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DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

Río Puerto Nuevo Flood Control Project

San Juan, Puerto Rico

APPENDIX C: WETLAND MITIGATION AND CONTINGENCY PLAN

U.S. Army Corps of Engineers
Caribbean District

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Wetland Mitigation and Contingency Plan

Río Puerto Nuevo Flood Control Project
San Juan, Puerto Rico

1 Background

This document outlines the Wetland Mitigation and Contingency Plan for the Preferred Alternative, Alternative 4, for the Rio Puerto Nuevo Flood Control Project (RPN Project) 2025 Supplemental Environmental Assessment (SEA). The purpose of this plan is to detail the strategy for determining the type and quantity of compensatory mitigation proposed to offset the unavoidable impacts to wetlands resulting from the implementation of the proposed project, as identified in this SEA.

In 2014 a compensatory wetland mitigation project was completed for the total RPN Project wetland impacts. The mitigation involved planting 28 acres of estuarine wetlands along the Margarita channel right-of-way within the Puerto Nuevo River. These were 28 acres of compensatory mitigation for the 20 acres of wetland areas to be impacted by the RPN Project. Initially, the RPN Project impact on wetlands (mangroves and mud flats) was estimated at 33.3 acres, which was reduced by 13.3 acres to a total of 20 acres due to changes to the RPN Project's footprint.

Changes in regulations since the project was initially approved have added restrictions for material placement on the material management areas (MMA) previously identified for the RPN Project. This SEA evaluation for a suitable MMA has concluded that the Preferred Alternative presented in the SEA, would unavoidably impact wetland resources. Specifically, 11.4 acres of estuarine wetlands to be impacted by placement of fill material. This plan details how those impacts will be mitigated to achieve no net loss of wetland function and value.

2 Objectives

The primary objective of this Wetland Mitigation and Contingency Plan is to offset the unavoidable losses to wetland habitat resulting from the proposed action for the RPN Project. Ecological model results define project impacts, and mitigation planning objectives reflect these losses. Specifically, the plan aims to compensate for impacts by restoring and enhancing estuarine wetland habitats, ensuring the continued provision of ecological functions and services within the watershed. The objectives are to restore and enhance wetland functions to a level equivalent to, or exceeding, those expected to be lost due to project construction within a 10-year timeframe.

3 Mitigation Type and Site Selection

Compensatory mitigation for unavoidable impacts to aquatic resources, in this case tidal

wetlands, can be accomplished through a series of options. For DA permit applications, a hierarchical strategy has been established for selecting the type and location of compensatory mitigation (40 CFR Part 230.93(b)). Mitigation bank credits is the preferred option with in-lieu fee programs credits as the second option preferred. Both of these help to reduce the risk of failure for the mitigation projects as they consolidate resources and involve more scientific expertise and financial planning. The third option is the permittee-responsible mitigation in which the permittee constructs a project to provide compensatory mitigation for the authorized activities. This permittee-responsible mitigation in turn is divided into three types: the watershed approach, the in-kind and on-site mitigation, and the out-of-kind and/or off-site mitigation.

Currently in Puerto Rico, mitigation banks or in-lieu fee programs for compensatory mitigation are not available. However, if they become available in the near future, they may be evaluated for consideration. For this project, the Corps is proposing in-kind and on-site mitigation, which is considered the most viable option for this project and preferred over the out-of-kind and/or off-site mitigation. The watershed approach was not considered viable as a potential compensatory mitigation strategy for the losses in aquatic resources. This was due to no outstanding resources, meaning rare, unique or high-quality aquatic resources, being identified on the project site and within the watershed.

Of the areas seen in Figure 1, some of the undeveloped sites are not available due to current or past usage such as the closed San Juan landfill, La Chuleta MMA, the 2014 RPN Project mitigation area and another mitigation area known as the Rupert Armstrong Farm, which has a conservation easement. These reduce available sites for enhancement, restoration and/or establishment.

Figure 1. Usage of undeveloped areas within the brackish waters of the RPN watershed.

Two in-site areas were identified within the RPN watershed as viable for an in-kind compensatory mitigation; the wetland area northwest of the J.F. Kennedy Expressway and southwest of the Bechara channel, and the upland and wetland area southeast of the proposed Bechara MMA (Figure 2).

The wetland area northwest of the Kennedy Expressway is approximately 22-acre of wetlands. This amount of acreage is not enough for the required compensatory mitigation by enhancement, using the Average Annual Habitat Unit (AAHU) calculating method. This was assuming that the wetland conditions and Unified Mitigation Assessment Method (UMAM) evaluation for those 22 acres are similar to the 11.4 acres of wetlands to be impacted.

The area southeast of the proposed Bechara MMA is partitioned by electric power transmission lines. The section between the Bechara channel and the power lines utility easement is about 10 acres of filled upland and about 20 acres of degraded wetlands. The section between the power lines utility easement and the San Juan landfill is about 4 acres of filled upland and about 5 acres of wetland. Due to the power lines easement, these two areas would not be connected, so they would essentially be designed, restored/enhanced and manage independently. Compensatory mitigation by restoring 4 acres and enhancing 5 acres would not suffice to offset the project's expected wetland impacts. In addition, compensatory mitigation on this section, would represent risks associated with working in close proximity to the landfill. There are also benefits with retaining this area as is, because it would continue to provide access to the electric power utility agency. Based on these considerations, the compensatory mitigation will be focused on the larger area between the Bechara channel and the power lines. Performing restoration and enhancement within the larger section between the Bechara channel and the power lines, the approximate 10-acre upland and 20-acre wetland area, would suffice to offset the project's anticipated impacts and result in no net loss of wetland resources.

Figure 2. Available acreage for wetland restoration and enhancement within the brackish waters of the RPN watershed.

Based on practicability and ecological suitability, the selected strategy is in-kind, on-site and within watershed restoration and enhancement of mangrove wetland habitat southeast of the proposed Bechara MMA. This approach maximizes the potential for successful mitigation within the affected watershed.

4 Mitigation Site Protection Instrument

The compensatory mitigation lands are located within the state/federal floodway within the Project construction limits. These lands are within the authorized project limits and are owned by the Government of Puerto Rico. The Department of Natural and Environmental Resources (DNER), as the non-Federal sponsor, will acquire the necessary lands and certify such for the Project.

5 Baseline Information

The Puerto Nuevo River basin was historically dominated by wetlands; however, by the end of the 1940s, a significant portion of wetlands had been lost (Figure 3). The brackish water conditions necessary for estuarine wetland habitat are largely restricted to areas of the project closer to San Juan Bay. Consequently, opportunities for in-kind, on-site, and in-watershed compensatory mitigation within the Puerto Nuevo River watershed are limited due to ongoing development.

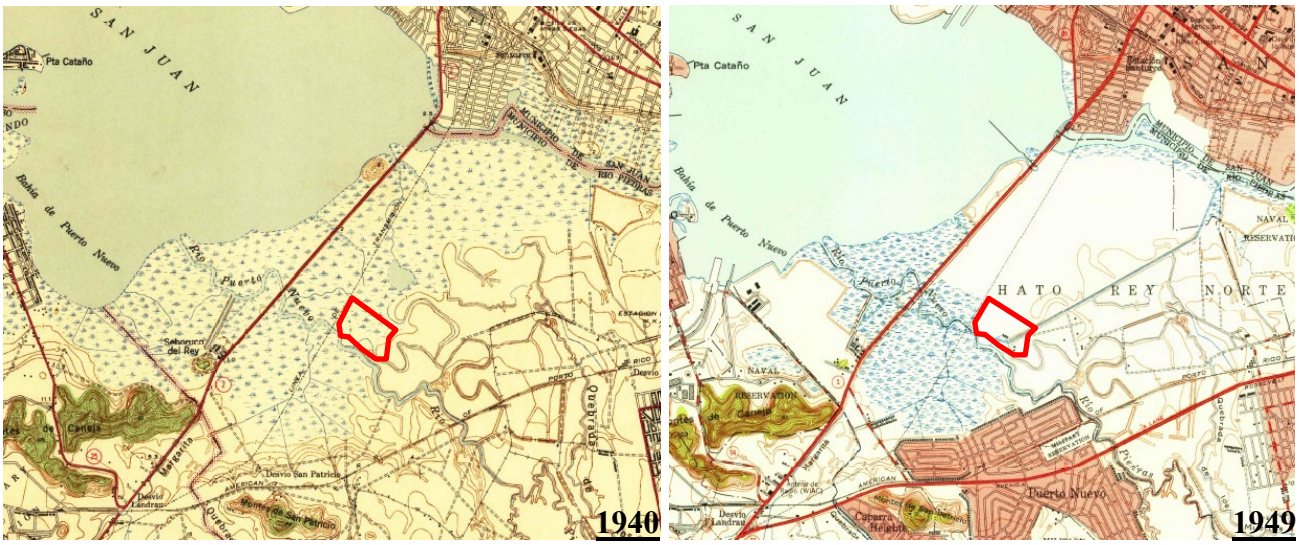

Figure 3. U.S. Geological Survey (USGS) 1940 and 1949 maps of the Puerto Nuevo area in San Juan, PR. The red polygon is the approximate location of the compensatory mitigation area.

The area identified for potential compensatory mitigation was partially filled in the mid-1900s (Figure 4), and subsequently maintained as an upland area by the Municipality of San Juan. Currently, this filled portion is vegetated by a monoculture of grass, offering limited ecological value.

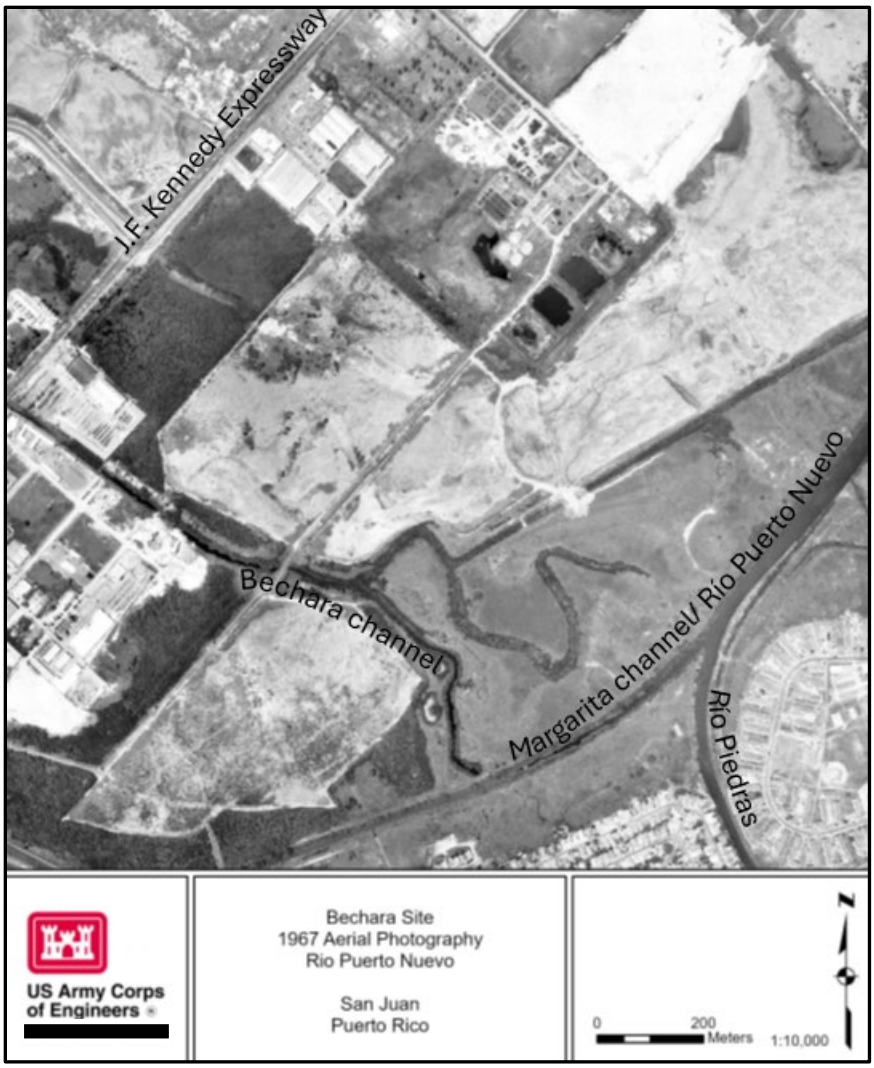

Figure 4. Filled material areas within the Bechara site (1967).

The wetland portion contains estuarine resources that provide habitat for various species and contribute to water quality. Hydrology is a critical factor influencing the ecological health of wetland systems. The wetland area proposed for compensatory mitigation exhibits disturbed hydrology, which is a likely cause of its degradation. This altered hydrology is visually represented in Figure 5, utilizing a U.S. Geological Survey (USGS) Digital Elevation Model (DEM) to highlight shallow areas within the wetland channels and therefore, inadequate hydrological connection to the Bechara channel or the Río Puerto Nuevo. Hydrological connectivity enhancement would facilitate the natural establishment of mangrove propagules and improve soil characteristics, thereby increasing organic carbon storage. Rehabilitating the hydrology would also benefit aquatic, bird, and wildlife habitats.

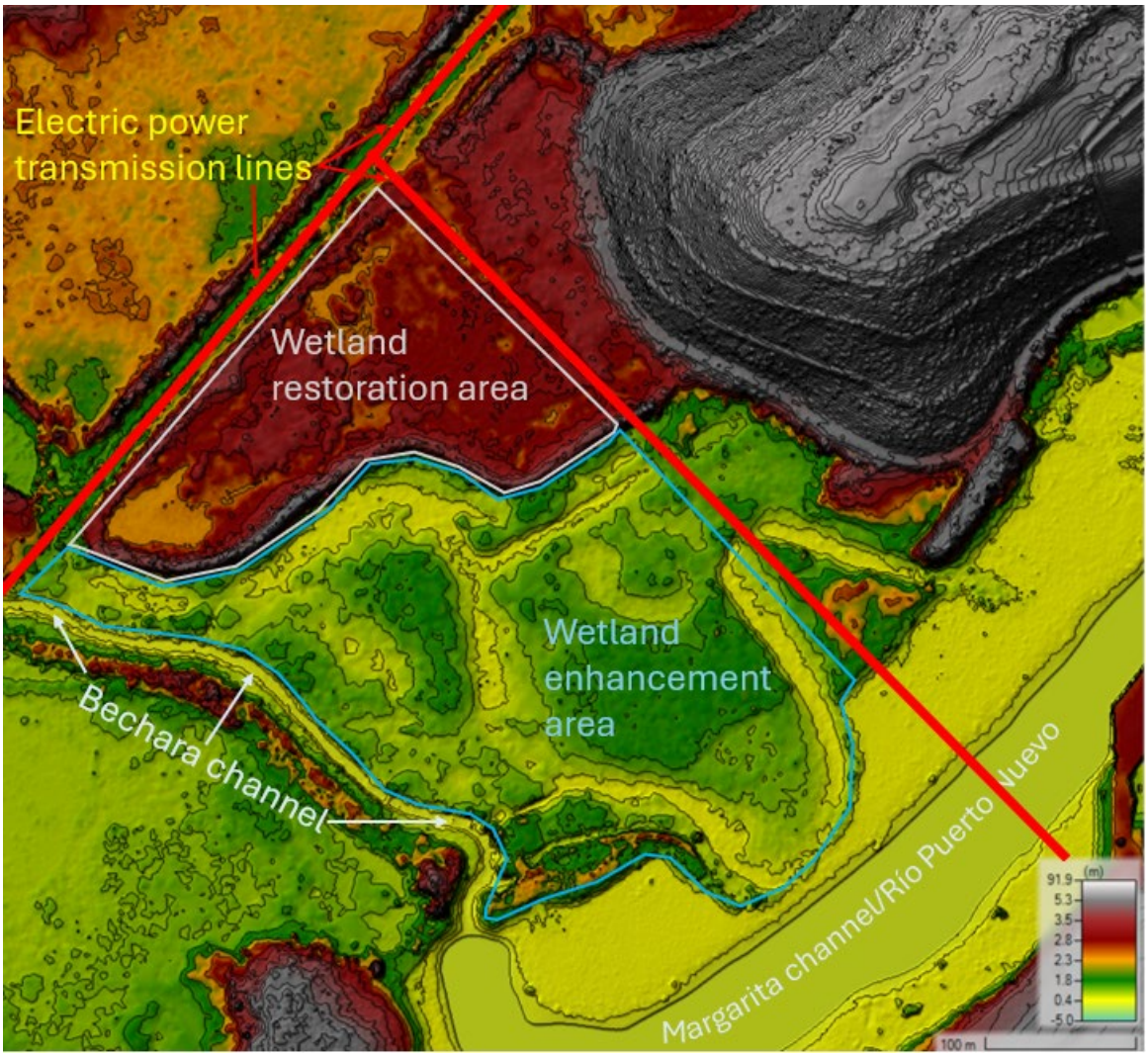

Figure 5. U.S. Geological Survey, Digital Elevation Model.

Wetland enhancement in this area would also include the removal of invasive species and the potential reestablishment of native mangrove communities. Commercial and industrial areas are particularly susceptible to invasive species due to increased human activities such as trade, transport, and shipping, which facilitate spreading through infrastructure and establishment in disturbed ecosystems. Flora surveys conducted for the proposed Bechara MMA site, located northwest of the proposed wetland mitigation area, identify a significant presence of invasive exotic species; approximately 32 percent of the plant species identified were considered invasive (Water and Air Research, Inc. 2023; Appendix D).

In summary, the proposed mitigation area represents a degraded estuarine wetland with compromised hydrology with a high potential for invasive species presence. Restoration efforts focused on hydrological rehabilitation that include invasive species removal are crucial to improving the ecological function of this area and achieving successful compensatory mitigation for unavoidable project impacts.

6 Compensatory Wetland Mitigation Functional Analysis and Mitigation Requirements

The UMAM was used to determine a Habitat Suitability Index (HSI) score for the wetlands to be impacted and restored. This method evaluates three functional assessment categories: Location and Landscape Support, Water Environment, and Community Structure (Vegetation). For each category between 8 and 12 attributes are considered to determine that category's score. Afterwards, the scores for each of the categories are added and the value is divided by 30 to yield a number between 0 and 1 (Bardi *et al*., n.d.). This number becomes the Habitat Suitability Index (HSI) on the calculations of the Habitat Units (HUs) and the AAHU for the Future without Project (FWOP), Future with Project (FWP) and the AAHUs Net Change or gains/losses.

The UMAM is well suited for evaluating a suite of impact and potential mitigation sites, including the preservation, enhancement, restoration, and creation of wetlands, as well as the evaluation and use of mitigation sites, and it provides a framework for standardized wetland assessment methodology. This method was approved for use in Puerto Rico by U.S. Army Corps of Engineers (Corps) National Ecosystem Restoration Planning Center of Expertise (ECO-PCX) on June 9, 2020.

The HUs and AAHUs were calculated using the U.S. Fish and Wildlife Service (USFWS) Habitat Evaluation Procedures (HEP), a standardized procedure for habitat evaluation developed by USFWS Division of Ecological Services (USFWS 1980) (HEP excerpt in Appendix A).

The wetland areas to be impacted, restored and enhanced were evaluated using the method and procedure mentioned above. A field site visit was done on January 22, 2025, for the UMAM evaluation of the wetlands to be impacted and restored. The evaluation combined the assessments performed by staff members of USFWS Caribbean Ecological Services Field Office, P.R. Department of Environmental and Natural Resources (DNER), and the U.S. Army Corps of Engineers, Caribbean District. For the wetland enhancement area, the USGS DEM was used to identify the lack of hydrological connectivity, and the evaluation score of the impacted wetland area was use as proxy.

The timeframe of analysis used for the AAHU calculations is 50 years. The impacted wetlands received a HSI score of 0.73 and during the 50-year timeframe of analysis, as described in Section 5.7 of the SEA, their conditions are expected to degrade further. The proposed project would unavoidably cause the loss 11.4 acres of wetlands. The HUs and AAHUs calculations based on the UMAM evaluation, 50-year timeframe and Future with and without project, will result in the loss of 6.94 AAHUs of wetlands, which would need to be offset by compensatory mitigation.

Compensatory mitigation for the losses of 6.94 AAHUs of wetland through restoration exclusively would require more than 10 acres. As mentioned previously, the area for restoration

has approximately 10 acres and the agencies' UMAM evaluations provided a HSI score of 0.13. The AAHUs calculations resulted in 6.34 AAHUs of compensatory mitigation, leaving the need for an additional 0.6 AAHUs. This is assuming that mitigation restoration success is achieved within 5 years of construction and its state will remain at or continue to improve.

Compensatory wetland mitigation through enhancement only with a HSI of 0.73, would require more than 100 acres of wetlands. The enhancement area has approximately 20 acres and enhancement of 9 acres (0.60 AAHUs) combined with the 10 acres of restoration, would be the amount required to comply with the total compensatory mitigation of 6.94 AAHUs. This calculation assumes that the mitigation success timeframe and continuing conditions will be the same to the restoration area.

Wetland area	Future with Project (FWP)/Future without Project (FWOP)	Target Year	Acres	HSI	Total HUs	Cumulative HUs	AAHUs	AAHUs Net Change (FWP-FWOP)
Impact	FWP	0	11.4	0.73	8.36			
	FWP	1-50	11.4	0.00	0.00	4.18	0.08	
	FWOP	0-50	11.4	0.73	8.36			
	FWOP	50	11.4	0.50	5.70	351.41	7.03	-6.94
Restore	FWP	0-5	10	0.13	1.30			
	FWP	5-50	10	0.80	8.00	360.00	7.67	
	FWOP	0-50	10	0.13	1.33	66.50	1.33	6.34
Enhance	FWP	0-5	9	0.73	6.57			
	FWP	5-50	9	0.80	7.2	324.00	11.15	
	FWOP	0-50	9	0.73	6.57	328.50	10.22	0.60

Table 1. Habitat Units (HUs) and Average Annual Habitat Units (AAHUs) input and results. (Note: A negative AAHUs Net Change value represents habitat losses, a positive AAHUs Net Change value represents habitat gains.)

Based on this analysis, the recommended plan for an in-kind, on-site, and in-watershed compensatory mitigation for no net loss of 6.94 AAHUs in wetlands involve:

- 10 acres of mangrove wetland habitat restoration (6.34 AAHUs) and,
- 9 acres of mangrove wetland habitat enhancement (0.60 AAHUs).

7 Mitigation Work Plan

The mitigation work will involve the following activities:

- **Site Preparation:** Clearing of grass vegetation, and identified nuisance and invasive species, grading to establish appropriate elevations, and installation of erosion control measures.
- **Planting and seeding:** Planting and seeding of native mangrove species appropriate to

the site conditions. There are three native mangrove species to the Island of Puerto Rico: Red Mangrove (*Rhizophora mangle*), which tend to grow at sea level, by or close to the water's edge,
Black Mangrove (*Avicennia germinans*), grow slightly inland, landward to the red mangrove in the intertidal zone and,
White Mangrove (*Laguncularia racemosa*) typically occurs further inland and upland than the other two species, on the landward fringe of mangrove communities.

- **Hydrological Restoration:** Re-establishment of natural hydrological regimes through modifications to drainage patterns or the removal of obstructions. Hydrological features would be created for the restoration area in order to obtain the desired conditions for the mangrove species to be planted. Restoring hydrological channel connectivity to more natural dimensions and reducing or removing barriers to water flow through mechanical means.
- **Monitoring:** Implementation of a monitoring plan to track progress towards performance standards. Monitoring mangrove health through Biological, Physicochemical and Hydraulic indicators to guide any required adaptive management strategy to have a successful compensatory mitigation.

All work will be conducted in coordination with the DNER and other relevant resource agencies.

8 Performance Standards

The ecological success criteria for mangrove wetland habitat are identified below. These criteria are based on a review of scientific literature (Rodríguez 2021, Teutli-Hernández, 2021, Bosire 2008, Krauss 2008, Lewis 2005, Twilley & Rivera-Monroy 2005,) and are designed to ensure the mitigation project meets the planning objectives. The following table outlines the key performance standards:

Criteria	**Metric**	**Target**	**Time-period**
Hydraulic Conditions	Hydroperiod	Consistent with natural tidal regime	Month 1
Physicochemical conditions	Salinity	Consistent with mangrove species tolerance	Each monitoring event
	pH	6.5-8.5	Each monitoring event
	Soil redox	-200 to +100mV	Each monitoring event
	Dissolved Oxygen (DO)	> 2.0 mg/L	Each monitoring event

Criteria	Metric	Target	Time-period
	Soil organic matter	5-15%	2 consecutive monitoring events
Biological	Mangrove cover	≥ 40% cover	2 consecutive years
	Mangrove planting survival	≥ 80% survival	Year 1
	Height	≥ 20 cm, ≥ 70 cm	Year 1, Year 3
	Stem diameter	≥ 0.4 cm, ≥ 1 cm	Year 1, Year 3
	Canopy width	≥ 0.4 m	Year 3
	Mangrove natural recruitment	≥ 10% of total stems	2 consecutive monitoring events
	Disease or Pests	≤ 5% total affected	Each monitoring event
	Invasive and nuisance plant species	≤ 5% total cover	Each monitoring event
	Estuarine wetland associated flora species	Document number of species present	Each monitoring event

9 Monitoring Requirements

Monitoring will be conducted to assess progress towards achieving the performance standards for the wetland restoration and enhancement areas.
The following schedule will be followed for the restoration and enhancement areas:

- Monitoring before enhancement actions.
- Monitoring after the enhancement and the restoration actions, time-zeros.
- Monitoring every 4 months during the first year.
- Monitoring every 6 months during the second year.
- Monitoring annually from the third year and beyond.

Monitoring will focus on the following criteria:

- Hydroperiod
- Plant structure and composition
- Regeneration

The metric's target value during the time-period specified will be used to determine the success of the compensatory mitigation and weather adaptive management actions are needed. Metrics with a time-period of a Year number can be considered accomplished once the target value is achieved on the Year number stated or later. Not achieving the target value for the Year may trigger the need of adaptive management actions until the value is achieved. Metrics with consecutive periods such as years or events can be considered accomplished once the target value is achieved for the number of consecutive periods specified. The first time the target value is achieved, it will be considered as the first time-period for the necessary number of consecutive periods specified. If the second time-period does not meet the target value, adaptive management actions may be taken and a new first time-period would be established in order to achieve the number of consecutive periods specified and determine the metric as successful. Metrics with a time-period of 'Each monitoring event' are to be used as reference in determining if adaptive management actions are necessary. These metrics along with the Hydraulic Conditions are not metrics to determined mitigation success, but to guide and facilitate a successful compensatory mitigation.

Monitoring of metrics with a time-period of a Year number or consecutive periods are considered independent from each other, so if one metric does not achieve the target value, it does not negate another metric achieving the target. Once that metric is achieved it can be determined as successful and further monitoring for that metric is not required.

Compensatory mitigation success will be determined once all metric targets with a Year number and consecutive period have been achieved. If an adaptive management action is implemented with the intent to achieve a target value, not to maintain or adjust it, the monitoring time-period will reset but will not exceed 10 years from the initial monitoring activities.

10 Long-term Management Plan

Long-term management of the mitigation site will be ensured in perpetuity under a legal Conservation Easement and through land ownership by the DNER. The DNER will be responsible for management and maintenance activities, once the Corps has determined that the compensatory mitigation was successful or after 10 years of monitoring, whichever occurs earlier.

11 Contingency Adaptive Management

Contingency adaptive management will be employed to address unforeseen challenges and optimize project performance. Shorter time intervals during the initial years of monitoring are intended to identify any necessary corrective action/s.

Potential adaptive management actions include:

Problem	Potential Adaptive Management Action

Problem	Potential Adaptive Management Action
Low mangrove survival rates	Reassess species-sites matching conditions, supplemental planting during favorable conditions, improve site preparation, reduce herbivore pressure, remove biofoul from roots and/or trunks
Low growth rates	Reassess species-sites matching conditions, improve hydrological conditions, fertilize organically if nutrient-limited
Low natural recruitment	Manually assisted recruitment, install seed traps or propagule retainers, reduce herbivore pressure
Disease, pests, and invasive and nuisance species	Targeted removal efforts, source disease-free plants/seedlings, use plant protectors, biological and/or chemical controls (if appropriate)
Hydrological alterations	Reassess elevations, adjustments to hydrological features, restoration of natural drainage

12 Financial Assurances

Standard Corps QA/QC contracting mechanisms will be in place as the contract will be part of the overall Río Puerto Nuevo Flood Control Project.

13 Compensatory Mitigation Plan Compliance

This Wetland Mitigation and Contingency Plan for the RPN Project SEA Preferred Alternative has been prepared in accordance with, and is compliant with, all applicable federal, state, and local laws, regulations, and executive orders. Specifically, this plan addresses requirements under Section 404 of the Clean Water Act, and USACE regulations (33 CFR Parts 320-330) regarding compensatory mitigation for unavoidable wetland impacts. The plan also adheres to guidance outlined in the Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Part 332 and 40 CFR Part 230). Lastly, this plan supports compliance with Executive Order 11990 (Wetland Protection) by demonstrating a commitment to avoiding and minimizing wetland impacts, and by providing for the restoration and enhancement of wetland resources to achieve no net loss of wetland function and value.

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Appendix A

Habitat Unit and Average Annual Habitat Unit Calculations
Excerpt from the USFWS Habitat Evaluation Procedures (102 ESM)