Corps Civil Works Planning Policy, the EPW analysis and the incremental cost analysis were used to determine the appropriate level of mitigation required. The EPW model will be further used in designing compensatory mitigation plans during the Preconstruction Engineering Design Phase and subsequently in post-construction monitoring to ensure the no net loss objective is achieved.

2.3 Preliminary Cost Estimate

A preliminary cost estimate was prepared and included costs for wetland and open water compensatory mitigation. The costs included any necessary excavation required to construct the proposed mitigation, removal of invasive plant species, herbicide applications, replanting native vegetation, installation of anti-herbivory measures such as netting and tree guards, post construction monitoring and adaptive management.

The Total Project First Cost for the mitigation is $2,717,961. The costs are presented in Account 06 "Fish and Wildlife Facilities in Appendix D Cost Engineering.

3.0 **Monitoring and Reporting**

An effective monitoring program will be required to determine if the mitigation performed is consistent with original project goals and objectives. Information collected under this monitoring plan will provide insights into the effectiveness of mitigation and adaptive management strategies and indicate where goals have been met, if actions should continue and/or whether more aggressive management is warranted. The information generated by the monitoring plan will be used by the District in consultation with the non-federal sponsor to guide decisions on operation changes that may be needed to ensure that the mitigation project meets the success criteria.

Federal wetland mitigation rules require monitoring until success criteria is met and do not establish a minimum required monitoring period. The New Jersey Freshwater Wetlands Protection Act Rules require that compensatory wetland mitigation be monitored annually for a total minimum monitoring period of five years and establish specific criteria for determining success. Therefore, for cost estimating purposes, the District is assuming annual monitoring for a minimum monitoring period of five years for each mitigation type. Monitoring is not to exceed ten years. The non-federal sponsor will be responsible for monitoring. Should success of the compensatory mitigation measures be achieved in less than five years, monitoring will either cease or be continued by the non-federal sponsor at their cost.

3.1 Evaluation of Planned Wetlands Model

The EPW will be used to follow the progress of the mitigation site in achieving success criteria and designed functional capacity. Surveys will be conducted prior to construction to form baseline conditions and obtain the necessary data to complete the EPW spreadsheet. The EPW spreadsheet will then be completed during each monitoring year following vegetation and hydrologic surveys and will be included in the monitoring reports.

3.2 Low and High Marsh Wetlands Monitoring Protocol

The District will utilize quadrat sampling to monitor the development of herbaceous vegetative cover and dominance patterns within the restored low marsh habitat. Within each 1-meter square quadrat, an estimate of the total percent cover provided by native and invasive herbaceous plants will be generated. Percent cover of individual species will also be noted. The location of each quadrat will be shown on the plans contained in the monitoring report.

The location of the sampling points will be evenly spaced across each marsh wetland area to be sampled. The same start location will be used each year of the monitoring program. The distance of the first sampling point from the starting point along the perimeter of the emergent area will be decided by using a new random number each year. Each successive sample will be at equidistant intervals along the perimeter. The distance will be determined by calculating the perimeter of each emergent wetland to be sampled from the as-built plans and divided it into a minimum of ten equal lengths. At each sampling point along the perimeter of the tidal and emergent wetland, a marker will be blindly tossed into the site to select the quadrat location. One edge of the quadrat will be aligned with a North-South axis. Each successive sample will be located using the same method at equidistant intervals along the perimeter.

A minimum of six soil pits will be dug and described to a depth of 20 inches within the mitigation area. The soil profiles will document the depth of topsoil placement as well as indicators of hydric soil. The depth to saturated soil and free water will also be recorded for each soil profile. The location of each soil pit will be documented using GPS and plotted onto a map for inclusion in the Monitoring Report.

Surveys to assess native vegetation establishment and growth will occur in the spring and fall.

The success criteria at the end of the five year monitoring period for which mitigation success is determined includes: 1) 85 percent survival and 85 percent area coverage of the mitigation plantings or target hydrophytes which are species native to the area and have habitat and hydrologic requirements similar to the vegetation identified in the mitigation planting plan. ; 2) Any trees planted are at least five feet in height; 3) The site contains hydric soils or there is evidence of oxidative reduction (redox) occurring in the soil; 4) Evidence that the site is meeting the hydrologic regime as specified in the mitigation proposal; 5) The site is less than 10 percent occupied by invasive or noxious species; and 6) The site delineates as a wetland using the 1989 Federal Manual for Identifying and Delineated Jurisdictional Wetlands.

Annual monitoring will occur during the five year monitoring period to ensure that the site is progressing toward the 5th yr criteria outlined above. For example, the 1st year monitoring could have a target criteria of less than 10 percent of the site being occupied by invasive or noxious species and 30% of areal coverage of the planted vegetation or target hydrophytes which are species native to the area and similar to ones identified in the mitigation plan. The 2nd year monitoring may increase the target areal coverage of planted vegetation or target hydrophytes to 45%, the 3rd year to 60%, and the 4th year to 75%. At any point during the annual monitoring it is determined that the site is not progressing towards the success criteria, adaptive management measures will be implemented.

3.3 Deciduous Scrub Shrub Wetland Monitoring Protocol

Densities of woody plants will be generated using stem counts within permanent 1-meter square sample plots randomly located within the scrub shrub mitigation area. Within each plot the number of shrubs will be counted, by species, and recorded onto a data form. Shrub height will also be recorded. The location of each sample plot will be shown on the plans contained in the monitoring report.

The location of each sample plot will be determined prior to conducting field work by randomly by establishing a 10- meter square grid over the area to be monitored as shown on the As-Built plans, assigning each grid block a number, and generating a series of random numbers. The random numbers corresponding to the first ten grid blocks will be used to establish the sample locations. The location of each quadrat will be shown on the plans contained in the monitoring report.

A minimum of six soil pits will be dug and described to a depth of 20 inches within the mitigation area. The soil profiles will document the depth of topsoil placement as well as indicators of hydric soil. The depth to saturated soil and free water will also be recorded for each soil profile. The location of each soil pit will be documented using GPS and plotted onto a map for inclusion in the Monitoring Report.

The success criteria at the end of the five year monitoring period for which mitigation success is the same as described in Section 3.1. Annual monitoring criteria will be similar to that described in Section 3.1 although it will include documentation demonstrating increasing in stem density and height each year. As noted in Section 3.1, if at any point during the annual monitoring it is determined that the site is not progressing towards the success criteria, adaptive management measures will be implemented.

3.4 Tidal Channel Monitoring

The tidal channel will be monitored on an annual basis for a minimum of five years. To ensure the channel is functioning as designed, a tide gauge may be installed to monitor tidal patterns and transects may be created to observe any post construction changes to channel morphology. Within the transect ranges, observations of any channel movement, depth, width, sediment deposition and erosion will be noted. Although exact annual monitoring periods will be decided in the PED phase, more than likely tide gauge monitoring will occur for one month during the high river discharge phase in the spring and one month in the summer during the lowest river discharge phase to ensure proper tidal flushing. Channel morphology monitoring would occur on a biannual basis; more than likely the same time as when data from the tide gauge is being obtained. If at any point during the annual monitoring it is determined that the channel is not functioning as designed, adaptive management measures will be implemented.

3.5 Monitoring Costs

Preliminary cost estimates for the monitoring of each mitigation type are presented in Table 1. Costs include the level of effort needed to complete the required field investigations and report preparation and coordination.

Table 1: Preliminary Mitigation Monitoring Costs

Mitigation Feature	Annual Monitoring Cost	Total Monitoring Period (5 yrs) Cost
High/Low Marsh/Tidal Creek/Mudflat	$23,070	$115,350
Scrub shrub wetland	$ 5,500	$ 27,500
Total	**$28,750**	**$142,850**

3.6 Reporting

The District will prepare an annual Monitoring Report summarizing the results of monitoring efforts conducted for each mitigation type and describing any necessary adaptive management measures.

The format of the report will contain, but not be limited to: 1) Executive Summary; 2) Requirements and goals of approved mitigation proposal have been achieved 3) Documentation includes tidal, topo for spring high tide, photos and field notes ; 4) suggested adaptive management measures and their estimated costs.

Figures contained within the report will include but not be limited to: 1) Mitigation site location delineated on USGS quad map; 2) mitigation site delineated on an aerial; 3) mitigation site delineated on tax map; and 4) preconstruction and post construction habitat type map.

Appendices will include but not be limited to: 1) permits; 2) as-built plans; 3) vegetation species table and survey data sheets; 4) photograph log and location map; and 5) soil investigation report.

As required by NJDEP, the District submit the Monitoring and Adaptive Management Report to the agency by 31 December each year the monitoring is conducted. The District will also post the report on the District webpage and will submit the report to the Corps Headquarters (Corps HQ) for inclusion to the annual mitigation report that is submitted to Congress and posted on the Corps HQ website.

4.0 **Adaptive Management**

A comprehensive adaptive management plan will be prepared, if needed, during post construction monitoring. However, the following sections describe common adaptive management measures associated with each habitat type.

4.1 Tidal Wetlands/Channel

- Replanting vegetation in areas where plantings do not meet predetermined criteria
- Enhancing survival of planted vegetation (by applying a fertilizer)
- Improving tidal flushing through modification of channel morphology and/or hydrology through additional topographical modifications.
- Suppressing encroachment by Phragmites through mechanical landscaping techniques, physical removal and/or replanting of desirable species
- Installation/maintenance of anti-herbivory measures (e.g. fencing, tree guards)

4.2 Scrub Shrub Wetlands

- Enhancing survival of planted vegetation (by applying a fertilizer)
- Suppressing encroachment by Phragmites and/or other invasive plant species through herbicide application, physical removal, landscaping techniques (e.g. weed mats) and/or replanting of desirable species
- Installation/maintenance of anti-herbivory measures (e.g. fencing, tree guards)
- Elevation modifications through additional grading/excavation to achieve desired hydrology.

4.3 Cost

The feasibility level cost estimate for adaptive management measures is $195,101.