Revised Draft Integrated Hurricane Sandy General Reevaluation Report & Environmental Assessment

Passaic River Tidal Protection Area, New Jersey Coastal Storm Risk Management Feasibility Study

January 2019

New Jersey Department of Environmental Protection

U.S. Army Corps of Engineers New York District

Revised Draft Integrated Hurricane Sandy General Reevaluation Report & Environmental Assessment

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Coastal Storm Risk Management Feasibility Study

January 2019

Executive Summary (ES)

The U.S. Army Corps of Engineers (USACE) - New York District (District) prepared this Revised Draft Integrated Hurricane Sandy General Reevaluation Report and Environmental Assessment (HSGRR/EA) for the Passaic River Tidal Protection Area, New Jersey, Coastal Storm Risk Management General Reevaluation Study (Passaic Tidal). The Passaic Tidal study area is a component of the larger Passaic River Main Stem Flood Risk Management Project, which was authorized for construction by Section 101(a)(18) of the Water Resources Development Act (WRDA) of 1990 (as amended by Section 102(p) of WRDA 1992 and Section 327(i) of WRDA 2000:

> *The Secretary shall design and construct the project in accordance with the Newark Bay tunnel outlet alternative described in the Phase I General Design Memorandum of the District Engineer, dated December 1987.*

A reevaluation of the Passaic River Main Stem project was underway when Hurricane Sandy devastated the area in 2012. Due to the devastation caused by storm surge in Newark, Harrison, and Kearny, the tidal portion of the Passaic River Main Stem study area was separated from the Main Stem to be expedited in its own study. USACE New York District and North Atlantic Division outlined the scope of the current study, focusing the analysis around the authorized alignment. Authorization and funding for the Passaic Tidal project is provided by the Disaster Relief Appropriations Act of 2013, Public Law 113-2 (127 Stat. 23) enacted January 29, 2013 (Public Law 113-2).

The Passaic Tidal study area is the tidally-influenced and surge-prone areas in the lower Passaic and Hackensack Rivers, and Newark Bay, New Jersey that were included in the authorized Passaic Main Stem project. Spanning 17 miles from Newark Bay to the Dundee Dam, the Passaic Tidal study area includes the City of Newark in Essex County and the Townships of Kearny and Harrison in Hudson County. The study area encompasses 5.0 square miles in the city of Newark, 0.7 square miles in the Town of Harrison, and 2.7 square miles in the Town of Kearny.

The waterfront areas of Newark, Kearny, and Harrison were severely impacted by Hurricane Sandy (October 28-30, 2012). The storm surge inundated an extensive area of highly developed industrial, commercial, and residential neighborhoods. In Newark, 266 homes and 10,522 businesses were damaged; Harrison had 100 homes and 536 businesses damaged; and Kearny had 96 homes and 1,484 businesses damaged (O'Dea, 2013). The highly utilized urban transit systems of the Port Authority Trans-Hudson (PATH), NJ Transit, and Amtrak were also severely impacted and operate through this area and the transportation infrastructure was extensively damaged from the storm surge. There was two documented fatalities in the study area due to the storm surge.

In the Passaic River Main Stem project, the Passaic Tidal component is referred to as the Tidal Protection Area and consisted of 10.8 miles of floodwalls and 2.1 miles of levees. This 13 mile alignment was designed to reduce flood risk from hurricane and tidal surges in the Lower Passaic Valley downstream of Interstate 280 to Newark Bay up to the 0.2-percent flood. Had the authorized Tidal Project Area project been constructed, flood damages to Newark, Kearny, and

Harrison would have been reduced during Hurricane Sandy. This reach is considered to be a separable element from the Passaic River Main Stem project because it is hydraulically separated from the rest of the basin (it is located below Dundee Dam) and is incrementally justified. Accordingly, as part of the response to the Disaster Relief Appropriation Act of 2013 (Public Law 113-2, Public Law 113-2), Passaic Tidal was separated from Passaic River Main Stem to be evaluated under a separate interim General Reevaluation Study.

The purpose of the Passaic River Tidal HSGRR/EA is to determine if the previously authorized or newly developed coastal storm risk management projects are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in the Passaic River Tidal Protection Area in Newark, Harrison, and Kearny, NJ.

The National Economic Development (NED) plan for coastal storm risk management in the study area consists of 13.5 miles of floodwalls on or near the Passaic River shoreline at crest elevation 16 feet North American Vertical Datum of 1988 (NAVD88) in Newark, Harrison, and Kearny, New Jersey; the plan also includes six pump stations, 64 closure structures, and 160 drainage outfall structures. After presenting the NED Plan to the Non-Federal Sponsor, the New Jersey Department of Environmental Protection, they expressed interest to pursue analysis of a more focused plan in Newark. The resulting Locally Preferred Plan, also known as the Newark Flanking Plan, consists of seven segments of concrete floodwall totaling approximately 4,850 feet of floodwalls and levee at crest elevation 14 feet NAVD88. USACE selected the Locally Preferred Plan as the Recommended Plan.

This report presents the Recommended Plan, and its comparison to the NED Plan, for concurrent public and agency review.

The Recommended Plan consists of six floodwall segments, one levee segment, and eight gates located mostly inland in the City of Newark (ES Figure 1). The plan will reduce the risk of flooding to 15,000 people and 2,300 structures and would provide approximately $4.2 million in annualized benefits. The Recommended Plan has a benefit cost ratio of 2.5 under the historic "low" sea level change scenario, 4.4 under the Curve I "intermediate" scenario, and 9.6 under the Curve III "high" scenario. The ultimate design of the project will be determined during preconstruction engineering and design based on site-specific information.

The Recommended Plan will not negatively impact public health or safety, the quality of the human environment, or endangered, threatened, or special concern state and federal species. Approximately 0.38 acres of wetlands and watercourses will be permanently impacted. Compensatory mitigation would be conducted to offset minor adverse impacts to wetlands and watercourses. The project would also result in the permanent loss of approximately 0.09 acres of mowed lawn, 0.01 acres of maintained roadside, and 0.02 acres of urban vacant lot habitat. A Programmatic Agreement has been prepared in coordination with the New Jersey State Historic Preservation Office, the Advisory Council on Historic Preservation and other interested parties to complete investigations that evaluate effects of the recommended plans on historic properties and ensure that adverse effects are managed in accordance with Section 106 of the National Historic Preservation Act as the project moves forward.

The estimated project first cost is $39,640,000 (Fiscal Year 2019 [FY19] price levels). The non-federal costs include the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas estimated to be $4,633,750. The non-federal sponsor, NJDEP,

has indicated its support for the Recommended Plan and is willing to enter into a Project Partnership Agreement with the Federal Government for the implementation of the plan.

ES Figure 1: The Recommended Plan in Newark, New Jersey

FINDING OF NO SIGNIFICANT IMPACT

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& Environmental Assessment
Passaic River Tidal Protection Area,
New Jersey

The U.S. Army Corps of Engineers, New York District (Corps) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Hurricane Sandy General Reevaluation Report and Environmental Assessment (HSGRR/EA) dated 31 January 2019, for the Revised Draft Integrated Hurricane Sandy General Reevaluation Report & Environmental Assessment addresses if the previously authorized or newly developed coastal storm risk management projects are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in the Passaic River Tidal Protection Area opportunities and feasibility in the Newark, Harrison, and Kearny, NJ area. The final recommendation is contained in the report of the Chief of Engineers, dated **XXXX**.

The Revised Draft Integrated HSGRR/EA, incorporated herein by reference, evaluated various alternatives that would reduce the risk of storm surge flooding and associated damages in the study area in the study area. The recommended plan is the Locally Preferred Plan (LPP) and includes:

- Segment 1: 170 linear feet (LF) of floodwall with one closure gate: a 140 LF gate across the intersection of Frelinghuysen Avenue and East Peddie Street. The gate would be approximately 4.0 feet high above ground. The floodwall height above ground would range from approximately 2.6 to 4.0 feet and tie into the adjacent railroad embankment.
- Segment 2a (western part of Segment 2): 1,990 LF of floodwall located between the main rail line to Newark Penn Station and the southern tie-off of the alignment. Segment 2A ties into the railroad embankments on each end of the wall. The Segment 2A alignment accommodates the proposed PATH railway extension from Newark Penn Station to the Newark Liberty Airport transit hub. Relocation of the Poinier Street ramp to McCarter Highway is planned to accommodate the PATH extension.
- Segment 2B (eastern part of Segment 2): 1,450 LF of floodwall from the tie-in at the NJ Transit/Amtrak railroad to the southern alignment tie-in. This segment includes a gate at New Jersey Railroad (NJRR) Avenue and the southern rail line, and an additional gate north of the rail line for stormwater drainage during extreme rainfall events. Floodwall and gate height above ground along this segment would vary from 4.8 to 8.2 feet.
- Segment 3: 135 LF of levee with three 36-inch culverts, headwalls, sluice gates, and backflow prevention devices. The levee crosses an unnamed tidal drainage ditch just east of the New Jersey Turnpike. The levee height above ground of this segment will be a maximum of approximately 9.4 feet.
- Segment 4: 190 LF of floodwall across Delancy Street just east of the New Jersey Turnpike. The closure gate across Delancy Street would be approximately 70 LF and the floodwall height would range from approximately 4.1 to 4.8 feet.

- Segment 5: 240 LF of floodwall across Wilson Avenue just east of the New Jersey Turnpike. The closure gate across Wilson Avenue would be approximately 85 LF and the floodwall height would range from approximately 3.1 to 3.2 feet above ground.
- Segment 6: 330 LF of floodwall along Edison Place and NJRR Avenue, and crossing NJRR Avenue to tie into the railroad embankment. The closure gate across NJRR Avenue would be approximately 30 LF. A closure gate was proposed along Edison Place at the Edison ParkFast. The height of the floodwall would range from approximately 0.9 to 3.1 feet above ground.

In addition to a "no action" plan, three alternatives were evaluated.[1] The alternatives included the following three heights based on the authorized levee and floodwall project: 14 feet NAVD88 (height of the authorized project), about 14.8 miles long, 16 feet NAVD88 (authorized height +2 feet), about 15 miles long and, 18 feet NAVD88 (authorized height +4 feet), about 15.6 miles long. This is discussed is section 4.4 Developing the Focused Array of Alternatives of the Integrated HSGRR/EA. The 16 feet alternative was identified as the NED plan. A primary reason for selecting the LPP instead of the NED Plan is the Non-Federal Sponsor, New Jersey Department of Environmental Protection's (NJDEP) concerns about the cost associated with addressing Hazardous, Toxic, and Radioactive Waste along the NED Plan's 13.5 mile alignment. There are many known contaminated sites along the NED Plan's alignment. Non-Federal Sponsors are required by law to provide the U.S. Army Corps of Engineers with 'clean' sites before a project can be implemented; the cost associated with the cleanup required to implement the NED Plan is would be significant. There are no known contaminated sites along the LPP's 4,850 linear feet alignment and, if contaminated sites are found, the potential cleanup required would be achievable by the NJDEP.

For all alternatives, the potential effects to the following resources were evaluated:

	IN-DEPTH EVALUATION CONDUCTED	BRIEF EVALUATION DUE TO MINOR EFFECTS	RESOURCE UNAFFECTED BY ACTION
AESTHETICS	☐	☒	☐
AIR QUALITY	☐	☒	☐
AQUATIC RESOURCES/WETLANDS	☐	☒	☐
INVASIVE SPECIES	☐	☒	☐
FISH AND WILDLIFE HABITAT	☒	☒	☐
THREATENED/ENDANGERED SPECIES	☐	☐	☒
HISTORIC PROPERTIES	☐	☒	☐
OTHER CULTURAL RESOURCES	☐	☒	☒
FLOODPLAINS	☐	☒	☐
HAZARDOUS, TOXIC & RADIOACTIVE WASTE	☐	☒	☐
HYDROLOGY	☐	☐	☐

[1] 40 CFR 1505.2(b) requires a summary of the alternatives considered.

	IN-DEPTH EVALUATION CONDUCTED	BRIEF EVALUATION DUE TO MINOR EFFECTS	RESOURCE UNAFFECTED BY ACTION
LAND USE	☐	☒	☐
NAVIGATION	☐	☐	☒
NOISE LEVELS	☐	☒	☐
PUBLIC INFRASTRUCTURE	☐	☒	☐
SOCIO-ECONOMICS	☐	☒	☐
ENVIRONMENTAL JUSTICE	☐	☒	☐
SOILS	☐	☒	☐
TRIBAL TRUST RESOURCES	☐	☐	☒
WATER QUALITY	☐	☒	☐
CLIMATE CHANGE	☐	☒	☐

All practical means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the Integrated HSGRR/EA will be implemented to minimize impacts. As described in Integrated HSGRR/EA Section 6.1.3 Soils, the implementation of Best Management Practices (BMPs), including adherence to applicable requirements of the New Jersey Standards for Soil Erosion and Sediment Control (N.J.S.A. 4:24-39 et seq.) and the Stormwater Management Rules (N.J.A.C. 7:8), soil erosion during construction is expected to be minimal. Changes in soils would be localized along the floodwall alignment and within the temporary construction easement. During construction of the proposed tide gate, there would be a potential for temporary, minor impacts on water quality in the vicinity of the Project Area. These water quality impacts could include temporary increases in turbidity and suspended solids, decreased dissolved oxygen, and increased biological oxygen demand. These temporary impacts would be limited to the construction phase and would be mitigated through implementation of BMPs. Additionally, impairments to water quality during construction due to increased suspended sediments would be minimized to the fullest extent possible by strict implementation of a sediment and erosion control plan, as well as meeting all requirements of state and local permits necessary for construction as described in the Integrated HSGRR/EA Section 6.4.2 Water Quality.

Impacts to Minish Waterfront Park would last approximately 6 months during the construction of Floodwall Section 8. Noise levels within the park would exceed local and state criteria, ranging from 70 to 90 decibels. Construction would be limited to weekdays with no evening or weekend work, where possible, to minimize impacts to park users as described in the Integrated HSGRR/EA Section 6.6.1 Environmental Justice Summary.

Potential minor indirect impacts during construction to finfish and benthic resources include changes in water quality due to sediment resuspension in the water column and adjacent wetlands. However, suspended sediment would settle quickly out of the water column thus causing only temporary minor impacts to water quality. This impact would be minimized by the use of BMPs such as erosion and sediment control measures during construction activities Section 6.9.2 Finfish and 6.9.3 Benthic Resources.

The Recommended Plan will result in unavoidable adverse impacts to 0.08 acres of temporary and 0.18 acres of permanent impacts to wetlands. To mitigate for these unavoidable adverse impacts, the U.S. Army Corps of Engineers will mitigate through a NJDEP approved Wetland Bank.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers determined that the recommended plan will have no effect on federally listed species or their designated critical habitat.

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that historic properties may be adversely affected by the recommended plan. The Corps and the New Jersey State Historic Preservation Office entered into a Programmatic Agreement (PA), dated XXXX**.** All terms and conditions resulting from the agreement shall be implemented in order to minimize adverse impacts to historic properties.[2]

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix B of the Integrated HSGRR/EA.

A water quality certification pursuant to section 401 of the Clean Water Act will obtained from the NJDEP – Division of Land Use Regulation prior to construction. In a letter dated **XXXX**, the state of New Jersey stated that the recommended plan appears to meet the requirements of the water quality certification, pending confirmation based on information to be developed during the pre-construction engineering and design phase. All conditions of the water quality certification will be implemented in order to minimize adverse impacts to water quality.

A determination of consistency with the state of New Jersey Coastal Zone Management program was provided to NJDEP – Division of Land Use Regulation on 6 October 2017 pursuant to Section 307 of the Coastal Zone Management Act of 1972. Due to the lack of response of New Jersey within six months of the Corps' submittal, consistency is presumed under 16 U.S.C. 1456(c)(3)(A).

Public review of the draft HSGRR/EA was completed on 27 October 2017. All comments submitted during the public comment period were responded to in the Revised Draft Integrated HSGRR/EA. A 30-day state and agency review of the Final Integrated HSGRR/EA was completed on **XXXX**.

Technical, environmental, economic, and cost effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives.[3] Based on these report, the reviews by other Federal, State and local Agencies, Tribes, input of the public, and the review by

[2] Required by 36 CFR 800.6(c)(3) meeting the terms and conditions of the MOA.
[3] 40 CFR 1505.2(B) requires identification of relevant factors including any essential to national policy which were balanced in the agency decision.

my staff, it is my determination that the recommended plan would not significantly affect the human environment; therefore, preparation of an Environmental Impact Statement is not required.[4]

_____ _____

Date

Thomas D. Asbery
Colonel, U.S. Army, Corps of Engineers
District Commander

[4] 40 CFR 1508.13 stated the FONSI shall include an EA or a summary of it and shall note any other environmental documents related to it. If an assessment is included, the FONSI need not repeat any of the discussion in the assessment but may incorporate by reference.

Pertinent Data (PD)

Recommended Plan Features*

The Recommended Plan is the Newark Flanking Plan and includes six separate floodwall segments and one levee segment with an approximate total length of 4,850 linear feet at 14 feet North American Vertical Datum of 1988 (NAVD88). It includes seven road closure structures, one railroad closures structure, and an interior drainage system along low lying areas. This plan reduces the risk of coastal storm damage for a large portion of Newark's Ironbound residential area. The project features would reduce damages from hurricanes and storms to an approximate still water elevation of 14 feet NAVD88.

Project first cost (Fiscal Year 2019): $39,640,000
Average annual cost[5]: $1,656,000
Average annual benefits: $4,160,000
Average annual net benefits: $2,504,000
Benefit Cost Ratio (BCR)[6]: 2.5

Construction:
The project assumes a start date of November 2021 with an overall duration of one year with a completion date at the end of 2022. Construction years are assumed for the economics evaluation in this study, but are subject to report approval, acquisition of necessary real estate, project approval and funding requirements, including federal and non-federal funds.

Real Estate Requirements: U.S. Army Corps of Engineers projects require the Non-Federal Sponsor, The New Jersey Department of Environmental Protection (NJDEP), to provide lands, easements, rights-of-way and relocations, and disposal/borrow areas (LERRDs) for a project. The Recommended Plan will require the Non-Federal Sponsor to acquire temporary and permanent easements, currently estimated at $4,633,750.

Project Cost

The project cost estimate is broken out by cost component in Table PD 1. This includes preconstruction engineering and design, construction management, interest during construction (IDC) and operation and maintenance (OMRR&R) (contingencies are included).

Project First Cost is the constant dollar cost of the Recommended Plan at current price level and is the cost used in the authorizing document for a project. Total Project Cost is the constant dollar cost fully funded with escalation to the estimated midpoint of construction. This is the "cost of money" because costs are expected to escalate over time due to various factors. The Total Project Cost is the cost estimate used in Project Partnership Agreements for implementation of design and construction of a project (Table PD 3). The Total Project Cost is also the cost estimate provided to

[5] Includes Interest During Construction and Operation, Maintenance, Repair, Replacement, and Rehabilitation costs. Detailed project estimate using a combination of MII's 2016 English Cost Book, 2016 Region 1 equipment book, estimator-created site specific cost items, local historic quotations, quotations from local material suppliers, and area-specific labor library.

[6] The Recommended Plan has a BCR of 2.5 under the historic "low" sea level change scenario. Under the Curve I "intermediate" and Curve III "high" scenarios, the BCR increases to 4.4 and 9.6, respectively.

the non-federal Sponsor, NJDEP, for their use in financial planning as it provides information regarding the overall non-federal cost sharing obligation.

Table PD 1: Recommended Plan Refined First Cost Estimate

DESCRIPTION	TOTAL
Lands and Damages	$3,625,000
Relocations	$1,429,000
Fish and Wildlife	$650,000
Levees and Floodwalls	$21,696,000
Floodway Control & Diversion	$3,428,000
Cultural Resources	$2,078,000
Engineering & Design	$4,391,000
Construction Management	$2,343,000
FIRST COST	**$39,640,000**

Economic Analysis

The costs and benefits of the Recommended Plan are provided in Table PD 2. Projects costs are annualized over a 50-year period of analysis at the Fiscal Year 2019 (FY19) federal interest rate for evaluation water resource projects (2.875%). Dividing the annual benefit of the project by the annual cost estimate results in an estimated Benefit Cost Ratio of 2.5 under the historic "low" sea level change scenario.

Table PD 2: Refined Recommended Plan, Annual Benefit and Cost Summary
(Price Level: FY19; Discount Rate: 2.875%)

ITEM	COST
Project First Costs	$39,640,000
Interest During Construction	$520,000
Total Investment Costs	$40,160,000
Annualized Investment Costs	$1,524,000
Annual Operations and Maintenance Costs	$132,000
Total Average Annual Costs (with IDC and OMRR&R)	$1,656,000
Average Annual Without-Project Damages	$97,742,000
Average Annual With-Project Damages	$93,582,000
Annual Benefits	$4,160,000
Net Benefits	$2,504,000
Benefit Cost Ratio	2.5

Federal and Non-Federal Project Cost Sharing

Once a final cost estimate is developed for the plan carried forward for feasibility-level design, a cost-sharing apportionment table will be developed. In accordance with the cost share provisions in Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2213), project design and implementation are cost shared 65% federal and 35% non-federal. The non-Federal sponsor is also responsible for providing all LERRDs as part of their

portion of the cost-share. Using the Total Project Cost, the non-federal portion is $15,307,000 (Table PD 3).

Table PD 3: Cost Apportionment

FEDERAL PROJECT COST (65%)	**$28,427,000**
NON-FEDERAL PROJECT COST (35%)	**$15,307,000**
LERR	
LER	$3,885,000
RELOCATIONS	$1,577,000
CASH BALANCE	$9,695,000
MONITORING	$150,000
TOTAL PROJECT COST* (100%)	**$43,734,000**

*NOTE: Constant dollar cost fully funded with escalation to the estimated midpoint of construction

TABLE OF CONTENTS

**Sections of text marked with an asterisk are applicable to the satisfaction of National Environmental Policy Act (NEPA) requirements.*

Contents

List of Appendices

List of Tables

List of Figures

List of Acronyms

ACRONYM	TITLE
AADT	Average Annual Daily Traffic
APE	Area of Potential Effect
BCR	Benefit Cost Ratio
BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSO	Combined Sewer Overflows
CWCCIS	Civil Works Construction Cost Index System
CZM	Coastal Zone Management
dBA	A-weighted decibels
District	United States Army Corps of Engineers, New York District
EA	Environmental Assessment
EFH	Essential Fish Habitat
ER	Engineering Regulation
E.O.	Executive Order
°F	Degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GDM	General Design Memorandum
HEC-FDA	Hydrologic Engineering Center's Flood Damage Analysis
HD	Historic District
HSGRR/EA	Hurricane Sandy General Reevaluation Report and Environmental Assessment
HTRW	Hazardous, Toxic, and Radioactive Waste
IPaC	Information for Planning and Conservation
LERRD	Lands, Easements, Rights of Way, Relocations and Disposal/Borrow Areas
LVRR	Lehigh Valley Railroad
MHW	Mean High Water
NACCS	North Atlantic Coast Comprehensive Study
NAE	No Adverse Effect
NAVD	North Atlantic Vertical Datum (1988)
NE	No Effect
NED	National Economic Development
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum (1929)
NHPA	National Historic Preservation Act of 1966, as amended
N.J.A.C	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJHPO	New Jersey Historic Preservation Office
N.J.S.A.	New Jersey Statute Annotated
NJTR	New Jersey Transit Rail Operations
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places

NWI	National Wetlands Inventory
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
OSE	Other Social Effects
PA	Programmatic Agreement
PATH	Port Authority Trans-Hudson
PCB	Polychlorinated Biphenyls
PL	Price Level
PPA	Project Partnership Agreement
PRR	Pennsylvania Railroad
PVSC	Passaic Valley Sewerage Commission
RBD	Rebuild by Design
RED	Regional Economic Development
SLC	Sea Level Change
SWO	Stormwater Overflows
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Chapter 1: Introduction

1.1 Integrated Hurricane Sandy General Reevaluation Report and Environmental Assessment

The U.S. Army Corps of Engineers (USACE), New York District (District), with the support of the Non-Federal Sponsor, the New Jersey Department of Environmental Protection (NJDEP), prepared this Revised Draft Integrated Hurricane Sandy General Reevaluation Report and Environmental Assessment (HSGRR/EA) for the Passaic River Tidal Protection Area, New Jersey, Coastal Storm Risk Management General Reevaluation Study (Passaic Tidal). The Passaic River Tidal Protection Area is located in Newark, Harrison, and Kearny counties. This study area is a component of the larger Passaic River Main Stem Flood Risk Management Project, which was authorized for construction by Section 101(a)(18) of the Water Resources Development Act (WRDA) of 1990, as amended by Section 102(p) of WRDA 1992 and Section 327(i) of WRDA 2000.

The purpose of the Passaic Tidal HSGRR/EA is to determine if the previously authorized or newly developed coastal storm risk management projects are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in the Passaic River Tidal Protection Area in Newark, Harrison, and Kearny, NJ. USACE New York District and USACE North Atlantic Division outlined the scope of the current study, focusing the analysis around the authorized alignment. This report presents the Recommended Plan for managing coastal storm risk within the tidal portion of the Passaic River. Over the course of the review process, the New York District will respond to input from the NJDEP, as well as local governments, resource agencies, and the public.

Water and related land resources projects are formulated to alleviate problems and leverage opportunities in ways that contribute to this objective. The federal objective of water and related land resources project planning is to contribute to national economic development (NED) consistent with managing and reducing risk to the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements (Principles and Guidelines, 1983). The NED Plan for the study area presented in this report is similar to the project authorized for construction and consists of 13.5 miles of floodwalls on or near the Passaic River shoreline at elevation 16 feet NAVD88 in Newark, Harrison, and Kearny, New Jersey. After careful consideration of the NED Plan, the Non-Federal Sponsor, the New Jersey Department of Environmental Protection, expressed interest in pursuing analysis of a more focused plan in Newark. The resulting Locally Preferred Plan, also known as the Newark Flanking Plan, consists of seven inland floodwall segments totaling approximately 4,850 feet of floodwalls at elevation 14 feet NAVD88. USACE presents the Locally Preferred Plan as the Recommended Plan.

This report (1) summarizes the problems, needs, and opportunities for coastal storm risk management in the Passaic River Tidal Protection Area, (2) presents and discusses the results of the plan formulation for coastal storm risk management, (3) identifies specific details of the Recommended Plan, including inherent risks, and (4) will be used to assist in determining the extent of the federal interest and local support for the plan.

1.2 National Environmental Policy Act Requirements*

This Revised Draft HSGRR/EA was prepared pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's Guidance Regarding NEPA Regulations, and the USACE's Procedures for Implementing NEPA (Engineering Regulation [ER]-200-2-2). NEPA requires the USACE to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. Federal regulations to implement NEPA are found in Title 40 Code of Federal Regulations (CFR) Parts 1500-1508. The intent of NEPA is to ensure that information is made available to public officials and citizens about major actions taken by Federal Agencies, and to identify and consider public concerns and issues. "Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork" (40 CFR §1506.4). This report integrates discussions into the feasibility report that normally would appear in a Final Environmental Assessment in the feasibility report. The purpose of an EA is to aid a Federal Agency's compliance with NEPA.

This Revised Draft Integrated Hurricane Sandy General Reevaluation Report and Environmental Assessment must discuss:

- the need for the proposed action;
- the proposed action and alternatives;
- the probable environmental impacts of the proposed action and alternatives;
- and the agencies and persons consulted during preparation of the HSGRR/EA.

This integrated report is consistent with NEPA statutory requirements. The report reflects an integrated planning process, which avoids, minimizes, and mitigates adverse project effects associated with coastal storm risk management actions. The probable environmental impacts of the alternatives considered for the Passaic River Main Stem project are presented in the NEPA documents associated with the 1987 and 1995 General Design Memorandums (GDMs). Sections of text marked with an asterisk are applicable to the satisfaction of NEPA requirements.

1.3 Study Purpose and Scope*

The purpose of the Passaic Tidal HSGRR/EA is to determine if the previously authorized or newly developed coastal storm risk management projects are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in the Passaic River Tidal Protection Area in Newark, Harrison, and Kearny. A 1987 GDM and 1995 GDM for the Passaic River Main Stem project presented preliminary designs of the authorized alignment. In the 20-plus years since the 1995 GDM was drafted, higher frequency storm events are affecting the area and engineering standards and criteria have been updated based on lessons learned from major storm events. Changes in study area conditions, post-hurricane resilience work, updated economic forecasting, and new engineering analyses have informed this study. USACE New York District and USACE North Atlantic Division outlined the scope of the current study in 2014, focusing the study on the evaluation of the authorized alignment at three heights, using the authorized levee and floodwall height, as detailed 1995 GDM, as one of the heights. The HSGRR/EA will be an interim response to the study authority as the Passaic River Main Stem General Reevaluation Study is ongoing.

This Revised Draft report presents the Recommended Plan that was refined and optimized based off of comments received during the concurrent public and agency review of the draft report released in September 2017.

1.4 Need for Action*

The City of Newark experiences surge-related flood damages that have devastating effects to life and property during coastal storm events. A coastal storm risk management project is needed to manage the risk to life and property in the City of Newark that are at risk from coastal storm surge damage. Some homeowners have implemented individual solutions but the area continues to experience storm damage due to inundation due to storm surge. In the 20-plus years since the 1995 GDM was drafted, higher frequency storm events are affecting the area and engineering standards and criteria have been updated based on lessons learned from major storm events. Changes in study area conditions, post-hurricane resiliency work, updated economic forecasting, and new engineering, hydrologic, and hydraulic analyses will inform the team's analysis.

This HSGRR/EA provides a recommendation for federal participation in a coastal storm risk management project that would be economically justified and environmentally acceptable.

1.5 Study Authority

The Passaic Tidal area is part of the larger Passaic River Main Stem project, which was authorized for construction by Section 101(a)(18) of the Water Resources Development Act (WRDA) of 1990, as amended by Section 102(p) of WRDA 1992 and Section 327(i) of WRDA 2000. The original authorization text is presented below; additional language is found in Appendix D (Pertinent Correspondence, Consultation, and Coordination):

Section 101(a)(18) WRDA 1990:

> *(i) In general. --The project for flood control, Passaic River Main Stem, New Jersey and New York: Report of the Chief of Engineers, dated February 3, 1989, except that the main diversion tunnel shall be extended to include the outlet to Newark Bay, New Jersey, at a total cost of $1,200,000,000, with an estimated first federal cost of $890,000,000 and an estimated first non–federal cost of $310,000,000.*
>
> *(ii) Design and construction – The Secretary shall design and construct the project in accordance with the Newark Bay tunnel outlet alternative described in the Phase I General Design Memorandum of the District Engineer, dated December 1987. The main diversion tunnel shall be extended approximately 6 1/2 miles to outlet in Newark Bay, the 9 levee systems in Bergen, East Essex, and Passaic Counties which were associated with the eliminated Third River tunnel outlet shall be excluded from the project, and no dikes or levees shall be constructed along the Passaic River in Bergen County in connection with the project.*

Engineering design work for the overall Passaic River Main Stem project (Figure 1) was underway until the sponsor withdrew support in 1995 due to local objections over the tunnel feature and work was halted. In February 2010, the New Jersey Station Passaic River Basin Flood Advisory Commission was formed and they had a renewed interest in the project. The commission recommended reevaluation of the authorized Passaic River Main Stem project in a

letter sent March 2011 to USACE. A Feasibility Cost Sharing Agreement was executed in June 2012 between USACE and NJDEP for the Passaic River Main Stem study.

The reevaluation study was underway when Hurricane Sandy severely impacted the study area in October 2012. The storm surge from Hurricane Sandy impacted the southern portion of the Passaic River Main Stem project area. In response to the destruction laid forth by Hurricane Sandy, the U.S. Congress passed and the President signed into law Public Law 113-2, Hurricane Sandy Disaster Relief Appropriations Act. The legislation provides supplemental appropriations to address damages caused by Hurricane Sandy and to manage future flood risk in ways that will support the long-term sustainability and resilience of the coastal ecosystem and communities, as well as reduce the economic costs and risks associated with large-scale flood and storm events.

The tidal portion of the Passaic River Main Stem project area was included in the Second Interim Report to Congress, listing it as eligible to be managed as its own separate project. The Passaic Tidal Protection Area reevaluation study is 100% federally funded for completion via Public Law 113-2. Public Law 113-2 reads:

> *… Secretary of the Army shall conduct, at full federal expense, a comprehensive study to address the flood risks of vulnerable coastal populations in areas impacted by Hurricane Sandy within the boundaries of the North Atlantic Division of the United States Army Corps of Engineers: Provided further, That an interim report with an assessment of authorized Corps projects for reducing flooding and storm risks in the affected area that have been constructed or are under construction, including construction cost estimates, shall be submitted to the Committees on Appropriations of the House of Representatives and the Senate not later than March 1, 2013: Provided further, That an interim report identifying any previously authorized but unconstructed Corps project and any project under study by the Corps for reducing flooding and storm damage risks in the affected area, including updated construction cost estimates, that are, or would be, consistent with the comprehensive study shall be submitted to the appropriate congressional committees not later than May 1, 2013…*

Projects authorized by this Act are subject to USACE Headquarters and North Atlantic Division Hurricane Sandy-related guidance; the full text of Public Law 113-2, Title II can be found in Appendix D (Pertinent Correspondence, Consultation, and Coordination). To date, the following guidance has been issued:

- Draft Integrated Feasibility Report and Environmental Assessment page 4 July 2016
- 17 December 2013 Engineering and Construction Bulletin 2013-33, "Application of Flood Risk Reduction Standard for Sandy Rebuilding Projects."
- 9 December 2013 CECW-ZA guidance, "Disaster Relief Appropriations Act of 2013, Policy Guidance Memorandum Construction Account."
- 7 July 2013 CECW-ZA guidance, "Disaster Relief Appropriations Act of 2013, Policy Guidance Memorandum Expenses and Investigations Accounts."

The study will be consistent with and use the technical analysis done under the purview of the North Atlantic Coast Comprehensive Study (USACE 2015).

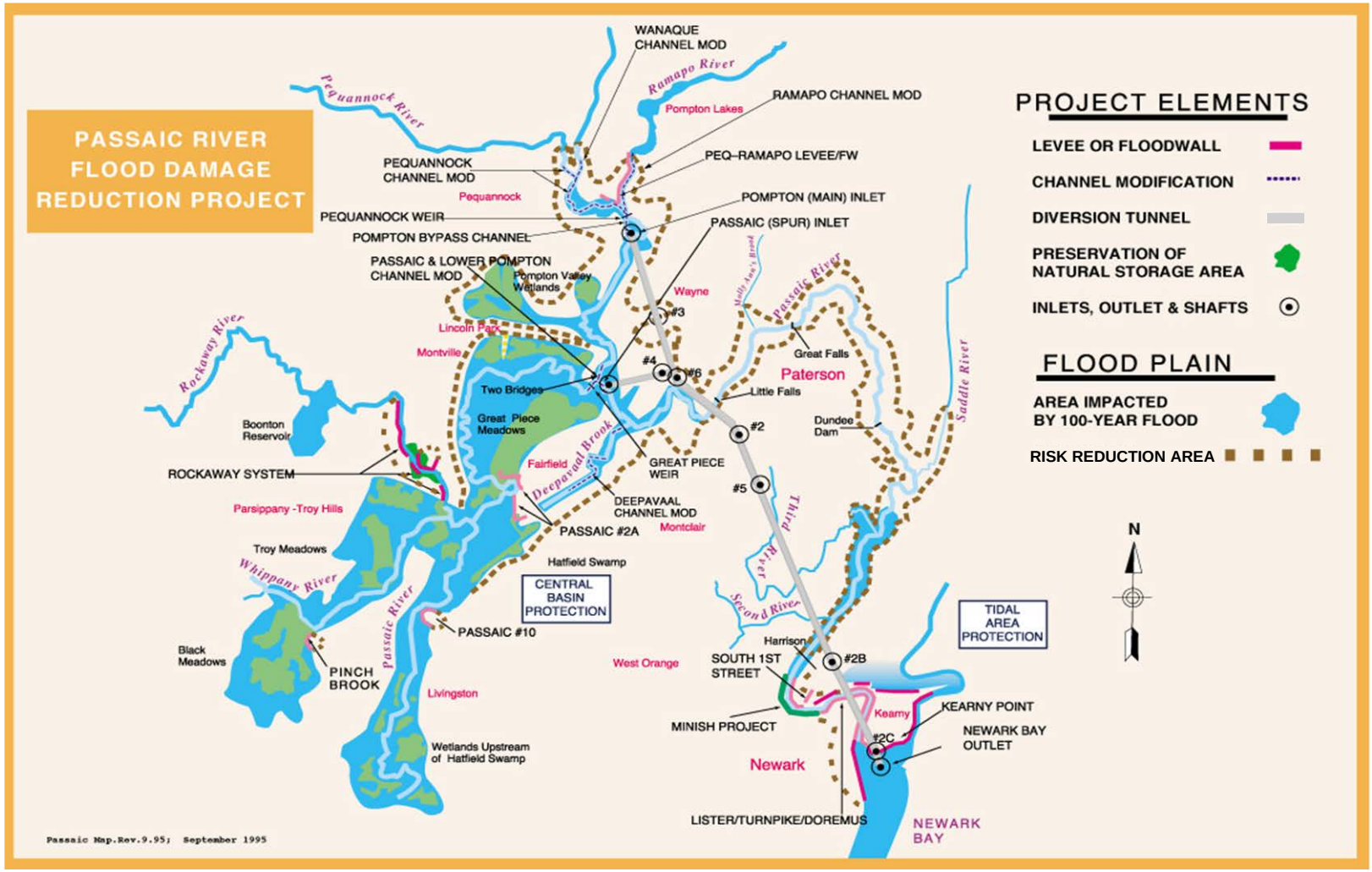

Figure 1: Passaic River Main Stem Authorized Project, Modified by the 1995 General Design Memorandum

1.6 Non-Federal Sponsor

The New Jersey Department of Environmental Protection is the Non-Federal Sponsor. This reevaluation study is 100% federally funded under Public Law 113-2. A Feasibility Cost Sharing Agreement for Passaic Tidal was executed between USACE and NJDEP on October 28, 2014.

1.7 Prior Studies, Reports, and Existing Water Projects

A study of water resource problems in the Passaic River watershed was first authorized by the Flood Control Act of 1936. Reports recommending plans of action were issued in 1939, 1948, 1962, 1969, 1972, and 1973. In October 1976, Congress authorized the Passaic River Basin Study in WRDA 1976. After a series of investigations, a GDM was finalized in 1987. It recommended a plan that included a tunnel diversion, channel modification of the Passaic River, and tidal levees/floodwalls to a height of 13.8 feet NAVD88 in Newark, Kearny, and Harrison, New Jersey (Figure 1).

Construction for the Passaic Main Stem Project, described in the 1987 GDM, was authorized by WRDA 1990. A 1995 GDM recommended modifications to the lengths of the authorized project due to changes in study area conditions. The 1995 GDM's modifications recommended a 13 mile alignment consisting of 10.8 miles of floodwalls and 2.1 miles of levees in Harrison, Kearny, and Newark. The 1995 GDM proposed alignment is presented as colored lines in Figure 2. Soon after the completion of the 1995 GDM, the State of New Jersey withdrew support for the overall project due to public objections over the tunnel feature.

Following the execution of the Feasibility Cost Sharing Agreement for the Passaic River Main Stem Reevaluation Study in 2012, USACE produced a Preliminary Alternative Reevaluation Report (2013), upon which the current interim HSGRR/EA draws upon for characterization of existing conditions and preliminary alternatives evaluation.

Additional information on the study area was obtained from the North Atlantic Coast Comprehensive Study (NACCS). USACE completed the NACCS to address coastal storm and flood risk to vulnerable populations, property, ecosystems, and infrastructure affected by Hurricane Sandy in the United States' North Atlantic region. The report is designed to help local communities better understand changing flood risks associated with climate change and to provide tools to help those communities better prepare for future flood risks (USACE 2015).

Prior USACE reports, federal water resource projects, and studies relating to the study area are listed below.

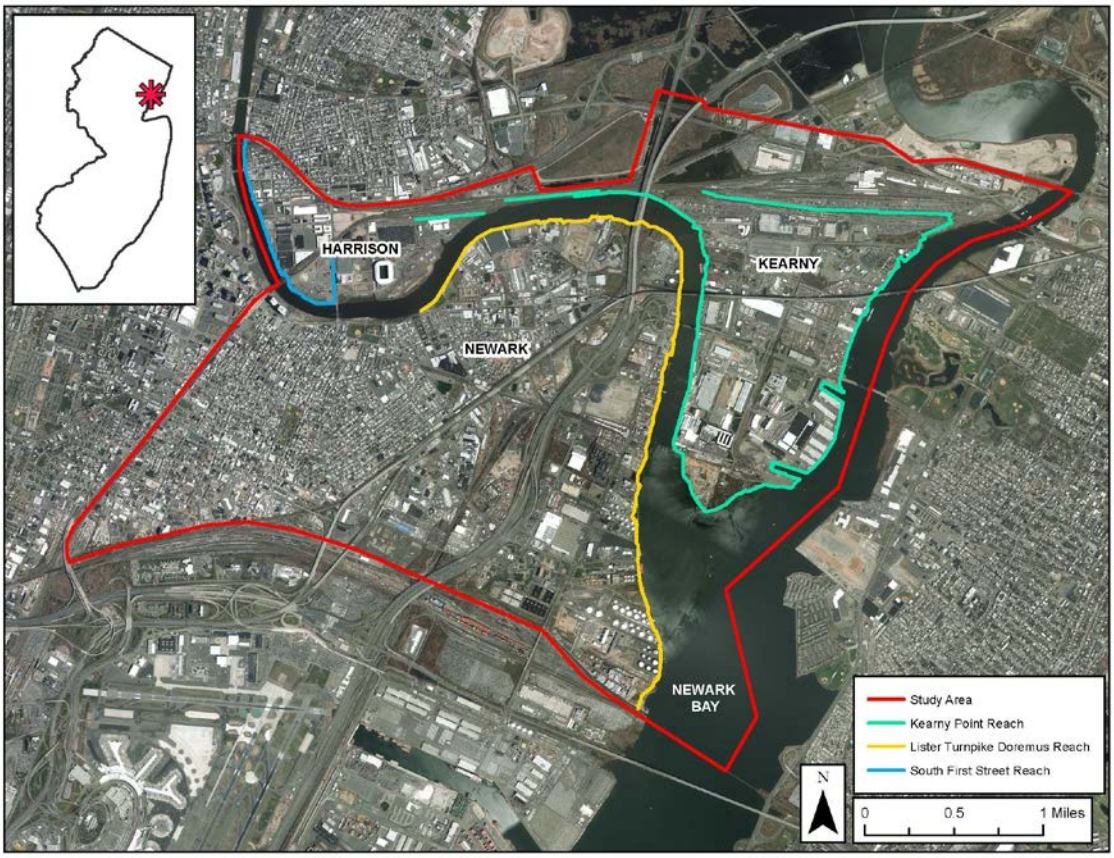

Figure 2: Authorized project alignment at a height of 14 feet NAVD88 in Passaic Tidal portion of the Main Stem Project

Prior USACE Reports

- Flood Frequency Studies, 1939, 1948, 1962, 1972, 1973, 1983
- General Design Memorandum Phase I, dated December 1987
    - Environmental Impact Statement
- General Design Memorandum Phase II, dated September 1995
    - Environmental Impact Statement
- South First Street Wall Survey Control Report, dated August 2005
- Lower Passaic Hudson Raritan Estuary Study, February 2017
- Draft Passaic Main Stem Phase I Preliminary Reevaluation Report, 2013

Existing Federal Water Resource Projects

- Joseph G. Minish Passaic River Waterfront Park and Historic Area, Phase I Project: Construction Ongoing

  The project will reduce erosion and provide environmental restoration, recreation, and economic development benefits.

- Lincoln Park, Section 1135: Constructed completed 2015

  The project involved the closure and remediation of a landfill, the restoration of coastal wetlands and shorelines and shallows, restoration of tidal exchange to an artificial lake, and increased public access.

- McKeel Brook: Construction completed 2004

  The project included construction of culverts and upgrading detention basin outfall structures.

- Molly Ann's Brook: Construction completed 2007

  The project included the replacement of five bridges, construction of a modified walled channel, and removal of several structures.

- Ramapo River at Oakland: Construction completed 2007

  The project included the widening and deepening of the existing Ramapo River, creation of wetlands in Potash Lake, and the installation of flood control gates at the Pompton Lake Dam.

- Passaic River Floodway Buyout: Ongoing construction

  The project involves the acquisition and removal from the state defined Floodway of approximately 800 homes in the municipalities of Fairfield, Lincoln Park, Wayne, Pompton Lakes, Montville, East Hanover, Pequannock, Little Falls, and Riverdale.

Federal Water Resource Studies

- Long Hill Township 205: Study deferred
- Ramapo River at Mahwah/Suffern: Study deferred
- Lower Saddle River: Ongoing study
- Jackson Brook: Ongoing study
- Lower Passaic River Restoration Project: Ongoing study, conducted jointly with the U.S. Environmental Protection Agency (USEPA)
- Newark Bay Superfund Study: Ongoing study by USEPA
- South First Street Floodwall at Harrison: Ongoing evaluation
- Malapardis Brook: Ongoing project design
- Preservation of Natural Storage Areas: Authorized for the purchase of up to 5,350 acres: 3,400 bought to date and project is ongoing.

1.8 Study Area

The study area is the area that encompasses areas damaged by flooding within which measures might be recommended and significant project impacts may occur. The study area includes the tidally-influenced and surge-prone areas in the lower Passaic and Hackensack Rivers, and Newark Bay, New Jersey that were included in the authorized Passaic Main Stem project (Figure

3). It includes portions of the city of Newark (Essex County), and its suburbs of Harrison and Kearny (Hudson County).

The study area encompasses 5.0 square miles (3,200 acres) in the city of Newark, 0.65 square miles (400 acres) in the Town of Harrison, and 2.73 square miles (1,880 acres) in the Town of Kearny. The Passaic and Hackensack Rivers intersect the study area.

The study area is a mixed use area of industrial, commercial, and residential development. The waterfront is mostly developed for industrial uses including manufacturing, shipping (oil and gas, containers/consumer goods) and wastewater treatment. Related rail, barge, truck, and storage infrastructure line the waterfront. There are public parks and a sports arena along the waterfront as well.

Most industrial development is found: 1) on the east bank of the Passaic River south of US-280 in Harrison and on Kearny Point, the peninsula located between the Passaic and Hackensack Rivers, and 2) on the west bank east of NJ-25/US-1/Lincoln Highway in Newark. Most residential communities are west of NJ-25/US-1/Lincoln Highway in Newark, and the northern portion of Harrison.

Most residential communities are west of NJ-25/US-1/Lincoln Highway in Newark, and the northern portion of Harrison. The rest of the study area is developed for industrial uses, including manufacturing, shipping, rail transport, oil and gas storage, and container storage. Most residents and businesses have demonstrated their commitment to their communities by returning after the devastation caused by Hurricane Sandy in 2012, and continue their recovery.

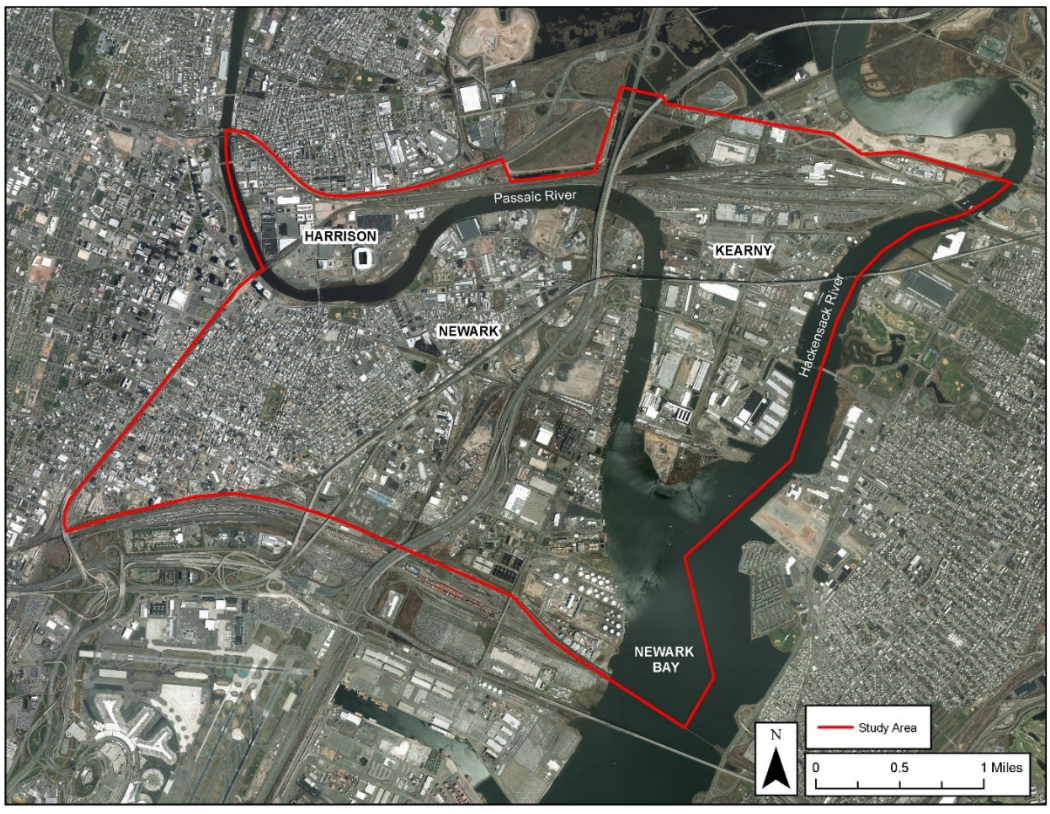

Figure 3: Passaic Tidal Study Area

Seven reaches were used for plan formulation and analysis (Figure 4). The reaches were determined using current land use, hydrology, and topography. The reaches are Harrison Section 1, Harrison Section 2, Kearny Section, Newark Section, Minish Park Section, Newark Flanking Section, and Newark Gap.

1. Harrison 1: the area of Harrison included in the 1995 alignment
2. Harrison 2: additional area in Harrison which includes Red Bull Arena and the PATH Service Station
3. Kearny: also referred to as Kearny Point, this includes all of Kearny Point peninsula to the northern rail yard
4. Newark: includes the areas of Newark subject to flooding from the east
5. Minish: area along Minish Park
6. Newark Flanking: located south of the South Ironbound area of Newark and north of Newark Liberty Airport
7. Newark Gap: just west of the Newark reach, the ground elevation is at or greater than 18 feet NAVD88

1.9 Project Area

The Project Area is where measures will likely be built and where direct and indirect effects will be evaluated. The project area consists of the alignment of the structural features associated with the proposed plan as well as any temporary construction easements or working areas.

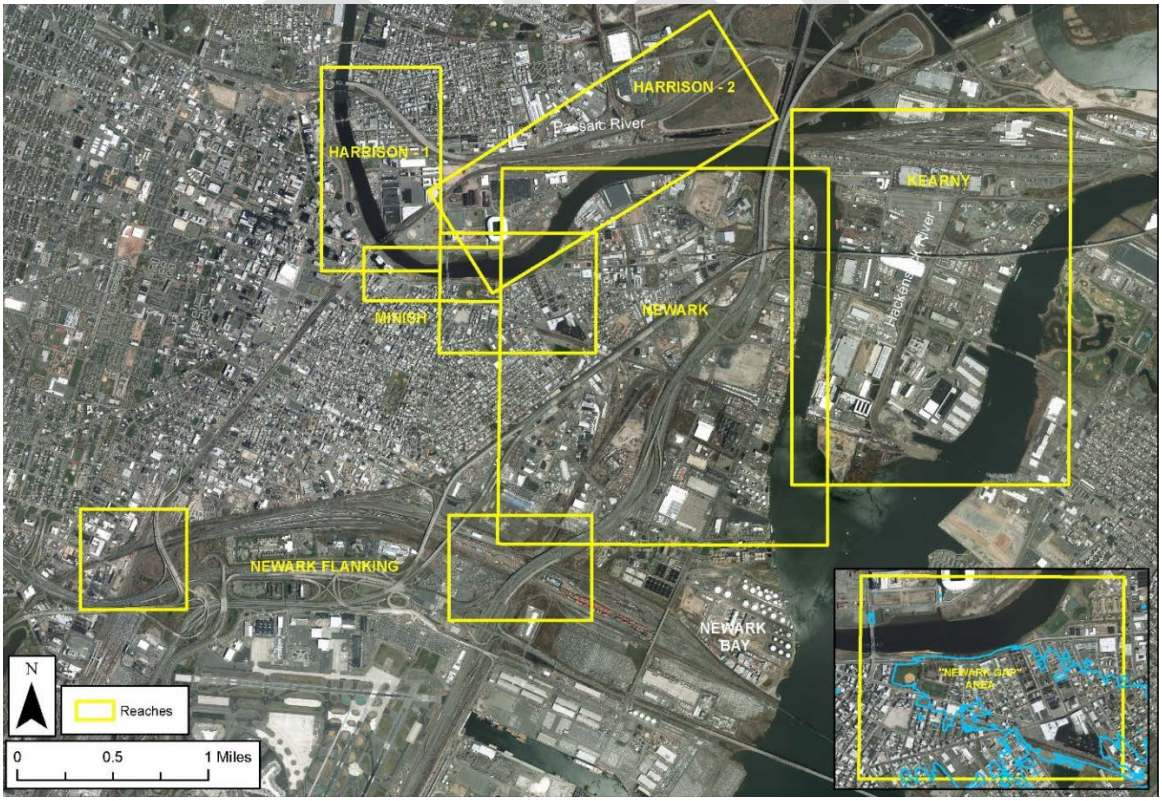

Figure 4: Passaic Tidal Planning Reaches

Chapter 2: Existing Conditions

Existing conditions serve as the basis for the characterization of problem identification and projection of future without-project conditions. The study area is a densely populated, urban environment with limited green spaces. The study area holds critical infrastructure and plays a central role in the region's economy. Existing conditions are described in this chapter (setting, significant storms, and assets at risk) and in Chapter 3 (environmental resources).

2.1 Storms and Flood Levels

Floods are often defined according to their likelihood of occurring in any given year at a specific location. The most commonly used definition is the "100-year flood." This refers to a flood level or peak that has a 1 in 100, or 1-percent chance of being equaled or exceeded in any year (i.e., 1-percent "annual exceedance probability"). Therefore, the 100-year flood is also referred to as the "1-percent flood," or as having a "recurrence interval" or "return period" of 100 years.

A common misinterpretation is that a 100-year flood is likely to occur only once in a 100-year period. In fact, a second 100-year flood could occur a year or even a week after the first one. The term only means that the average interval between floods greater than the 100-year flood over a very long period (say 1,000 years) will be 100 years. However, the actual interval between floods greater than this magnitude will vary considerably.

In addition, the probability of a certain flood occurring will increase for a longer period of time. For example, over the life of an average 30-year mortgage, a home located within the 100-year flood zone has a 26-percent chance of being flooded at least once. Even more significantly, a house in a 10- year flood zone is almost certain to be flooded at least once (96-percent chance) in the same 30-year mortgage cycle. The probability (P) that one or more of a certain-size flood occurring during any period will exceed a given flood threshold can be estimated as

$$P = 1 - \left[1 - \frac{1}{T}\right]^n$$

where T is the return period of a given flood (e.g., 100 years, 50 years, 25 years) and n is the number of years in the period. The probability of flooding by various return period floods in any given year and over the life of a 30-year mortgage is summarized in Table 1.

Table 1: Examples of Flooding by Various Return Periods

RETURN PERIOD (YEARS)	CHANCE OF FLOODING IN ANY GIVEN YEAR	PERCENT CHANCE OF FLOODING DURING 30-YEAR MORTGAGE
10	10 in 100 (10%)	96%
50	2 in 100 (2%)	46%
100	1 in 100 (1%)	26%
500	0.2 in 100 (0.2%)	6%

Because of the potential confusion, recent USACE guidance documents and policy letters recommend use of the annual exceedance probability terminology instead of the recurrence interval or return period terminology. For example, one would discuss the "1-percent-annual-exceedance-probability flood" or "1-percent-chance-exceedance flood," which may be shortened to "1-percent flood" as opposed to the "100-year flood." This report uses the short form "1-percent flood."

The study area was identified as a Significantly Impacted Area in the NACCS January 2015 report. Flooding in the study area occurs when surge from coastal storms such as nor'easters, tropical storms and hurricanes travel north through Newark Bay into the Passaic and Hackensack Rivers, inundating the area. Hurricane Sandy resulted in an approximate 1-percent flood for this area. Hurricane Sandy inundated the study area with water up to 8 feet deep; this equates to a stillwater elevation of about 12 feet NAVD88 (Figure 5).

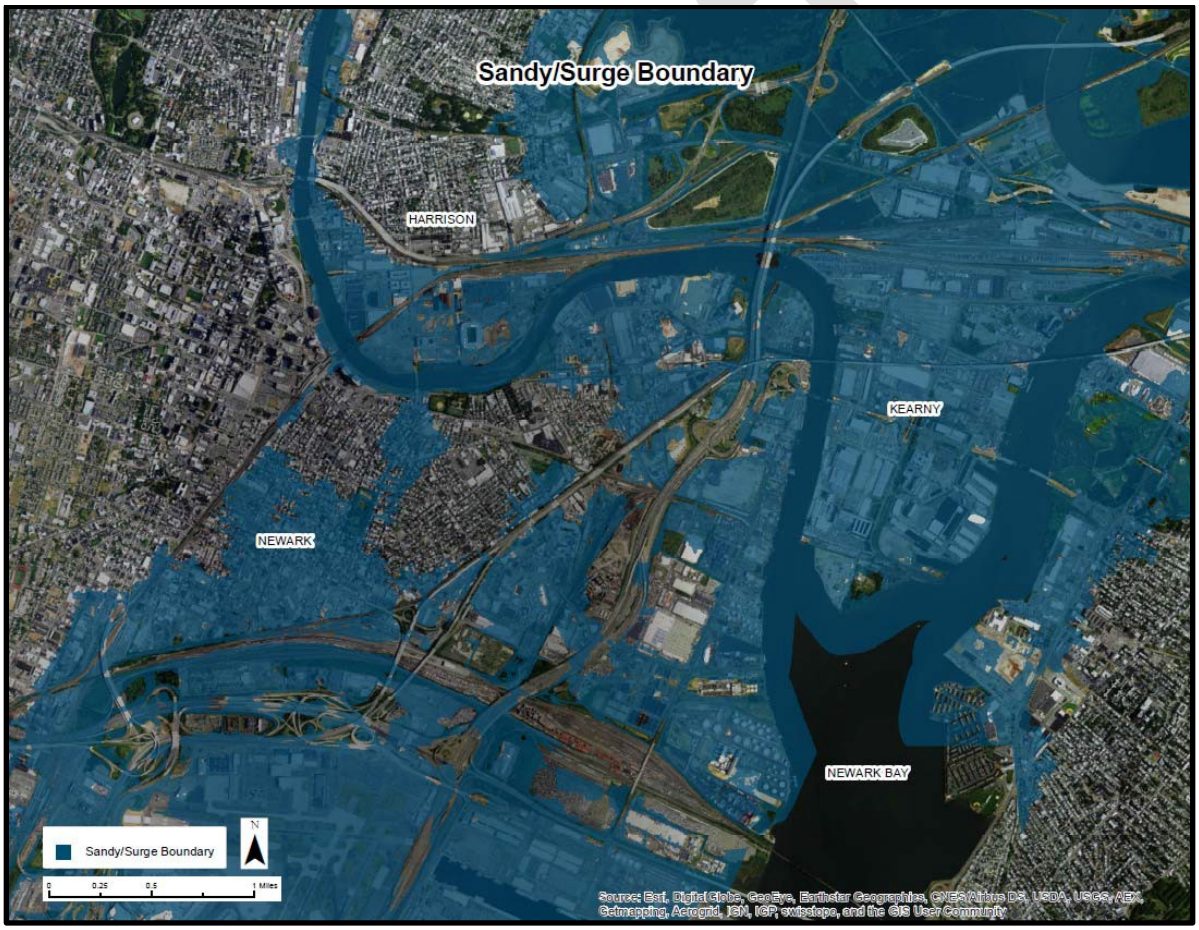

Figure 5: Extent of Hurricane Sandy Flooding with the Study Area (United States Geological Survey (USGS), accessed April 2016).

2.2 Water Surface Elevation

Stage-frequency curves for existing conditions were acquired from the NACCS coastal surge model and the Federal Emergency Management Agency (FEMA) for the study area. Stage-frequency relationships for the study area were based on NACCS data for all reaches directly

fronting the Passaic River. The NACCS model, finalized in 2015, computed the coastal storm hazard for the east coast region from Maine to Virginia and the primary focus was on storm winds, waves, and water levels along the coast for both tropical and extratropical storms. The 1992 tidal epoch was used in the initial NACCS coastal analysis; for this study, stillwater elevations in the project area were updated to 2020 levels using USACE Curve 1 projected sea level change data for the region (0.35 feet to 2020; 1.27 feet to 2070).

The principal source of flooding for the southern portion of our study area in Newark is overland flow from Newark Bay rather than from the Passaic River. The most recent FEMA stage-frequency data was assigned to southern portion because the FEMA coastal model has inland water surface elevations, while the NACCS water surface elevations are estimated only along the waterfront. The NACCS stage frequency curve for the Passaic Tidal project area in year 2020 is presented in Table 2.

Table 2: NACCS Stillwater Elevation - Stage versus Frequency

AVERAGE FREQUENCY	ANNUAL RECURRENCE INTERVAL (frequency)	WATER LEVELS [FEET NAVD88] 2020
100%	1-year	5.4
50%	2-year	6.2
20%	5-year	7.4
10%	10-year	8.3
5%	20-year	9.6
2%	50-year	10.8
1%	100-year	12.1
0.5%	250-year	13.7
0.2%	500-year	15.0

2.3 Development

The study area in densely populated with little green space. Current land use in the study area is a combination of urban, industrial, and limited suburban developments. Much of the shoreline in the study area is hardened by bulkheads. A structure inventory was completed for use in computing flood inundation damages in the study area using standard planning methods and models. In addition to theoretical flood damages, the study team collected historic damage figures from local and state government, and businesses. Table 3 shows the number and value of structures in the study area and Table 4 shows the value of vehicles in the study area. Section 3.5 of the main report describes the land use in more detail and detailed information about the survey methodology and structure inventory is presented in Appendix G (Economics).

Table 3: Number and Value of Structures in the Study Area, by Type and Floodplain, In Thousands ($1,000s)

DAMAGE CATEGORY		10% FLOODPLAIN	1% FLOODPLAIN	0.2% FLOODPLAIN	0.2% FLOODPLAIN + 2FT
APARTMENT	NUMBER	46	449	695	859
	VALUE	$97,000	$894,000	$1,415,000	$1,752,000
COMMERCIAL	NUMBER	89	556	784	926
	VALUE	$301,000	$1,273,000	$1,540,000	$2,061,000
INDUSTRIAL	NUMBER	402	900	1,058	1,128
	VALUE	$2,963,000	$4,304,000	$4,860,000	$4,957,000
MUNICIPAL	NUMBER	29	66	78	87
	VALUE	$131,000	$829,000	$962,000	$1,049,000
RESIDENTIAL	NUMBER	131	1,620	2,886	3,774
	VALUE	$35,000	$583,000	$1,048,000	$1,378,000
TOTAL	**NUMBER**	**697**	**3,591**	**5,501**	**6,774**
	VALUE	**$3,528,000**	**$7,882,000**	**$9,825,000**	**$11,196,000**

Table 4: Value of Vehicles in the Study Area, by Location and Floodplain

DAMAGE CATEGORY	10% FLOODPLAIN	1% FLOODPLAIN	0.2% FLOODPLAIN	0.2% FLOODPLAIN + 2 FT
NEWARK SECTION	$567,000	$1,940,000	$3,914,000	$5,032,000
KEARNY SECTION	$0	$0	$0	$0
HARRISON SECTION 1	$1,081,000	$3,823,000	$4,032,000	$4,134,000
HARRISON SECTION 2	$0	$0	$0	$0
MINISH PARK SECTION	$635,000	$9,383,000	$14,577,000	$18,074,000
NEWARK FLANKING SECTION	$371,000	$9,766,000	$16,882,000	$21,621,000
NEWARK GAP SECTION	$0	$1,142,000	$3,533,000	$6,623,000
TOTAL	$2,654,000	$26,054,000	$42,939,000	$55,484,000

2.4 Economy

The City of Newark acts as one of the major hubs for air, shipping and rail transportation; including Port Newark, Newark Liberty International Airport, and several universities. Historically, the City of Newark has had a strong industrial and commercial economic base. It is home to four universities; New Jersey Medical School, New Jersey Institute of Technology, Rutgers University – Newark, and Essex County College.

Although Harrison is within Hudson County and is influenced by other Hudson County municipalities, Harrison is also influenced by the adjacent City of Newark due to its close proximity. In the past the Town of Harrison was heavily involved in industry and manufacturing, which began to move out in the late 1960s. Due to the Waterfront Redevelopment Plan of 2012, there has been an influx in residential and mixed-use development along the Passaic River and a decline in the manufacturing industrial sector. The Town of Harrison includes the Red Bull Arena, which is located near the Passaic River and was opened in 2010.

Much of Kearny within the study area hosts commercial and industrial areas and is located roughly six miles west of Manhattan. From the late 1800s Kearny was an industrial area and was known as a factory town until the late 20th century. It was also the location of a ship yard for the construction of cargo ships and home of the 'Kearny Standard' for the manufacturing of tools and equipment. The Town of Kearny includes an extensive residential area in the north of the Town limits, which is located outside the boundary of this study.

Based on the American Community Survey (2012-2016), the median household income for Essex County is $54,860 and Hudson County is $60,894. Compared to the New Jersey State median household income of $73,702, the average study area median household income of $57,877 is significantly lower than the state.

2.5 Transportation and Infrastructure

The study area contains important infrastructure that includes methods residents may use to evacuate the area during a storm event. Wastewater treatment services, energy infrastructure, railroads, and other valuable infrastructure are present in the study area (Figure 6):

- Passaic Valley Sewerage Commission Wastewater Treatment Plant
- Energy Infrastructure
    - Essex County Power Generation Plant
    - Kearny Power Generation Plan
- Newark Airport
- Rail Infrastructure
    - Newark Pennsylvania Station
    - Amtrak Kearny Sub Station
    - NJ Transit Train Yards
- Highways
    - I-95
    - I-280
- Port Newark

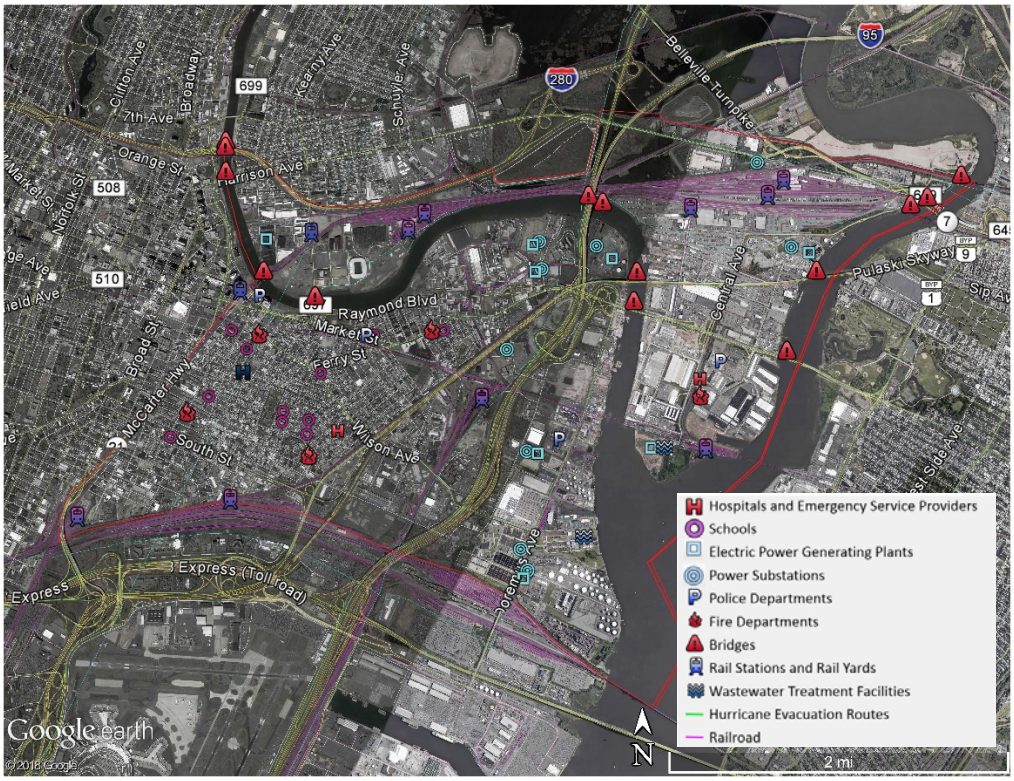

Figure 6: Infrastructure in the Study Area

2.6 Environmental Conditions

The existing environmental conditions are identified in Chapter 3 below. The Recommended Plan to manage the risk of coastal storm damage in the study area is presented in Chapter 5; an assessment of potential environmental impacts of the Recommended Plan is provided in Chapter 6.

Chapter 3: Existing Environment*

3.1 Physical Setting

3.1.1 Geology and Physiography

The study area is located along the southeastern edge of the Piedmont Physiographic Province, which encompasses Essex County and Hudson County. The Piedmont Province is characterized by rolling hill lowlands divided by broad, winding river valleys with well-developed floodplains. The province slopes from the foot of the Highlands Province toward its southeastern boundary toward the Inner-Coastal Plain Province.

The study area consists of an underlying slightly folded and faulted sedimentary rocks of Triassic and Holocene Age (240 to 140 million years old). The Triassic Age sedimentary rock is primarily comprised of siltstone, shale, sandstone, and conglomerate; the Holocene Age material is comprised of estuarine deposits and beach (NJDEP 1999).

Topography

In general, topography within the Piedmont Province is relatively flat with low rolling hills. Elevations in the Passaic River watershed range from approximately 400 feet above sea level in upstream portions, north and west of the study area to 0 feet (sea level) in lower portions. The study area lies within the Lower Valley portion of the Passaic River Basin, which is low-lying and relatively flat, with elevations that range from sea level to approximately 30 feet above sea level. In this dense urban area, much of the topography has been altered by human activity through filling and construction of structures and infrastructure. The banks along the rivers and bay within the study area are mostly relatively steep and consist primarily of hardened shorelines consisting of bulkheads and other structures in an urban setting.

Most of the study area is within the 1-percent floodplain (Figure 7). The ground elevation is generally 4 to 8 feet NAVD88 in the study area. The base flood elevation of areas shown in blue on Figure 7 is 10 NAVD88 to 12 feet NAVD88.

The Federal Emergency Management Agency's, Preliminary Flood Insurance Rate Maps (FIRMs), released on December 20, 2013 for Hudson County and May 30, 2014 for Essex County, were used within the municipalities of Kearny, Harrison, and Newark, to delineate floodplains and identify structures subject to inundation during, flood events, notably the 1-percent flood event and the 0.2-percent flood event. A floodplain corresponding to the 0.2-percent annual chance exceedance plus two feet was also developed to define the maximum extent of the structure inventory. Building footprint data for the approximately 7,000 structures covered by the study was obtained from the City of Newark, the New Jersey Meadowlands Commission, and the New Jersey Department of Environmental Protection.

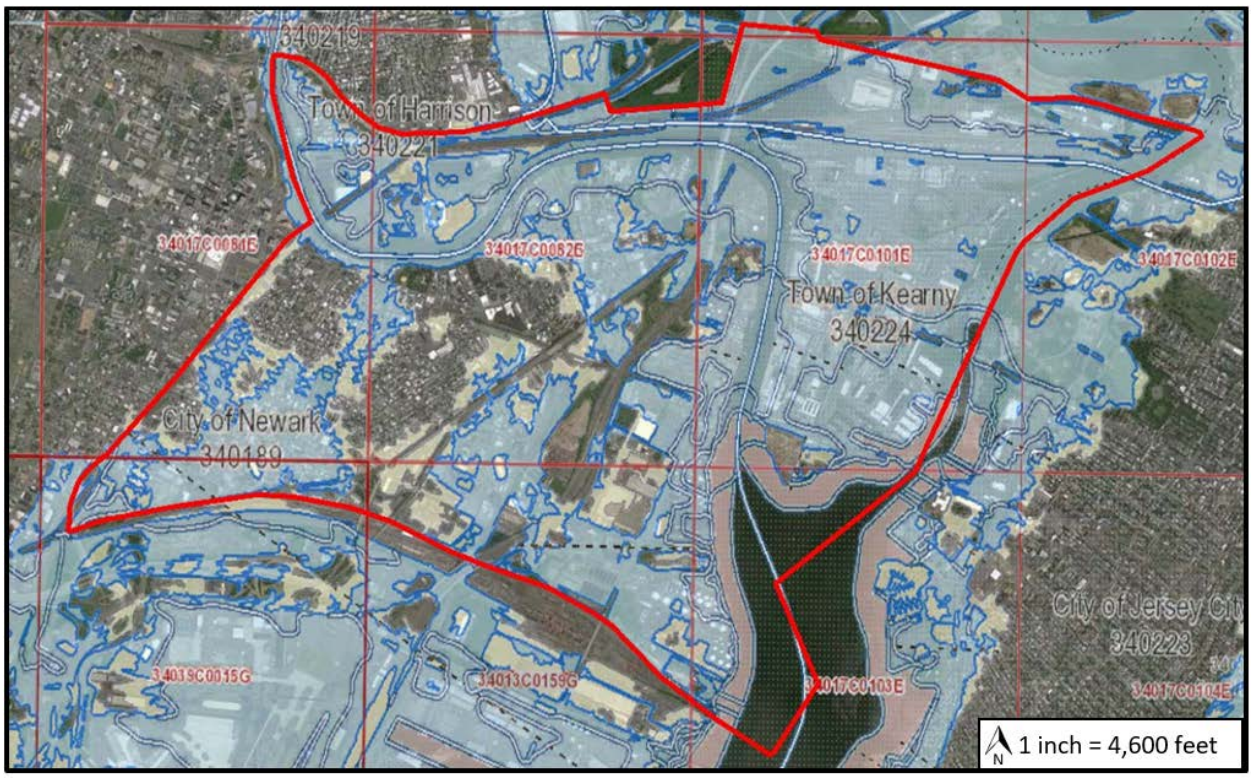

Figure 7: Preliminary FIRM showing the 1% (blue) and 0.2% (yellow) floodplains (FEMA, January 2015)

3.1.2 Soils

Soils in the study area include predominately non-hydric/upland soils. There is a small percentage of hydric/wetland soils located along the banks of the Passaic River, Hackensack River, and Newark Bay. According to the U.S. Department of Agriculture National Cooperative Soil Survey (Soil Survey Staff 2016), a large majority of the study area consist of Urban land, Dunellen substratum (0-8 percent slopes); Urban Land, wet substratum (0-8 percent slopes); Urban land, Bigapple substratum (0-8 percent slopes) and Secaucus artifactual fine sandy loam (0-3 percent slopes). Hydric soils tend to be concentrated in lower elevations along the Hackensack River and Passaic River. These soils typically have grayish and/or black subsoil and occur on tidal areas. Soils throughout the study area have been heavily disturbed as a result of urban development and industrial activities. Many of the soils consist of a mixture of construction debris and filled dredge materials. The majority of the natural soils are formed in stratified materials, from crystalline rocks, overlain by impervious surfaces of pavement, concrete, buildings, or other structures.

A layer of highly variable fill materials up to approximately 20 feet overlies the natural soils throughout the alignment of the floodwall/levee system in thickness (USACE-NYD 2016). These materials are predominantly granular soils intermixed with silt, clay, and decaying organic soil that have been placed incident to development over the past 200 years or more and include wood, metal, and general building demolition rubble (USACE-NYD, 2016).

3.2 Climate and Weather

Essex County and Hudson County experience significant seasonal and daily temperature fluctuations. Winters are generally cool with moderate snowfall and summers are moderate with hot mid-summer weather and frequent thunderstorms. Average temperatures range from 27 degrees Fahrenheit (°F) in January to a high of 84 °F in July. The monthly precipitation average ranges from 3.2 inches in February to 4.6 inches in July (National Weather Service, 2016). The growing season lasts approximately 180 days beginning in late April and ending in middle to late October. Changes in climate, with increases in frequency and intensity of coastal storms along with sea level rise from 0.64 to 2.61 feet (USACE Climate Preparedness and Resilience, 2017) is expected in the Study Area over the next 50 years between 2020 and 2070.

3.3 Floodplains and Coastal Processes

The following includes a description of the floodplains and coastal processes in the study area.

3.3.1 Floodplains

Over half of the study area lies within the FEMA designated 1-percent floodplain, based on the FIRMs. The 1-percent flood elevation is 11.82 feet NAVD88 in the study area. The 0.2-percent annual chance of exceedance is 14.84 feet NAVD88 in the study area. The portions of the study area within the 1-percent and 0.2-percent floodplain are illustrated in Figure 8.

3.3.2 Coastal Processes

Coastal processes include erosion and accretion which together result in shaping the shoreline. Erosion is the removal of sediment or material from a particular location by the action of wind or water. Accretion is the deposition of sediment or material in a particular location. The shoreline along the water bodies in the study area is subject to river currents and tidal fluctuation but is not influenced by larger waves and ocean currents such as longshore drift that are present in coastal environments that are exposed to the open ocean. Wind driven waves can erode the shoreline of the water bodies in the study area. Fetch is the distance that wind travels over open water and is a variable in determining the maximum wind driven wave height at a particular location. The Passaic River and Hackensack River are both relatively narrow with a short fetch thus limiting the development of larger wind driven waves. Upper Newark Bay in the study area is less than 1 mile wide with a limited fetch from east wind driven waves. The portion of the study area that is exposed to wind driven waves with the longest fetch is Kearny Point with of a fetch of approximately 6 miles for northeast winds. Potential wave heights in Newark Bay can be over 6 feet for the most severe storms but are typically less than 4 feet (Shrestha *et. al.*, 2014). Vessel-generated wakes associated with larger boats such as tugs, barges other deep-draft vessels are another source of wave action that has the potential to erode the shoreline in the study area.

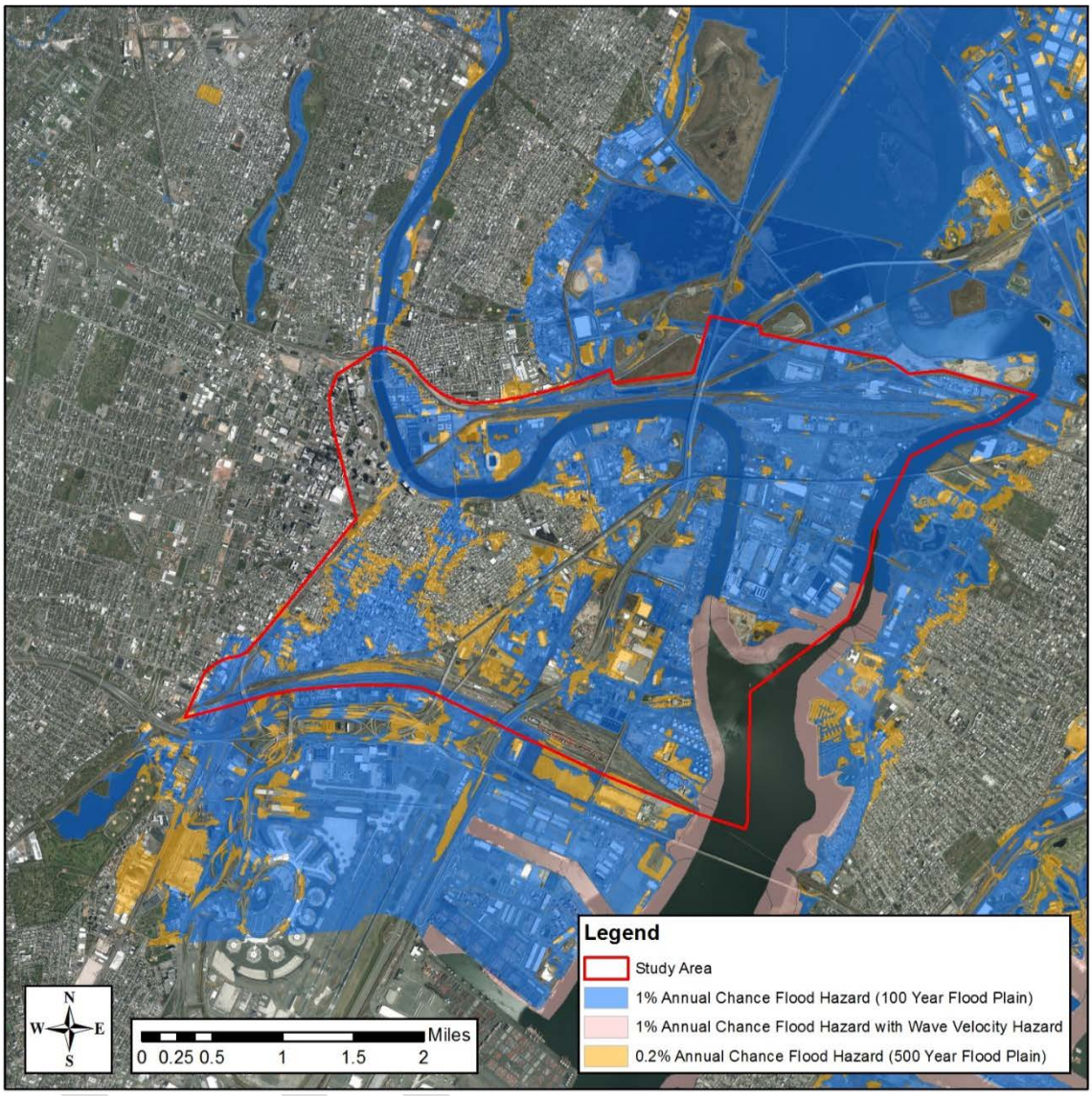

Figure 8: Floodplain within the Study Area

Like waves, currents can also erode the shoreline. Tidal currents in Newark Bay as well as in the Passaic River and Hackensack River are moderate with maximum speeds of 0.5 meters/second (approximately 1 knot) (HydroQual Inc., 2008). Localized higher velocity currents with the greater potential to erode the shoreline are present in constricted areas along the Passaic River and Hackensack River such as around bridges. Although these coastal processes exist, much of the shoreline in the study area is hardened, consisting of steel, timber or concrete bulkheading or walls or riprap for erosion reduction and to support the landward industrial development.

3.4 Water Resources

The following profile of water resources in the study area focuses on tidal surface waters, fresh surface waters, and regional hydrogeology and groundwater. Potential environmental impacts to each of these resources resulting from the No Action Alternative as well as construction and maintenance of the Proposed Action follow the existing conditions descriptions.

3.4.1 Surface Waters

The main surface water bodies in the study area include the Passaic River, Hackensack River, and upper Newark Bay. The study area includes the lower ±5 miles of the lower Passaic River above Newark Bay. The Passaic River flows south into the study area through the City of Newark and Town of Harrison. After entering the study area, the river turns east then south again before flowing into upper Newark Bay. The area of the Passaic River watershed is approximately 935 square miles. There are also several small, tributaries to the Passaic River in the study area. An unnamed stream that drains the Kearny Marsh is located west of I-95 and enters the north bank of the Passaic River approximately 0.75 mile west of I-95. A smaller tributary (Lawyers Creek) is located just to the north of the Pulaski Skyway and flows east for approximately 0.25 mile to the west bank of the Passaic River. Additional sources of freshwater to the Passaic River include combined sewer overflows (CSOs) and stormwater overflows (SWOs). Density stratification is present in the Passaic River causing a reversal of residual current layers between the top and bottom layers of the water column with the shipping channel acting as a conveyance for the denser salt water (HydroQual Inc., 2008).

The lower ±2.75 miles of the Hackensack River flows south into the study area through the Town of Kearney and Jersey City before flowing into upper Newark Bay. The area of the Hackensack River watershed is approximately 202 square miles. There are no tributaries to the Hackensack River within the study area; however, CSOs and SWOs discharge a combination of stormwater runoff and graywater to the river.

The western portion of upper Newark Bay is within the study area. The Passaic River and Hackensack River are the principal sources of freshwater to Newark Bay with mean daily discharges of 1500 ft^3/sec and 218 ft^3/sec, respectively (Shrestha *et. al.*, 2014). Other much smaller tributaries to upper Newark Bay include Jasper Creek located in the far south end of the study area and a small, short section of an unnamed, channelized stream that discharges to Newark Bay just south of the Passaic Valley Sewerage Commission (PVSC) wastewater treatment facility. Newark Bay also receives freshwater input from CSOs, SWOs and wastewater treatment plant outfalls. In the absence of strong winds the navigational channel in Newark Bay displays a two-layer circulation with a seaward surface flow of freshwater and a landward bottom flow of salt water similar in what is found in many estuaries (Shrestha, *et. al.*, 2014). Tidal currents in Newark Bay, as well as in the Passaic River and Hackensack River, are moderate with maximum speeds of 0.5 meters/second (approximately 1 knot) (HydroQual Inc., 2008).

3.4.2 Water Quality

Surface waters in the study area are saline/estuarine waters, with tidal influences resulting in brackish water throughout the study area. The portion of the Passaic River and its two tributaries in the study area are classified in accordance with the NJDEP Surface Water Quality Standards (New Jersey Administrative Code (N.J.A.C.) 7:9B) as SE3 (SE means a general surface water classification applied to saline waters and estuaries with the number following the classification referring to the designated best use of the water body) (NJDEP 2011). The Hackensack River is classified as SE3 from the Route 1 and 9 crossing downstream to Newark Bay. Upstream of the Route 1 and 9 crossing the Hackensack River is classified as SE2. Newark Bay and the two small tributaries are classified as SE3. SE3 waters are saline waters with designated uses of secondary

contact recreation, maintenance and migration of fish populations, migration of diadromous fish, maintenance of wildlife, and any other reasonable uses. SE2 waters are saline waters with designated uses of maintenance, migration and propagation of the natural and established biota, migration of diadromous fish, maintenance of wildlife, secondary contact recreation, and any other reasonable uses.

Recreational activities in the Passaic River, Hackensack River, and Newark Bay are generally limited to boating. Uses of these waters for recreational fishing is limited or prohibited due to NJDEP established Fish Consumption Advisories; both statewide and in the Newark Bay Complex and the tidal portion of the Passaic River, where specific advisories apply to the study area (NJDEP, 2013). The lower eight miles of the Passaic River, including the portion in the study area has been designated a Superfund site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) by the U.S. Environmental Protection Agency due to contaminated sediments. Additional detail on this designation is provided in Section 3.16 Hazardous, Toxic, and Radioactive Waste.

3.4.3 Regional Hydrogeology and Groundwater

The study area is located in the Newark Group of aquifers that consist of shale and sandstone. Groundwater generally is present in weathered joint and fracture systems in the upper 200 to 300 feet with groundwater availability below 500 feet being less due to fractures being fewer and smaller (USGS, 2016). Surface water reservoirs in northern New Jersey serve as the drinking water supply for communities in the study area. Groundwater is not a source of potable water in the study area.

3.4.4 Tidal Influences

The Passaic River, Hackensack River, and Newark Bay are tidal within the study area. These water bodies experience semi-diurnal tidal fluctuations but are sheltered from direct ocean waves. Brackish water extends throughout the study area. Two National Oceanic and Atmospheric Administration (NOAA) subordinate tidal stations are located in the study area. The Point No Point tidal station is located in the Passaic River under the US Route 1/9 truck bridge. The Kearny Point tidal station is located in the Hackensack River also below the US Route 1/9 truck bridge. The mean tidal range at both of these stations is 5.21 feet (NOAA, 2016).

3.5 Land Use and Zoning

The study area is dominated by industrial and urban land uses and includes some residential areas and suburban developments.

Current land use in the Study Area is a combination of: (1) urban land uses (2) industrial land uses, and (3) transportation corridors.

3.5.1 City of Newark

The City of Newark has a total area of 26.1 square miles, including 24.2 square miles of land and 1.9 square mile of water (US Census, 2010). According to the US Census, Newark has the third smallest land area among the 100 most populous cities in the United States. The densest areas of Newark are located further inland in proximity to public transportation.

The city of Newark is divided into five wards: East, South, Central, West, and North. The East Ward is zoned primarily as heavy industrial and port use however, an island of residential properties are present. The South Ward encompasses Newark Liberty International Airport and associated airport support development. The Central Ward is a mix of light industrial use, institutional, neighborhood commercial and low-rise multifamily residential development. The West and North Wards consist of mostly residential use with a mix of single family residential, one-to-three family and townhouse residential, and parks with open space (DMJM Harris *et. al.*, 2008).

The future development potential of the City of Newark is based on the development of approved projects not yet built and future development plans. There have been several proposals focusing on underutilized existing sites as potential redevelopment areas.

3.5.2 Town of Harrison

The Town of Harrison, located on the western edge of Hudson County along the eastern banks of the Passaic River, has a total area of 1.3 square mile, including 1.2 square mile of land and 0.12 square mile of water (US Census, 2010). Elevation is approximately 20 feet above sea level. Historically, the Town of Harrison has been occupied by industrial activities. Recently, the Town of Harrison developed a Waterfront Redevelopment Plan to capitalize on the Harrison PATH Station, in order to provide a variety of mixed-use, transit-oriented, and pedestrian scale development (Heyer Gruel & Associates, 2012).

The Town of Harrison primarily consists of industrial and commercial land uses. The entire southern portion, south of Interstate-280, is occupied by railroad/utility, industrial, and residential development land uses. The area to the north of Interstate-280 features a mix of commercial mixed use buildings, industrial use, and single-family residential and multifamily residential units, with limited park/recreation use (Heyer Gruel & Associates, 2012).

The future development potential of the Town of Harrison is based on the development of approved projects not yet built and future development plans. Recently, the Town of Harrison prepared a Waterfront Redevelopment Plan in order to capitalize on the Harrison PATH Station and to provide a variety of potential mixed-use, transit-oriented, and pedestrian scale development (Heyer Gruel & Associates, 2012). Underutilized existing, primarily nonresidential sites are identified in the Waterfront Redevelopment Plan as potential redevelopment areas.

3.5.3 Town of Kearny

The Town of Kearny has a total area of 10.2 square miles, including 8.8 square miles of land and 1.4 square miles of water. The Town of Kearny is divided into three sections: the Kearny Uplands, the Kearny Meadows, and Kearny Point, also referred to as the South Kearny Peninsula. The Kearny Uplands consists of residential communities, while Kearny Point is an industrial district. Kearny Meadows consist of wetlands and tributaries, interspersed with residential and industrial communities (Department of Community Affairs, 2013). The Study Area includes Kearny Point, a heavily used industrial area.

The future development potential of the Town of Kearny is based on the development of approved projects not yet built and future development plans. The town planning board does not propose any substantially different land use concepts that would dramatically change the character of the community (NY, NJ, CT Regional Plan Association, *et. al.*, 2009). The Town of

Kearny plans to focus on the 'Transit-Oriented Development Vision Plan,' using underutilized sites for potential redevelopment areas (NY, NJ, CT Regional Plan Association, *et. al.*, 2009).

3.6 Socio-Economics

The Study Area falls within Essex and Hudson counties, specifically the City of Newark, Town of Harrison, and Town of Kearny. The communities in Newark, Harrison, and Kearny are relatively vulnerable to disasters such as nor'easters, tropical storms, and hurricanes. Vulnerability is defined by the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard. As compared to New Jersey and National population statistics, the communities are relatively young, minority, foreign-born, and poor.

Residents generally have problems evacuating prior to storms. This is due largely to a lack of automobiles available to many households. According to the 2010 U.S. Census, Newark has the second highest percentage (44.17%) in the Nation of households that do not own or otherwise have access to an automobile, only second to New York City. Cultural norms, lack of emergency money, and language barriers significantly contribute to the problem.

In general, the study area contains predominantly industrial facilities with a mix of residential development. Profiles of the three communities within the study area are presented below.

3.6.1 The City of Newark

The City of Newark, located in Essex County, is the largest city in the state of New Jersey. It is situated on the western side of the Passaic River and Newark Bay, serving as a major international hub for air, shipping, and rail transportation in the metropolitan region. Port Newark, Newark Penn Station, and Newark Liberty International Airport are located in Newark. Historically, Newark has had a strong industrial and commercial economic base.

Newark is a dense urban area surrounded by residential communities. It is home to four universities: New Jersey Medical School, New Jersey Institute of Technology, Rutgers University – Newark, and Essex County College. Cultural amenities within the city include the Prudential Center sports arena and the New Jersey Performing Arts Center, as well as numerous museums, art galleries and cultural centers.

Newark is the second most racially diverse city in New Jersey, with a 52-percent African American population, followed by 26-percent White, and a 33-percent Hispanic population. Newark's population primarily consists of children under the age of 18, young adults and middle-aged persons with an average age of 32 years. As of the last census data for the city, 25.6-percent of the population were under the age of 18, 11.9-percent were from 18 to 24, 31.9-percent were from 25 to 44, 22.1-percent were from 45 to 64, and 8.6-percent were 65 years of age or older (US Census, 2010).

Table 5 presents the populations, Table 6 presents the medium household incomes, and Table 7 presents the employment by sector for the three municipalities in the study area.

Table 5: Population of Study Area Jurisdictions

	1980	1990	2000	2010	2014
City of Newark	329,248	275,221	273,546	277,140	280,579
Town of Harrison	12,242	13,425	14,424	13,620	15,376
Town of Kearny	35,735	34,874	40,513	40,684	41,837

Sources: U.S. Bureau of the Census: 1980, 1990, 2000, 2010, 2014

Table 6: Median Household Income of Study Area Jurisdictions

	2000	2010	2014
State of New Jersey	$55,146	$69,811	$72,062
City of Newark	$29,913	$35,659	$34,012
Town of Harrison	$41,350	$51,193	$53,772
Town of Kearny	$47,757	$58,698	$63,093

Sources: U.S. Bureau of the Census, American Community Survey 5-Year Estimates 2000, 2010, 2014

Table 7: Employment by Sector (2010) of Study Area Jurisdictions

INDUSTRY	KEARNY		HARRISON		NEWARK	
	Total	%	Total	%	Total	%
Civilian employed population 16 years and over	19,543	100	6,828	100	111,834	100
Agriculture/Forestry/Fisheries/Mining	15	0.1	0	0	167	0.1
Construction	1,710	8.7	827	12.1	11,014	9.8
Manufacturing	1,923	9.8	741	10.9	9,327	8.3
Wholesale Trade	1,025	5.2	360	5.3	3,120	2.8
Retail Trade	1,538	7.9	797	11.7	10,525	9.4
Transportation/Utilities	2,327	11.9	655	9.6	10,652	9.5
Information	438	2.2	163	2.4	2,036	1.8
Finance/Insurance/Real Estate	1,330	6.8	411	6.0	6,618	5.9
Professional/Management	2,098	10.7	851	12.5	10,835	9.7
Educational/ Health care	3,855	19.7	1,068	15.6	25,771	23.0
Arts/Entertainment/Hospitality/Food	1,337	6.8	345	5.1	8,874	7.9
Public Administration	605	3.1	137	2.0	5,788	5.2
Other	1,342	6.9	473	6.9	7,107	6.4

Sources: U.S. Bureau of the Census: 1970, 1980, 1990, 2000, 2010, 2014

3.6.2 Town of Harrison

The Town of Harrison is located in Hudson County on the Passaic River adjacent to the City of Newark. In the past, the Town of Harrison was heavily influenced by industry and manufacturing; however, these business sectors began to decline in importance in the late 1960s. The town's Waterfront Redevelopment Plan of 2012 has resulted in an influx of residential and mixed-use development along the Passaic River and a further decline in the industrial and manufacturing sectors. The Town of Harrison includes Red Bull Arena, which is located along the Passaic River.

In the Town of Harrison, 20.8-percent of the population were under the age of 18, 10.9-percent were from 18 to 24 years of age, 35-percent were from 25 to 44 years of age, 24-percent were from 45 to 64 years of age, and 9.3-percent were 65 years of age or older (US Census, 2010). The Town of Harrison is racially made up of 61.7-percent White, 2.8-percent African American, 17-percent Asian, and 21.7-percent other race (US Census, 2010).

3.6.3 Town of Kearny

The Town of Kearny, located in Hudson County, is situated between the Passaic River and Hackensack River. A large majority of Kearny contains commercial and industrial uses, and there are several residential communities in the eastern and northwestern portions of the town (Town of Kearny, 2016). The South Kearny peninsula, which is the portion of the town within the study area, is primarily industrial. Since the late 1800s, Kearny has been an industrial region and has served as a shipyard for the construction of cargo ships and home of the Kearny Standard for the manufacturing of tools and equipment. The Kearny Works of Western Electric, which employed as many as 24,000 people in the production of hardware and supplies for the Bell System between 1926 and 1986, was formerly located in Kearny. AT&T sold the Kearny Works in 1984, at which time it employed 4,000 people.

In the Town of Kearny, 20.7-percent of the population were under the age of 18, 11.0-percent were from 18 to 24, 31.2-percent were from 25 to 44, 26.4-percent were from 45 to 64, and 10.7-percent were 65 years of age or older. The Town of Kearny is racially made up of 48.7-percent White, 39.9-percent Hispanic or Latino, 4.4-percent Asian, 5.4-percent African American (US Census, 2010).

3.6.4 Environmental Justice Summary

In accordance with Executive Order 12898 (dated February 11, 1994), Federal Agencies are required to identify and address the potential of disproportionately high and adverse human health on environmental effects of its programs, policies, and activities on minority populations and low-income populations.

According to the US Census, approximately 29.9-percent of the population of the City of Newark, 16.9-percent of the population of the Town of Harrison, and 10.8-percent of the population of the Town of Kearny had income below the poverty level in 2014.

Low income and minority populations are present in the study area and reside in the City of Newark, Harrison, and Kearny. Demographics and household income levels for each municipality are provided in Table 8 and Table 9, respectively. The identification of Environmental Justice populations, by County and Census tracts are provided in Table 10 and

Table 11 and shown visually in Figure 9. Although the Proposed Action is intended to protect the study area from coastal storm damages and, therefore, would provide a public safety benefit to these populations, consideration must also be given to the potential for adverse impacts to these communities. Coordination and consultation with the municipal officials and community groups has been conducted and will continue throughout the project planning and design phases. Access to the waterfront and parklands has been identified by these entities as a key consideration.

In January 2017, the District and NJDEP met with the mayors of Newark, Harrison, and Kearny to communicate the proposed plan before the draft report was released. During these meetings, the local officials supported the plan. The District also coordinated with local, state, and federal stakeholders through the Ironbound Community Cooperation, Community Advisory Group, and Urban Rivers meetings. In November 2017, the District and NJDEP held public meetings in Newark with Spanish and Portuguese translators. Project handouts were provided in English, Spanish and Portuguese in an effort to reach as many people as possible. In addition, the study area is a non-attainment zone for air quality; therefore, construction related impacts to the local air quality are also evaluated from an environmental justice perspective.

The Newark Municipal Council passed the Environmental Justice and Cumulative Impacts Ordinance to address cumulative impacts that lead to disproportionate risks on low-income and residents of color. The ordinance requires industrial and commercial development proposals to include information on cumulative environmental impacts that will allow for informed decisions regarding development and the city's sustainability goals. The ordinance goal is to protect the health of all Newark residents from adverse health effects, including cumulative impacts, from development and to avoid or minimize any net new pollution to the environment or adversely impact public health.

As presented in the tables and figure, the vast majority of the study area is populated with high levels of minority and low-income people that represent Environmental Justice populations. The areas that are not Environmental Justice populations are predominantly located in the Ironbound and North Ironbound neighborhoods (Census Tracts 70, 71, 72, 73, 76, and 77).

Table 8: Demographics in the Three Study Area Municipalities, as of the 2010 U.S. Census

DISTRIBUTION OF RACE/ETHNICITY								
	KEARNY		HARRISON		NEWARK		STATE OF NEW JERSEY	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
TOTAL	40,684	100	13,620	100	277,140	100	8,791,894	100
White alone	29,933	73.6	7,91	58.3	72,914	26.3	5,214,878	59.3
Black alone	2,186	5.4	297	2.2	145,085	52.4	1,204,826	13.7
American Indian alone	163	0.4	76	0.6	1,697	0.6	29,026	0.3
Asian/Pacific Islander alone	1,825	4.5	2,219	16.3	4,603	1.7	725,726	8.3
Other race alone	5,099	12.5	2,517	18.5	42,181	15.2	559,722	6.4
Two or More Races	1,478	3.6	570	4.2	10,660	3.8	240,303	2.7
Hispanic Origin	16,253	39.9	6,017	44.2	93,746	33.8	819,975	9.3

Source: U.S. Bureau of Census: 2010

Table 9: Household Income Levels in the Three Study Area Municipalities

HOUSEHOLD BY INCOME - 2010								
HOUSEHOLD INCOME BASE	KEARNY		HARRISON		NEWARK		NEW JERSEY (STATE OF)	
	TOTAL	%	TOTAL	%	TOTAL	%	TOTAL	%
TOTAL	13,518	100	4,582	100	92,618	100	3,172,421	100
<10,000	604	4.5	335	7.3	14,538	15.7	174,342	5.5
$10,000-14,999	526	3.9	272	5.9	7,385	8.0	130,977	4.1
$15,000-24,999	1,247	9.2	385	8.4	12,166	13.1	270,609	8.5
$25,000-34,999	1,261	9.3	305	6.7	11,503	12.4	256,073	8.1
$35,000-49,000	2,178	16.1	921	20.1	13,464	14.5	353,152	11.2
$50,000-74,999	2,642	19.5	1,099	24.0	15,053	16.3	541,530	17.1
$75,000-99,999	1,812	13.4	533	11.6	8,628	9.3	414,452	13.1
$100,000-149,999	2,239	16.6	505	11.0	7,259	7.8	526,854	16.6
$150,000-199,999	718	5.3	175	3.8	1,608	1.7	264,604	8.3
>$200,000	291	2.2	52	1.1	1,014	1.1	257,828	8.1

Source: U.S. Bureau of Census: 2010

Table 10: Environmental Justice Populations in the Study Area, Essex County

COUNTY	MUNICIPALITY	CENSUS TRACT	TOTAL POPULATION	MINORITY PERSONS	PERCENT MINORITY	PERCENT BELOW POVERTY LEVEL	HIGH MINORITY POPULATION	HIGH POVERTY POPULATION
Essex	Newark	48.02	3297	2836	86.02%	52.1%	Yes	Yes
Essex	Newark	50	2760	2695	97.64%	30.9%	Yes	Yes
Essex	Newark	57	2564	1641	64.00%	26.9%	Yes	No
Essex	Newark	68	6062	3329	54.92%	24.5%	Yes	No
Essex	Newark	69	5100	2758	54.08%	20.9%	Yes	No
Essex	Newark	70	3963	1368	34.52%	13.8%	No	No
Essex	Newark	71	3696	834	22.56%	14.8%	No	No
Essex	Newark	72	4290	1211	28.23%	12.5%	No	No
Essex	Newark	73	5922	2633	44.46%	18.2%	No	No
Essex	Newark	74	5359	3245	60.55%	18.9%	Yes	No
Essex	Newark	75.01	4341	2060	47.45%	34.1%	No	Yes
Essex	Newark	75.02	2741	1599	58.34%	33.7%	Yes	Yes
Essex	Newark	76	3321	1381	41.58%	20.7%	No	No
Essex	Newark	77	3299	1578	47.83%	20.3%	No	No
Essex	Newark	78	3844	2123	55.23%	16.8%	Yes	No
Essex	Newark	79	4285	2213	51.65%	23.4%	Yes	No
Essex	Newark	80	2447	1562	63.83%	28.9%	Yes	No
Essex	Newark	81	3160	2670	84.49%	40.1%	Yes	Yes
Essex	Newark	229	4265	3136	73.53%	40.7%	Yes	Yes
Essex	Newark	9801	2388	1797	75.25%	N/A	Yes	N/A
Essex	Newark	9802	1721	1253	72.81%	N/A	Yes	N/A

Source: American Community Survey 2016

Notes: 1. N/A represents a lack of data reported in ACS 2016 resulting in no value reported
2. High Minority Population defined as a census tract with a Non-White population over 50%
3. High Poverty Population defined as a census tract with a percent poverty population greater than the percent poverty population for the municipality in which it is located (Bayonne 15.5%, East Newark 13.3%, Harrison 14.4%, Kearny 11.6%, Newark 29.1%)

Table 11: Environmental Justice Populations in the Study Area, Hudson County

COUNTY	MUNICIPALITY	CENSUS TRACT	TOTAL POPULATION	MINORITY PERSONS	PERCENT MINORITY	PERCENT BELOW POVERTY LEVEL	HIGH MINORITY POPULATION	HIGH POVERTY POPULATION
Hudson	Jersey City	40	5485	4396	80.15%	12.1%	Yes	No
Hudson	Jersey City	48	4257	3284	77.14%	15.7%	Yes	No
Hudson	Jersey City	54	7226	5823	80.58%	5.6%	Yes	No
Hudson	Jersey City	69	44	21	47.73%	63.6%	No	Yes
Hudson	Bayonne	101	5915	2188	36.99%	17.2%	No	Yes
Hudson	Kearny	127	6035	2130	35.29%	9.8%	No	No
Hudson	Kearny	128	4230	1685	39.83%	8.7%	No	No
Hudson	East Newark	134	2717	1166	42.91%	13.3%	No	Yes
Hudson	Harrison	137	2492	1246	50.00%	9.4%	Yes	No
Hudson	Harrison	138	2285	1335	58.42%	10.6%	Yes	No
Hudson	Harrison	139	2880	1568	54.44%	12.3%	Yes	No

Source: American Community Survey 2016

Notes: 1. N/A represents a lack of data reported in ACS 2016 resulting in no value reported
2. High Minority Population defined as a census tract with a Non-White population over 50%
3. High Poverty Population defined as a census tract with a percent poverty population greater than the percent poverty population for the municipality in which it is located (Bayonne 15.5%, East Newark 13.3%, Harrison 14.4%, Kearny 11.6%, Newark 29.1%)

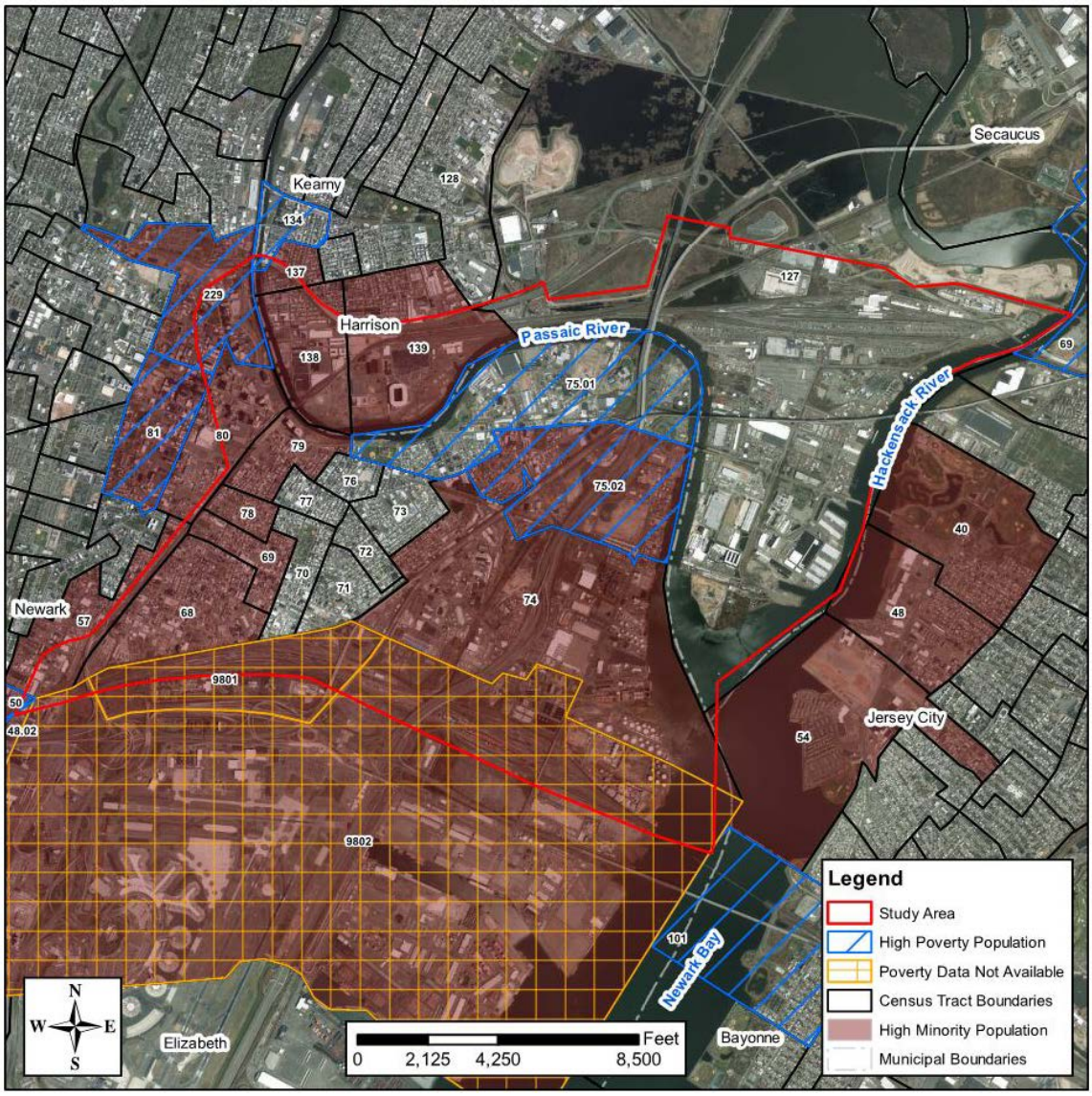

Figure 9: Environmental Justice (High Poverty and Minority) Populations

3.7 Coastal Zone Management

Pursuant to the Coastal Zone Management (CZM) Act of 1972 and the Coastal Zone Reauthorization Act Amendments of 1990, New Jersey has defined its coastal zone boundaries and developed legislation and policies to regulate resource protection and land use within the designated coastal zone. The NJDEP regulates the use and development of coastal resources under the Coastal Area Facility Review Act New Jersey Statute Annotated (N.J.S.A. 13:19-1 et seq.), the Wetlands Act of 1970 (N.J.S.A. 13:19-1 et seq.), and the Waterfront Development Law (N.J.S.A. 12:5-1 et seq.). Implementing policies and permit requirements for these coastal areas are presented in the CZM Rules at N.J.A.C. 7:7 (last amended on July 6, 2015). Each of these acts provides a slightly different definition of the coastal zone; therefore, the designated coastal zone consists of the cumulative total of these three definitions.

Portions of the study area are within the Waterfront Development Law regulated area, including upland and in-water Waterfront Coastal areas. There are no areas regulated under the Wetlands Act of 1970 or Coastal Area Facility Review Act in the study area. Although tidally influenced wetlands are present, these areas are not regulated pursuant to the Wetlands Act, which only pertains to wetlands mapped by the NJDEP in response to enactment of the Wetlands Act. Tidal wetland mapping by the NJDEP does not extend north of the south bank of the Raritan River, which is south of the study area.

Coastal areas defined in and regulated by the Waterfront Development Law includes tidal waters up to the mean high water (MHW) line and lands adjacent to tidal waters, extending from the MHW line to the first paved public road, railroad, or surveyable property line, to a maximum distance of 500 ft.

3.8 Vegetation

The study area is largely developed with commercial, industrial, and residential land uses where vegetation is limited to disturbance tolerant species that are typical of an urban/industrial setting. Vegetated areas are limited to maintained transportation corridors, lawns, and parks. These vegetative communities have been degraded as a result of centuries of anthropogenic disturbance. The wetland and upland habitats that comprise these communities are described below.

3.8.1 Upland Habitat

The upland communities within the study area are generally located in vegetated vacant lots, vegetated railroad corridors, and maintained lawns and parkland. Disturbed successional fields with early successional and invasive species dominate the undeveloped portions of the study area. Vegetation in these lots consists of mugwort (*Artemisia vulgaris*), English plantain (*Plantago lanceolata*), goldenrod (*Solidago* spp.), eastern cottonwood (*Populus deltoides*), tree of heaven (*Ailanthus altissima*), crown vetch (*Securigera varia*), garlic mustard (*Alliaria petiolata*), common mullein (*Verbascum thapsus*), downy brome grass (*Bromus tectorum*), and bedstraw (*Galium spp.*). Wooded uplands occur along riverbanks, including the southern shore of the Passaic River, the Turnpike Crossing along Raymond Boulevard, and on the northwestern shoreline of Kearny Point. Open spaces serving as parkland contain large areas of mowed lawn and ornamental shrubs, often with trees along the perimeter.

The NJDEP regulated riparian zone extends 50 feet from each riverbank and streambank within the study area. Vegetated areas within the riparian zone would require mitigation for permanent and temporary impacts resulting from clearing. Mitigation will be conducted in accordance with applicable rules and permit conditions and in cooperation with the appropriate agencies.

3.8.2 Wetlands Habitat

Human-induced alterations, including dredging and filling, have modified most of the wetlands within the study area. Extensive residential, commercial, and industrial development is built upon wetlands that were filled prior to the enactment of the Clean Water Act. Development encroaches into the edges of wetlands currently present in the study area. These alterations have created areas of hydrologic obstruction and the segregation of historically contiguous wetlands.

A desktop assessment of wetlands within the Study Area was completed using wetland data available from NJDEP and the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) (Figure 10). These map products are developed through interpretation of aerial photographs and presence of hydric soils and are not field verified, but they provide the general location of wetlands. The NJDEP and NWI maps indicate that wetlands may be present within the southern portion of the Study Area. The wetlands are identified as palustrine emergent wetlands by NJDEP and estuarine and marine deepwater in the NWI. NWI and NJDEP wetlands and their classifications are outlined in Table 12.

All wetlands in the study area are regulated by NJDEP under the New Jersey Freshwater Wetlands Protection Act. In addition, the tidal wetlands are under the jurisdiction of the USACE under Section 404 of the Clean Water Act. The USACE may also assert jurisdiction over non-tidal wetlands within 1,000 feet of MHW, as well as wetlands further landward impacted by the Recommended Plan. Impacts to regulated wetlands would require compensatory mitigation. Mitigation will be conducted in accordance with applicable rules and permit conditions and in cooperation with the appropriate agencies.

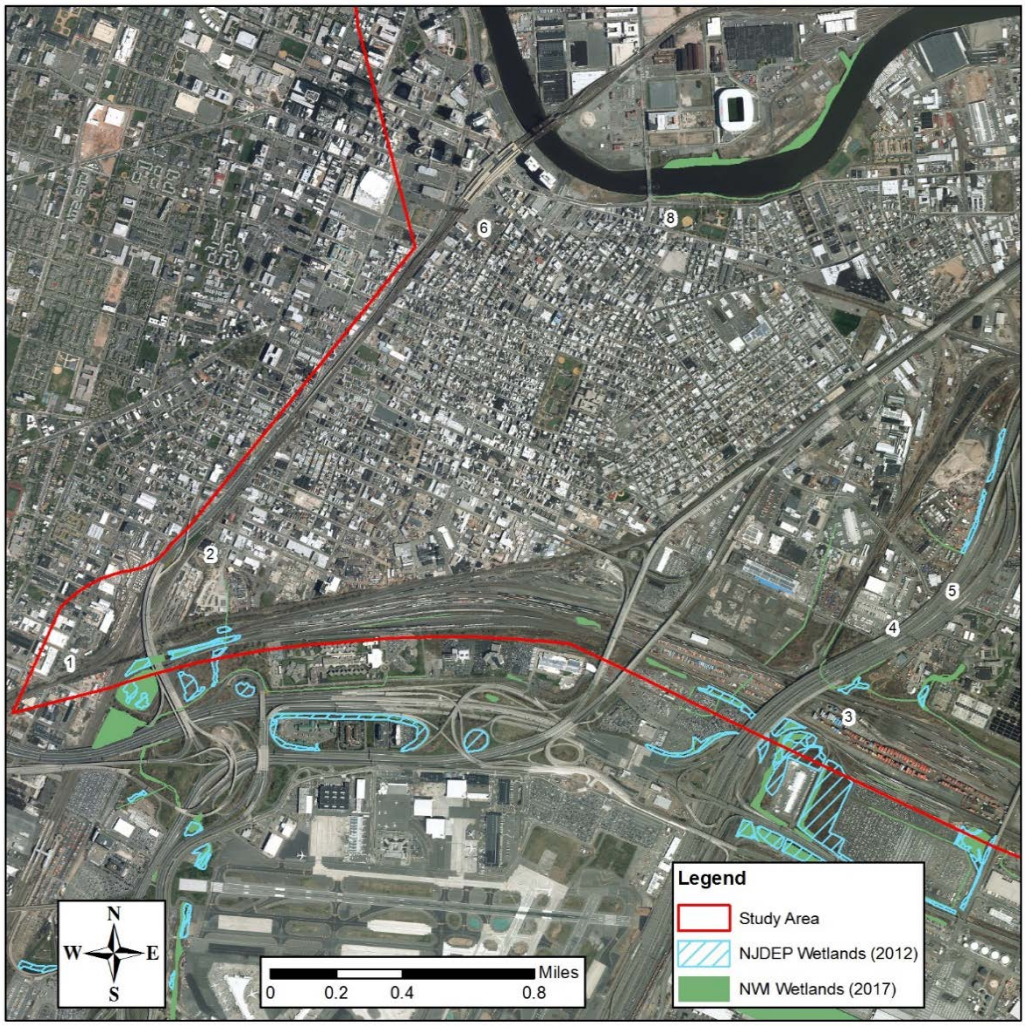

Figure 10: Wetlands within the Study Area

Table 12: NJDEP and NWI Wetlands Mapped within the Study Area

NJDEP WETLAND CLASSIFICATION	NWI WETLANDS CLASSIFICATION
PEM1B: Palustrine, Emergent, Persistent, Saturated	E1UBLx: Estuarine, Subtidal, Unconsolidated bottom, Subtidal, Excavated

3.9 Fish and Wildlife Resources

3.9.1 Shellfish

Historic overharvesting, loss of habitat and pollution have had substantial impacts on shellfish populations within Newark Bay and its tributaries. Historically, the Passaic River has had shellfish populations that included Eastern oysters (*Crassostrea virginica*), various clam and mussel species, shrimp and crabs (Iannuzzi and Ludwig 2004). Today, there are no commercial shellfish populations located in the Passaic River. Soft-shell clams (*Mya arenaria*) and blue mussels (*Mytilus edulis*) were reported in small numbers during a USACE benthic community survey that took place in Newark Bay in 2005 and 2013 (USACE 2014). Few blue crabs were also collected during USACE fish surveys in nearby Newark Bay near the confluence of the Passaic River (USACE, 2011, 2015). Little information is available on Hackensack River shellfish, however, due to the close proximity and similar conditions to Newark Bay and the Lower Passaic River, a similar community would be found.

3.9.2 Finfish

Aquatic habitats such as tidal rivers, creeks, and marshes with intertidal mudflats and subtidal shallows occurring in the study area represent those typically encountered in mid-Atlantic estuaries. Typically, these habitats serve as a nursery area for early life stages of both resident and transient estuarine/marine species, and provide spawning habitat for freshwater and anadromous fish populations. The Study Area is a high density urban and industrial estuary with hardened shorelines that limit natural shallow and vegetated estuarine habitats that serve early life stages of fish populations.

Characteristic finfish found in the Passaic River include the American shad (*Alosa sapidissima*), gizzard shad (*Dorosoma cepedianum*), Atlantic menhaden (*Brevoortia tyrannus*), mummichog (*Fundulus heteroclitus*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), brown bullhead (*Ameiurus nebulosus*), striped bass (*Morone saxatilis*), and silversides (*Menidia* spp.), as well as alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring, and bluefish (*Pomatomus saltatrix*) and winter founder (*Pseudopleuronectes americanus*) which are managed fish species. Diversity and abundance of fish in the lower Passaic River is low relative to species reported in other New York/New Jersey estuaries (Iannuzzi and Ludwig 2004).

A number of aquatic species surveys have been completed in the Passaic and Hackensack Rivers and Newark Bay. A survey of aquatic species within the lower Passaic River was conducted during 1999 and 2000. A total of 22 fish species and blue crab were collected during the survey. Six species made up 98% of the total catch with mummichog comprising more than 75% of the total catch (Iannuzzi and Ludwig, 2004). In a comparative study that took place in 1987-1988 and 2001-2003, the New Jersey Meadowlands Commission in association with the Meadowlands

Environmental Research Institute documented the finfish population of the Hackensack River. White perch, mummichog, and Atlantic silverside (*Menidia menidia*) made up more than 80% of the total catch during the 2001-2003 study, compared to mummichog alone comprising approximately 85% of the catch in 1987-1988.

The U. S. Army Corps of Engineers also conducted a number of fish surveys in Newark Bay. A bottom trawl survey of aquatic species within Newark Bay was conducted from 1998 through 2010 (USACE 2011). A total of 53 fish species and blue crab were captured during the survey. Five species made up 94% of the total catch. These species included white perch, bay anchovy (*Anchoa mitchilli*), Atlantic herring, striped bass, and spotted hake (*Urophycis regia*). A mid-water trawl survey of aquatic species within Newark Bay was conducted in 2006 and 2011 (USACE 2015). A total of 41 fish species and blue crab were captured during the survey. Five species made up 96% of the collections with bay anchovy (*Anchoa mitchilli*) making up 81% of the total catch. Other abundant species include alewife, blueback herring, and gizzard shad. The ten most abundant species captured during these surveys are outlined in Table 13.

Table 13: Ten Most Abundant Species Captured during Surveys in or Near the Study Area

COMMON NAME	SCIENTIFIC NAME	LOWER PASSAIC RIVER	NEWARK BAY – BOTTOM TRAWLS	NEWARK BAY – MIDWATER TRAWLS	HACKENSACK RIVER
Alewife	*Alosa pseudoharengus*		X	X	
American eel	*Anguilla rostrata*	X			
Atlantic herring	*Clupea harengus*		X	X	
Atlantic menhaden	*Brevoortia tyrannus*	X		X	X
Atlantic silverside	*Menidia menidia*				X
Atlantic tomcod	*Microgadus tomcod*		X		
Bay anchovy	*Anchoa mitchilli*		X	X	
Blueback herring	*Alosa aestivalis*	X	X	X	X
Bluefish	*Pomatomus saltatrix*	X		X	
Brown bullhead	*Ameiurus nebulosus*				X
Butterfish	*Peprilus triacanthus*			X	
Common carp	*Cyprinus carpio*	X			
Gizzard shad	*Dorosoma cepedianum*	X		X	X
Inland silverside	*Menidia beryllina*	X			X
Mummichog	*Fundulus heteroclitus*	X			X
Red hake	*Urophycis chuss*		X		
Spotted hake	*Urophycis regia*		X		
Striped anchovy	*Anchoa hepsetus*			X	
Striped bass	*Morone saxatilis*	X	X		X
Striped killifish	*Fundulus majalis*				X
Weakfish	*Cynoscion regalis*			X	
White perch	*Morone americana*	X	X		X
Winter flounder	*Pseudopleuronectes americanus*		X		

Managed fish species are protected under the Magnuson-Stevens Fishery Management and Conservation Act (1996, as amended). In accordance with this Act, the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, and the National Marine Fisheries Service (NMFS) have compiled and assigned Essential Fish Habitat (EFH) designations for species and life stages of fish, shellfish,

and mollusks in the Passaic River/Newark Bay area. Consultation with NMFS is currently ongoing. An EFH Assessment Worksheet has been completed and is provided in Appendix C.

3.9.3 Benthic Resources

Benthic invertebrate taxa abundance and richness within the study area appears to be relatively low in comparison to other New York/New Jersey Harbor areas (e.g., Arthur Kill, Kill van Kull, Ambrose Channel) based on surveys conducted during 2005 and 2013 in Newark Bay (USACE 2014). Benthic macroinvertebrates found in the Passaic River, Hackensack River and the unnamed tributary to Jasper Creek would be expected to include various pollution-tolerant species of annelids, arthropods, and mollusks. Lower abundance and overall taxa richness would likely be due to a number of factors which include sediment type (silt and fine sand), low dissolved oxygen levels, and high ammonia/sulfide levels, lack of hard substrates and submerged aquatic vegetation, as well as high contamination levels within the substrates (mercury, Polychlorinated Biphenyls [PCBs], dioxins) found in Newark Bay and the Passaic River.

3.9.4 Reptiles and Amphibians

Reptiles and amphibians occupy a wide diversity of habitats during their lifecycle, including vegetated uplands, permanently and seasonally flooded vegetated wetlands, and open water. Seventy-one species of reptiles and amphibians may occur in New Jersey (NJDEP 2016). A study was completed in the nearby Newark Bay area located to the south of the study area, identifying the presence of 17 species of reptiles and amphibians (USACE 1997). Based on existing conditions, available habitat and previous studies conducted in the vicinity, it is estimated that seven reptile and two amphibian species may occur within the Study Area. A list of species expected within the Study Area is provided in Table 14.

The species identified may utilize vegetated habitat found along the banks of the Passaic River or brackish waters found in the Study Area. These species are common and tolerant of disturbance. The diamondback terrapin is typically found in brackish waters and is listed in the State of New Jersey as a species of special concern. Although not identified within the vicinity of the Study Area under the NJDEP Landscape, this species is known to inhabit the Hackensack Meadowlands and the lower Hackensack River (Bragin and Wood undated) and may migrate to portions of the Study Area, which contain saline tidal wetlands.

Table 14: Reptiles and Amphibians expected in Study Area

COMMON NAME	SCIENTIFIC NAME
Amphibians	
Red-backed salamander	*Plethodon cinereus*
American toad	*Anaxyrus americanus*
Reptiles	
Northern brown snake	*Storeria dekayi*
Eastern black racer	*Coluber constrictor*
Common garter snake	*Thamnophis sirtalis*
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Diamondback terrapin	*Malaclemys terrapin*
Eastern fence lizard	*Sceloporus undulatus*

3.9.1 Birds

Seasonal bird surveys conducted on the lower Passaic River in 1999 and 2000 reported 48 species of birds (Table 15), 19 of which are strictly terrestrial (Iannuzzi and Ludwig 2004).

Gulls are the most abundant species, followed by common ducks and swallows (Iannuzzi and Ludwig 2004). Other aquatic birds that may forage along the shorelines of the rivers or on mudflats in the Study Area include the double-crested cormorant, herons, and egrets (Iannuzzi and Ludwig 2004).

Table 15: Birds Occurring Along the Lower Passaic River

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Double-crested cormorant	*Phalacrocorax auritus*	Canada goose	*Branta canadensis*
Great egret	*Ardea alba*	Common merganser	*Mergus merganser*
Snowy egret	*Egretta thula*	American black duck	*Anas rubripes*
Black-crowned night-heron	*Nycticorax nycticorax*	Wood duck	*Aix sponsa*
Great blue heron	*Ardea herodias*	Mallard	*Anas platyrhynchos*
Green heron	*Butorides virescens*	Black scoter	*Melanitta nigra*
Little blue heron	*Egretta caerulea*	Osprey	*Pandion haliaetus*
White-winged scoter	*Melanitta fusca*	Belted kingfisher	*Ceryle alcyon*
Peregrine falcon	*Falco peregrinus*	Eastern kingbird	*Tyrannus*
Red-tailed hawk	*Buteo jamaicensis*	Blue Jay	*Cyanocitta cristata*
Killdeer	*Charadrius vociferus*	American crow	*Corvus brachyrhynchos*
Least sandpiper	*Calidris minutilla*	Fish crow	*Corvus ossifragus*
Spotted sandpiper	*Actitis macularia*	Barn swallow	*Hirundo rustica*
Greater yellowlegs	*Tringa melanoleuca*	Northern rough-winged swallow	*Stelgidopteryx serripennis*
Lesser yellowlegs	*Tringa flavipes*	Gray catbird	*Dumetella carolinensis*
Great black-backed Gull	*Larus marinus*	Northern mockingbird	*Mimus polyglottos*
Herring Gull	*Larus argentatus*	European starling	*Sturnus vulgaris*
Laughing gull	*Larus atricilla*	Northern cardinal	*Cardinalis cardinalis*
Ring-billed gull	*Larus delawarensis*	American tree sparrow	*Spizella arborea*
Budgerigar	*Melopsittacus undulatus*	Song sparrow	*Melospiza melodia*
Mourning dove	*Zenaida macroura*	White-throated sparrow	*Zonotrichia albicollis*
Rock dove	*Columba livia*	Red-winged blackbird	*Angelaius phoeniceus*
Common grackle	*Quiscalus quiscula*	House sparrow	*Passer montanus*
American goldfinch	*Carduelis tristis*	House finch	*Carpodacus mexicanus*

Note: Findings based on surveys conducted in 1999 and 2000 (Iannuzzi and Ludwig 2004)

3.9.2 Mammals

Based on the availability and types of habitats present, and previous research completed in the Hackensack Meadowlands located to the north of the study area (Kiviat and MacDonald 2002), approximately 14 species of terrestrial mammals potentially occur within the study area (Table 16). Most of these are common species adapted to living in proximity to human communities, such as the eastern cottontail rabbit (*Sylvilagus floridanus*), eastern chipmunk (*Tamias striatus)*, eastern gray squirrel (*Sciurus carolinensis)*, raccoon (*Procyon lotor*), and Virginia opossum (*Didelphis virginiana*).

Table 16: Common Mammals Found in the Study Area

COMMON NAME	SCIENTIFIC NAME
Eastern cottontail rabbit	*Sylvilagus floridanus*
Eastern chipmunk	*Tamias striatus*
Eastern gray squirrel	*Sciurus carolinensis*
Raccoon	*Procyon lotor*
Virginia opossum	*Didelphis virginiana*
Striped skunk	*Mephitis mephitis*
Norway Rat	*Rattus norvegicus*
House mouse	*Mus musculus*
White-footed mouse	*Peromyscus leucopus*
Meadow vole	*Microtus pennsylvanicus*
Groundhog	*Marmota monax*
Muskrat	*Ondatra zibethicus*
Masked shrew	*Sorex cinereus*
Eastern mole	*Scalopus aquaticus*

3.10 Threatened and Endangered Species

The presence of federally or state listed threatened, endangered and special concern species were evaluated within the study area using the USFWS Information for Planning and Conservation (IPaC) system and the NJDEP Division of Fish and Wildlife Landscape Project (Version 3.1). The findings of this evaluation are provided below. Consultations with USFWS and the New Jersey Natural Heritage Program have been initiated to confirm the presence or absence of the species identified within the study area. Agency consultations are provided in Appendix D.

3.10.1 Federal Species of Concern

Under Section 7(a)(2) of the Federal Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) all federally listed rare, threatened, and endangered species are legally protected (USFWS, 1999). Based on IPaC review, no federally listed endangered or threatened wildlife species have been identified within the boundaries of the study area (USFWS 2016).

Additionally, no federally listed threatened or endangered species are documented as occurring within the study area, per the NJDEP's Landscape Project.

3.10.2 State Species of Concern

State-listed threatened, endangered, and special concern species were evaluated within the study area using NJDEP's Landscape Project (Version 3.1). Based on this evaluation, five threatened, endangered, or special concern species were identified, as listed in Table 17.

Four of the five species listed are wading birds that forage in tidal shallows and ponds. The peregrine falcon (*Falco peregrinus*) nests in urban structures and may forage within the study area.

Table 17: State Listed Species Identified within the Study Area

COMMON NAME	SCIENTIFIC NAME	STATE STATUS
Glossy ibis	*Plegadis falcinellus*	Species of Special Concern
Snowy egret	*Egretta thula*	Species of Special Concern
Little blue heron	*Egretta caerulea*	Species of Special Concern
Black crowned night-heron	*Nycticorax nycticorax*	Threatened
Peregrine falcon	*Falco peregrinus*	Endangered

3.10.3 Designated Critical Habitat

Based upon the IPaC record search, there is no designated critical wildlife habitat present within the study area.

3.11 Cultural Resources

As a Federal Agency, the USACE has certain responsibilities for the identification, protection and preservation of cultural resources that may be located within the Area of Potential Effect (APE) associated with the proposed Passaic Tidal Protection Area (Passaic Tidal or the Undertaking). Present statutes and regulations governing the identification, protection and preservation of these resources include the National Historic Preservation Act of 1966 (NHPA), as amended; the National Environmental Policy Act of 1969; Executive Order 11593; the regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties, August 2004); and the U.S. Army Corps of Engineers Identification and Administration of Cultural Resources (33 CFR 305). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places (NRHP). This work is done in coordination with the New Jersey Historic Preservation Office (NJHPO).

As established by 36 CFR Part 60, an historical property (generally a property over 50 years of age) is eligible for listing in the National Register if it possesses "integrity of location, design, setting, materials, workmanship, feeling, and association," and it meets at least one of four criteria:

A. It is associated with events that have made a significant contribution to the broad patterns of our history; or
B. It is associated with the lives of persons significant in our past; or
C. It embodies the distinctive characteristics of a type, period, or method of construction, or it represents the work of a master, or it possesses high artistic values, or it represents a significant and distinguishable entity whose components may lack distinction; or
D. It has yielded, or may be likely to yield information important in prehistory or history.

Cultural resource work is coordinated with the NJHPO. The Advisory Council on Historic Preservation, federally-recognized Tribes, other interested parties and the public are given opportunities to participate in the process.

3.11.1 Study Method and Area of Potential Effect

The cultural resources investigation for Passaic Tidal has been limited to documentary research, a review of field conditions using on-line imagery and a limited pedestrian survey. Documentary research consisted of gathering existing data from previous cultural resource studies and an examination of existing digital databases held by the NJHPO on NJ-GeoWeb. Limited research into primary materials such as historic maps was undertaken although few published works on county and local histories were consulted at this time. Historical files on historic resources, such as Peddie's Ditch, were examined at the City of Newark Archives. The current study area has considerable overlap with other studies and relevant results from previous work have been integrated into the analyses and conclusions for this report. An initial site assessment and limited windshield survey where properties were visible from public roadways was conducted on 20 May 2016 and 12 July 2017. Google Earth satellite imagery was also used to assess site conditions.

3.11.2 Previous Work

Reports resulting from cultural resources investigations were consulted for information relevant to the current study area. One extensive study that encompassed much of the Passaic Tidal APE was conducted for the City of Newark as part of Combined Sewer Overflow Abatement Project (Richard Grubb & Associates 2000). While covering a very large area this survey was, however, very limited in terms of resources surveyed as it looked primarily at the extant historic sewer system. This work determined that the extant historic sewer systems constitutes an NRHP-eligible property. The researchers documented that the sewers were built almost exclusively of brick but were constructed in different dimensions and configurations including "circular, arch-shaped, U-shaped, horseshoe-shaped, box-shaped, egg-shaped and eye-shaped" (Modica 2007). The predominant shape is egg-shaped. Interestingly, some of the earliest sewer lines were built in the then outskirts of the city where there was no development as real estate interests hoped to encourage settlement by having this infrastructure in place. Mitigation undertaken by the City of Newark for impacts from their project on the sewer system included the public distribution of a publication on the historic sewer system (Modica 2007).

3.11.3 Historic Properties

Above-Ground

Several NRHP-listed or eligible historic districts and individual properties are located within the Study Area. These consist of: Lehigh Valley Railroad Historic District (LVRR HD) and contributing elements, Pennsylvania Railroad (PRR) New York to Philadelphia HD (now Amtrak's Northeast Corridor), PRR New York Bay Branch HD; LVRR Oak Island Yard HD; Newark Penn Station; Jackson Street Bridge; Riverbank Park and Fieldhouse; Passaic Valley Sewerage Commission Newark Bay Outfall Sewerage Works; Second Reformed Dutch Church and Rectory and the Ironbound Trust Company.

Below Ground

In addition to the NRHP-eligible Newark City Sewer System, other sub-surface resources include the Morris Canal HD, and associated archaeological resources, and the Balbach & Sons Smelting and Refining Works archaeological site (28-Ex-129).

Potential archaeological resources that may be encountered include sections of the Morris Canal, railroad features such as embankments, Peddie's Ditch, remains of the 19th-century Robinson & Roders Company factory, and the Balbach & Sons Smelting and Refining Works archaeological site (28-Ex-129).

3.12 Air Quality

Emissions from the project are associated with non-road construction equipment working on the site and on-road trucks moving on public roads to and from the project site. Emissions from these two source categories, primarily generated from their diesel engines, include NO_x, VOCs, SO^2, CO, and PM2.5. Emissions from federal actions, such as the proposed project, are regulated under 40 CFR §93 Subpart B General Conformity, which aims to ensure that emissions from federal actions to not impede a state's progress toward achieving or maintaining compliance with National Ambient Air Quality Standards under their applicable State Implementation Plan. Fugitive dust on the worksite can potentially be generated due to trucks and equipment moving on unpaved surfaces, but can be significantly reduced through the use of best management practices relating to site work dust mitigation.

The City of Newark, particularly the Ironbound neighborhood, has been impacted by polluting facilities and air pollutants from one of the country's largest seaports, an international airport, and a numerous heavily used commercial and passenger rail lines. Newark is also home to the largest trash incinerator in the northeast, which also contributes to the area pollution. It has been estimated that approximately 7,000 trucks make about 10,000 trips per day. As a result, Newark residents suffer from cancer risk due to diesel emissions and asthma. With an asthma rate of 25%, Newark school children have double the New Jersey State and the nation average rates (Mazzola, 2015). The USEPA has been working with the city to monitor and track air quality environmental impacts on the community.

3.13 Noise

The adjusted noise metric that most closely duplicates human perception of noise is known as the A-weighted decibel (dBA). Community noise levels in urban areas usually range between 45 dBA and 85 dBA with 45 dBA being the approximate daytime noise level in a typical quiet living room and 85 dBA being the approximate daytime noise level near a sidewalk adjacent to

heavy traffic. The study area contains commercial, industrial, and transportation/utility land uses, and with public open space contributing to noise levels.

The primary source of noise in the study area is from vehicular traffic on state and local roadways and the New Jersey Turnpike; New Jersey Transit passenger rail traffic; CSX Intermodal Terminals and freight rail traffic; and commercial aircraft accessing Newark International Airport. Based on the land uses and identified noise sources typical noise levels in this area can be expected to be in the range of 60 to 80 dBA (USEPA 1978). However, noise levels greater than 80 dBA are also likely to occur given the presence of passenger rail and freight traffic near the Study Area, and aircraft associated with the airport.

The New Jersey statewide noise control code (N.J.A.C. 7:29) does not regulate noise from construction activities, however, the regulation contains a provision allowing for local municipalities to adopt their own noise control ordinance, provided it's consistent with, or more stringent than, N.J.A.C. 7:29.

The Study Area is located in the City of Newark and therefore is subject to comply with the city's local ordinances. Title 20:3-13(g) of the Newark Ordinance prohibits the operation of tools or equipment used in construction, drilling, demolition or similar work between the hours of 8:00 p.m. and 7:00 a.m. on weekdays or Saturday, and at any time on Sunday or legal holidays except for emergency work, or by special variance issued pursuant to the Newark Ordinance, or when the resulting sound level does not exceed the maximum permissible sound levels outlined in Table 18. Table 18 outlines the noise thresholds for the City of Newark as detected at receiving properties generated at adjacent or surrounding residential, commercial, and industrial properties. Because no construction would occur within the Kearny or Jersey City portions of the study area under the Proposed Action, the noise ordinances of those municipalities are not presented herein.

Table 18: Maximum Permissible Sound Levels by Receiving Property

SOUND SOURCE PROPERTY CATEGORY	RECEIVING PROPERTY CATEGORY			
	RESIDENTIAL (7:00 A.M. TO 10:00 P.M.)	RESIDENTIAL (10:00 P.M. TO 7:00 A.M.)	COMMERCIAL (ALL TIMES)	INDUSTRIAL (ALL TIMES)
RESIDENTIAL	55 dBA	50 dBA	65 dBA	75 dBA
COMMERCIAL	65 dBA	50 dBA	65 dBA	75 dBA
INDUSTRIAL	65 dBA	50 dBA	65 dBA	75 dBA

3.14 Recreation

The City of Newark and the Towns of Kearny and Harrison maintain open spaces, town parks, and recreational areas in the study area. The locations of these public spaces are shown on Figure 11 and are described below. There also numerous private playgrounds, baseball fields, basketball courts and pools within the study area. In addition, there are also public access points for small recreational vessels, for boating and fishing, rowing, canoeing, and kayaking. Recreational activities in the study area include field sports, biking, birding, and wildlife observation.

Joseph G. Minish Passaic River Waterfront Park and Historic Area (Minish Park) is located in Newark along the Passaic River from Bridge Street to Brill Street. Following Hurricane Sandy, the District, partnered with the NJDEP and the City of Newark to construct the Minish Park Project. This project has reduced riverbank erosion and created waterfront park development and returned public access to the Passaic River. Phase I has been completed and includes 6,000 feet of new bulkhead, 3,200 feet of restored riverbank and creation of wetlands. Overall, the project has reduced erosion, provided environmental restoration, recreation, and economic development benefits (USACE 2016). As of February 2016, project partners are working towards a project agreement for Phase II/III design and construction. Phases I and II would complement the existing park space by providing stream bank stabilization to the park and furnishing railings along all of the bulkheads. Phase II would add a 9,200 foot waterfront walkway and Phase III would consist of park facilities, plazas, and landscaping, and enables the development of complementary facilities by others, i.e. links to the New Jersey Performing Arts Center and Riverbank Park.

Washington Park is located on Washington Avenue and Washington Place in Newark. This small, triangular park is across the street from the Newark Main Library and a short distance from One Washington Place (where the Rutgers Business School and the Audible Headquarters are housed). The Newark Light Rail also stops here.

Riverfront Park is located along the west ascending bank of the Passaic River at river mile 5.9 in the City of Newark. This 12-acre park in Newark was completed in 2013 with Green Acres and *Hazardous Discharge Site Remediation Fund* funding, and has transformed a former brownfield site/industrial site, into public open space (Trust for Public Land, 2016). The park consists of forested open space plus amenities including a baseball field, two playgrounds, tennis and basketball courts, an open grassy area and a turf soccer field, as well as walking paths and river views (Essex County 2016).

Riverbank Park is located in what is commonly known as the "Ironbound" section of the City of Newark, and also part of Kearny. It sits along the Passaic River and is host to many recreational uses. Riverbank Park is located off Raymond Boulevard, Market, Van Buren, and Somme Streets, within the east side section of Newark. A portion of the park across Raymond Boulevard has 1,000 feet of waterfront access on the Passaic River, and includes land which once held the old Morris Canal. At 11 acres, it is the smallest park in Essex County (Essex County 2016). Riverbank Park was designed by the Olmsted brothers and is listed on both the New Jersey and the National Registers of Historic Places, and a multi-million dollar restoration and upgrade of the park was completed in 2003.

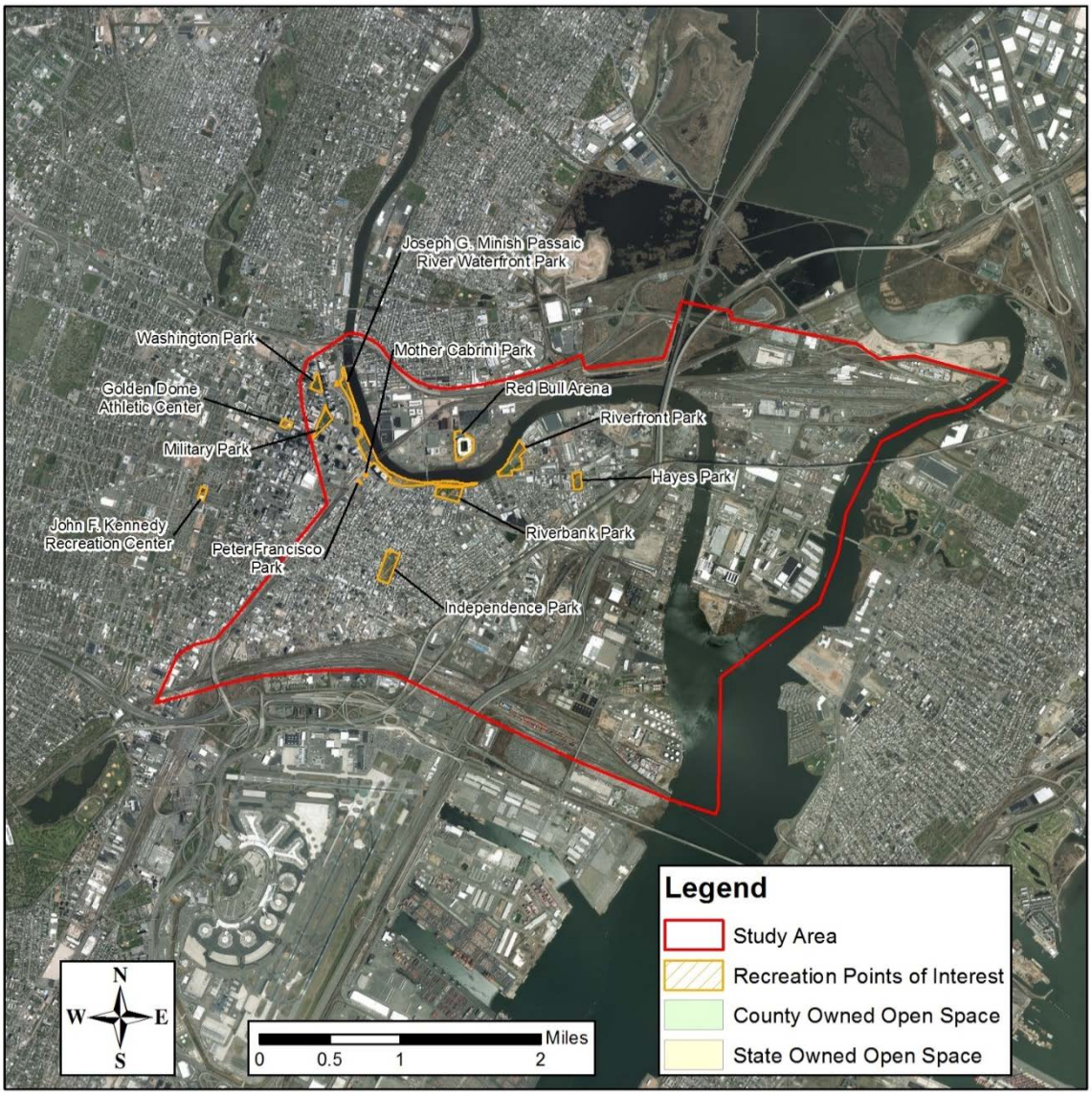

Figure 11: Recreation Facilities Located within the Study Area

Independence Park is located in the Ironbound or "Down Neck" section of Newark. It is bordered by Walnut Street on the north, Oliver Street on the south, and Adams and Van Buren Streets west and east. This 13-acre park was designed by the Olmsted brothers and serves the neighborhood with athletic fields, basketball courts, a playground, and walking paths (Essex County 2016).

Hayes Park on Raymond Boulevard in Newark is a common space in a former industrial neighborhood. It currently consists of open/grass weedy areas with trees around the perimeter. Plans are being developed to improve the park for community use (Heritage Architecture 2016).

Military Park is a historic park that serves as the central downtown gathering space for the Newark community. After many years as an underutilized space, Military Park is now part of Newark's revitalized town square. The park is privately operated and managed by a nonprofit

corporation, the Military Park Partnership. Fitness programs, arts and culture programs, and children's programs are offered at the park, on a weekly basis (Military Park Partnership 2016).

Among the many smaller public parks within the study area are: **Lombardy Park**, a very small triangular lot located off of McCarter Highway; **Peter Francisco Park**, located just outside of Penn Station on Ferry Street in Newark. The park was built in 1966 by the Municipal Council of Newark and contains a 12-feet monument in honor of Peter Francisco, funded by the Portuguese American Community, and **Mother Cabrini Park**, also a small, triangular park located outside of Penn Station Newark, on Commerce Street, named after Saint Francesca Xavier Cabrini.

There are also numerous recreation centers, including **John F. Kennedy Recreation Center**, located on Kinney Street in Newark, and the **Golden Dome Athletic Center**, a stadium located in Rutgers University Newark campus on Warren Street, among other recreation centers and aquatic complexes. Harrison is home to **Red Bull Arena**, a soccer-specific stadium, home of the New York Red Bulls of Major League Soccer and New York Red Bulls II of the United Soccer Leagues.

3.15 Aesthetics and Scenic Resources

The lower Passaic River and Hackensack River are bounded primarily by private property and areas where public access is limited. Land uses immediately surrounding the waterfront are predominantly developed for industrial uses, including shipping and wastewater treatment. Rail, barge, truck, and storage infrastructure also line the waterfront. As such, the majority of the study area currently offers limited aesthetic and scenic resources due to its developed commercial and industrial character. Riverfront and Minish parks are the only public spaces that offer open water views of the lower Passaic River in the study area.

Views from the Passaic River offered to recreational boaters in the study area are primarily industrial development. This is particularly true along the east bank of the Passaic River on Kearny Point between the Passaic and Hackensack rivers, and on the west bank of the Passaic River east of NJ-25/US-1/Lincoln Highway in Newark, where industrial development is heaviest. Riverfront and Minish parks located along the waterfront of the Passaic River in the study area offer views of public open space. Existing industrial complexes, commercial buildings, residences, and other structures serve as sources of light and glare, which are generated from interior and exterior lighting, traffic headlights, street lighting, and reflective surfaces.

There are no designated State Scenic Byways located in the Study Area. In addition, the Passaic and Hackensack Rivers hold no designations as National Wild and Scenic Rivers or American Heritage Rivers.

3.16 Hazardous, Toxic, and Radioactive Waste

3.16.1 City of Newark

Much of the City of Newark, particularly along the Passaic River and along the railroad and highway corridors, has been occupied by industrial sites for nearly 150 years. These sites ranged from heavy industrial uses, including chemical and paint manufacturing, power generating

stations and oil refining and storage, to light manufacturing, and truck/vehicle maintenance areas and transportation hubs.

There are two National Priority List (NPL) Superfund sites, two Superfund sites and one RCRA site within Newark. The NPL Superfund sites include the Diamond Alkali Site,and Pierson's Creek. The Diamond Alkali Site is an Environmental Protection Agency (EPA)-managed site. The EPA constructed an on-site landfill to contain the dioxin impacted soil and debris, which has been capped with an impervious material. In addition to this upland site, the Lower Passaic River Study Area has been identified as part of this site. Dioxin-contaminated sediment was removed from the river adjacent to the upland site and a highly contaminated mudflat on the river's east bank near Lyndhurst, just north of Newark, was also completed. Additional study areas now include Newark Bay and portions of the Hackensack River as well as the Arthur Kill and the Kill Van Kull (EPA 2018).

Chemical manufactures and other industrial operators have been located along Pierson's Creek since the 19th century. Discharges and spills from these industries into the stream have resulted in contamination along the creek and within its sediments (EPA 2018)

The two Superfund sites include the White Chemical Corp site and the Riverside Industrial Park. Mishandling of chemicals led to the contamination of the soil and groundwater at the White Chemical Corp site in the 1980s. All of the buildings, above ground storage tanks and soils were removed and replaced with clean fill. The entire site was covered with stone. Currently there is a plan for the remediation of the groundwater (EPA 2018).

The Riverside Industrial Park site is a former paint and varnish manufacturing facility from which tanks and drums with hazardous liquid and sludge have been removed. Buildings on the site, which are deteriorating, have friable asbestos (EPA 2018).

The RCRA cleanup site is the Terrell Homes site, portions of which were once a part of Barth Smelting Corporation, the last of a series of industries along the Passaic River that processed metals. Elevated levels of lead were found in the soils surrounding the housing complex. Contaminated soil was removed and replaced with clean fill. Other portions of the Barth property have not been remediated (EPA 2018).

The Known Contaminated Sites list, maintained by the NJDEP, list more than 650 active sites for Newark, Kearny and Harrison. These sites include current and former gasoline stations, dry cleaners, machine shops, salvage yards, former manufacturing sites and portions of the railroad. Much of the area, particularly just inland of the river, was former wetlands that were filled in the late 19th and early 20th century to create additional land for the expansion of the region's industrial base.

Figure 12: Location of National Priority List, Superfund, RCRA and other sites 1- Diamond Alkali and the Lower Passaic River (Newark Bay to mile marker 11); 2 –Pierson's Creek; 3-White Chemical Corp; 4-Riverside Industrial Park; 5-Terrel Homes; 6-Diamond Head Oil Refinery; 7-Syncon Resins; and 8-Standard Chlorine Chemical Company.

3.16.2 Town of Harrison

The Diamond Head Oil Refinery Division National Priority List Superfund Site is located in Harrison and consists of an abandoned refinery with tanks and potentially underground pits used to store oily waste.

3.16.3 Town of Kearny

In Kearny, there are two National Priority List Superfund sites. They are the Syncon Resins site and the Standard Chlorine Chemical Company. Syncon Resins manufactured paints, varnishes and resins. The site has soil and groundwater contamination. The Standard Chlorine Chemical Company site has contaminated soils and groundwater. Tanks, drums and contaminated fill not related to the site are also present. Dioxins, dichlorobenzenes, naphthalene, among other semivolatile and volatile compounds have been detected on the site.

3.17 Transportation and Other Infrastructure

The study area is located within the New York metropolitan region with direct access to road, rail, and air networks, and is bounded by Newark Turnpike and Essex Freeway to the north, Interstate 78 to the south, Hackensack River to the east, and McCarter Highway to the west. The majority of roads in the study area are classified as local streets, which primarily function to

provide access to abutting residential, industrial, and commercial properties; however, there is nearby access to major highways, such as U.S. Route 1/9 (US-1/9, NJDOT 2013 Average Annual Daily Traffic (AADT) 77,000), the Essex Freeway (I-280, NJDOT 2015 AADT 74,000), and Interstate 95 (I-95, CBRE Traffic Counts 2011 AADT 177,000). Nine bridges span the Passaic River and five bridges span the Hackensack River within the study area which is served by several transit providers for service throughout much of the state and connection to New York City, including New Jersey Transit Rail Operations (NJTR), New Jersey Transit Bus Operations, Amtrak Northeast Corridor, and PATH. The Newark Pennsylvania Station is a major transit hub located in the vicinity of the study area.

The study area also contains a network of active and inactive commercial freight rail tracks. NJTR owns several lines used for freight, and the main storage and maintenance facility is the Meadows Maintenance Complex in Kearny. CSX owns several rail lines for freight within the study area, and owns the CSX South Kearny Yard in Kearny.

Most of the lower Passaic River within the study area has been deepened as a result of various navigation projects for the purpose of commerce and industry (USACE 2010). The navigation channels of the Passaic River and the Hackensack Rivers connect communities, supporting both commercial and recreational boating.

A wastewater treatment plant, operated by PVSC, is located on the west side of the lower Passaic River at its confluence with Newark Bay. Two power generation plants, Essex Generating Station in Newark and Kearny Generating Station in South Kearny, serve the study area. The City of Newark, which makes up 5.0 miles of the project alignment, is served by a century-old combined sewer system with CSO events (Amar et al. 2014).

Chapter 4: Plan Formulation

4.1 Problem Identification and Opportunities

Problem definition is the detailed description of a problem. It begins with a problem statement, a simple assertion of what the basic problem is.

Problem Statement: The study area experiences damages from flooding due to storm surge caused by coastal storms such as nor'easters, tropical storms, and hurricanes.

Structures and infrastructure in the study area are repeatedly flooded by coastal storms. Major damage is caused by inundation from storm surge. The areas that incur the most repeated damages are within the 1-percent floodplain.

Hurricane Sandy was devastating to the area. In Newark, 266 homes and 10,522 businesses were damaged; Harrison had 100 homes and 536 businesses damaged; and Kearny had 96 homes and 1,484 businesses damaged (O'Dea, 2013). The average damage to homes was $10,600 in Newark, $6,000 in Kearny, and $12,200 in Harrison. There were two Hurricane Sandy-related deaths in the study area; a 47 year old died from drowning and a 65 year old died from acute asthma exacerbation.

Since the inception of the National Flood Insurance Program, almost $53 million in insurance claims have been distributed in the study area (Table 19). Most of these claims were due to damage incurred by coastal storms.

Table 19: FEMA National Flood Insurance Program Claims in Newark, Harrison, and Kearny, 1978 - June 28, 2018

MUNICIPALITY	TOTAL
Newark	$18,131,114
Kearny	$29,426,008
Harrison	$5,358,554
Total	$52,915,676

Source: FEMA (2018) Policy & Claim Statistics for Flood Insurance

There is an opportunity in the study area to reduce the risk of coastal storm flooding to residents, property, and infrastructure. Other opportunities include improving interior drainage (though not a primary project purpose, interior drainage will be managed by proposed project elements such as gates), and increasing or improving recreation and waterfront access.

4.1.1 Future Without-Project Conditions

Under future without-project conditions, the study area will continue to be subject to flooding due to storm surge from coastal storms. Inundation due to storm surge is expected to increase over time due to sea level change.

Sea level is predicted to continue to rise in the study area. Figure 13 shows predicted sea level change scenarios based on long term trends measured in the area over the 50 year planning horizon (2020 – 2070) and the 100 year adaptation horizon (2020 – 2120) at the Sandy Hook NOAA gage, as calculated using procedures in ER 1100-2-8162 (USACE Climate Preparedness and Resilience, 2017). Within the 50 years between 2020 and 2070, the USACE low (historic)

sea level change scenario predicts a 0.64 foot increase, while the USACE intermediate and high sea level change scenarios predict a 1.11 feet and 2.61 feet increase, respectively (Table 20). While the 1-percent storm may be associated with a water surface elevation of approximately 12 feet NAVD88 in 2020, the USACE low sea level change scenario predicts the 1-percent storm will produce a water surface elevation of approximately 12.7 feet NAVD88 in 2070 (Table 21).

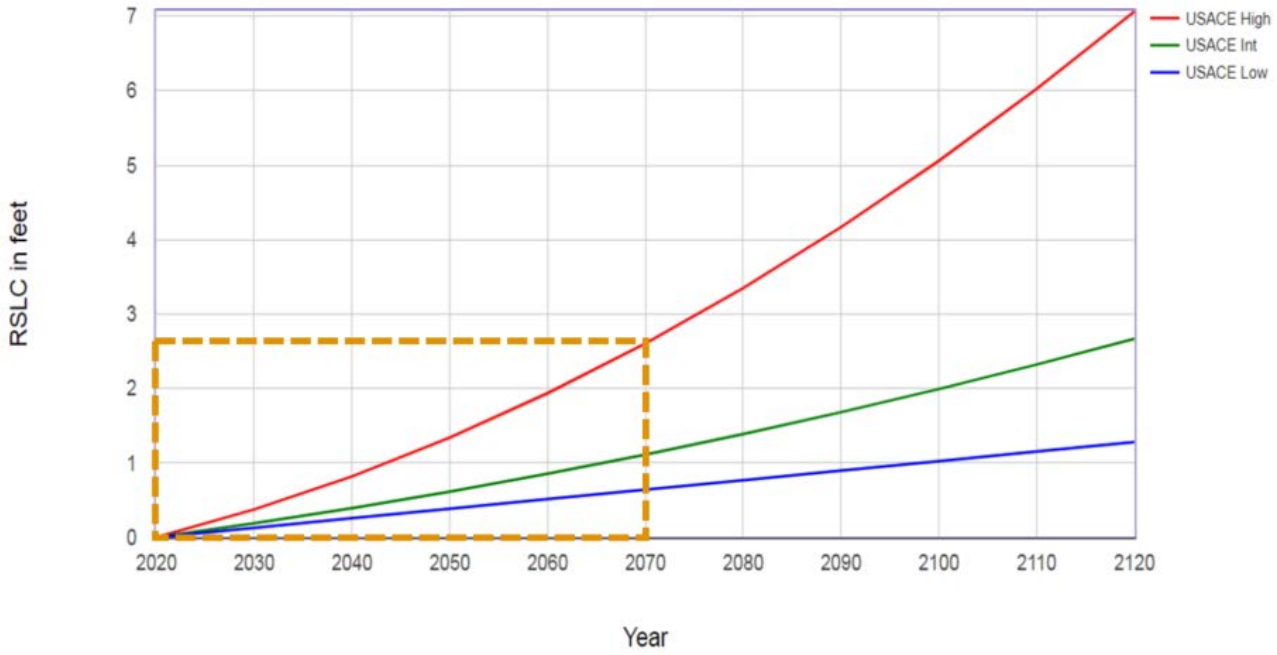

Figure 13: Estimated Relative Sea level Change Projections from 2020 to 2120 The dashed line represents the 50 year study horizon. (Sandy Hook, NJ, USACE Climate Preparedness and Resilience)

Table 20: Projected Sea Level Change from 2020 to 2120, Gauge 8531680, Sandy Hook, NJ

YEAR	SEA LEVEL CHANGE SCENARIO		
	HISTORIC "LOW"	CURVE I "INTERMEDIATE"	CURVE III "HIGH"
2020	0	0	0
2030	0.13	0.19	0.37
2040	0.26	0.39	0.82
2050	0.38	0.61	1.34
2060	0.51	0.85	1.94
2070	0.64	1.11	2.61
2080	0.77	1.39	3.35
2090	0.9	1.68	4.17
2100	1.02	1.99	5.06
2110	1.15	2.32	6.02
2120	1.28	2.67	7.06

Table 21: NACCS Stillwater Elevation - Stage versus Frequency for 2020 and 2070
**The 2070 values reflect the USACE "intermediate" rate scenario*

AVERAGE FREQUENCY	ANNUAL RECURRENCE INTERVAL (frequency)	WATER LEVELS [FEET NAVD88]	
		2020	2070*
100%	1-year	5.4	6.5
50%	2-year	6.2	7.3
20%	5-year	7.4	8.5
10%	10-year	8.3	9.4
5%	20-year	9.6	10.7
2%	50-year	10.8	11.9
1%	100-year	12.1	13.2
0.5%	250-year	13.7	14.8
0.2%	500-year	15.0	16.1

It is expected that structures will be damaged more frequently and severely in the future due to increased water levels from predicted sea level rise in the study area. The study team has completed a structure inventory from which data will be used with the certified Hydrologic Engineering Center's Flood Damage Analysis, Version 1.4.1, economic model (HEC-FDA) and appropriate depth-damage curves to estimate economic damages. HEC-FDA incorporates risk and uncertainty associated with critical parameters in the computation of flood damages in accordance with current Corps policies. Equivalent annual damages over the 50-year period of

analysis are presented in a similar format in Table 22. The without-project equivalent annual damage due to flood inundation of structures and motor vehicles in the study area is approximately $97.7 million (FY19 price levels).

Table 22: Summary of Equivalent Annual Without-Project Damages

REACH	DAMAGE CATEGORIES							TOTAL EQUIVALENT ANNUAL
	APART-MENT	COMMERCIAL	INDUSTRIAL	MUNICIPAL	RESIDENT-IAL	VEHICLES	DEBRIS	
HARRISON 1	$231,000	$2,845,000	$4,726,000	$60,000	$1,283,000	$161,000	$95,000	$9,400,000
HARRISON 2	$0	$741,000	$1,102,000	$0	$0	$0	$21,000	$1,864,000
KEARNY	$0	$6,105,000	$26,422,000	$5,604,000	$0	$0	$474,000	$38,605,000
NEWARK	$381,000	$9,074,000	$16,246,000	$3,639,000	$1,218,000	$135,000	$347,000	$31,039,000
MINISH PARK	$501,000	$2,122,000	$304,000	$324,000	$1,880,000	$156,000	$17,000	$5,304,000
NEWARK FLANKING	$517,000	$4,207,000	$2,027,000	$646,000	$2,177,000	$147,000	$55,000	$9,776,000
NEWARK GAP	$48,000	$976,000	$141,000	$5,000	$555,000	$24,000	$5,000	$1,754,000
TOTALS	**$1,678,000**	**$26,070,000**	**$50,968,000**	**$10,277,000**	**$7,113,000**	**$622,000**	**$1,014,000**	**$97,742,000**

Price Level: FY19, Discount Rate 2.875%

The study area is predominantly an urban environment, with limited natural resources interspersed amongst the development. These remnant natural areas, such as wetlands and vegetated uplands that provide wildlife habitat, would also be subject to sea level change. There are few locations where these areas can naturally migrate landward to higher ground due to the proximity of development. As sea level rise results in inundation of these natural resource areas under the without-project future condition, the natural resource areas can be expected to be scarcer than at present. Detailed assessments of potential impacts to all environmental resources in the future-without project scenario, including the natural (e.g., aquatic species), physical (e.g., water quality) and human environment (e.g., recreation), are presented in Chapter 6 (Environmental Impacts of the Recommended Plan) of this report under the No Action Alternative discussion for each environmental topic.

4.2 Planning Goal & Objectives

A study goal is the overarching intent of the project and is based on problems and opportunities. The study goal is developed to help create and evaluate alternative plans. The period of analysis for this study is 2020 to 2070.

Project Goal: Reduce the risk of storm surge flooding and associated damages in the study area

Study Goal: Determine if the previously authorized or newly developed coastal storm risk management projects are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in the Passaic River Tidal Protection Area in Newark, Harrison, and Kearny, NJ.

Plans are formulated to achieve planning objectives. Planning objectives and constraints are inexorably linked to problems and opportunities. A planning objective states the intended purposes of the planning process and is a statement of what solutions should try to achieve. Objectives provide a clear statement of the study purpose. In support of the goal, the planning objectives are to:

- Reduce the risk of damages due to storm surge in the study area through the period of analysis.
- Support community resilience and cohesion in the study area through the period of analysis.

4.3 Planning Constraints, Considerations, and Key Uncertainties

Constraints are restrictions that limit the extent of the planning process. They can be divided into universal constraints and study-specific constraints. Universal planning constraints are the legal and policy constraints to be included in every planning study. Study-specific planning constraints are statements of things unique to a specific planning study that alternative plans should avoid. Only study-specific constraints are included below. Constraints are designed to avoid undesirable changes between without- and with-project conditions. Uncertainties will also be taken into consideration when formulating plans.

Study-specific constraints include:

- Maintain current and planned waterfront uses: The waterfront is entirely developed, mostly with industrial infrastructure related to manufacturing and shipping (barges, rail infrastructure, trucks, etc.). The area immediately upstream and downstream of the Jackson Avenue Bridge consists of parkland, including Minish Park and Riverfront Park. The largest park, Riverfront Park, is an important open space and recreational facility in downtown Newark and, as of the release of this report, is currently being expanded. A coastal storm risk management project cannot greatly impact this existing and planned waterfront infrastructure.
- Minimize impacts to resilience projects: federal, state, and local governments, as well as businesses and homeowners, have heavily invested in post-storm recovery projects in the study area. The project should not compromise the function of existing or planned and funded resilience projects.
- Minimize impacts to current and planned development: The study area is a densely-developed urban environment. The City of Newark is the second largest city in the New York Metropolitan Area. The study team will consider current and planned development, specifically when investigating potential alternations to the 1987 authorized floodwall and levee alignment.

Planning Considerations and Key Uncertainties:

- Location and extent of contaminated sites: Risk and uncertainties of encountering Hazardous, Toxic and Radioactive Waste (HTRW) is high within the study area, especially located along the Passaic River, given this area's heavy industrialized use over the past 150 years. There are many contaminated sites of concern that have been identified by the USEPA and NJDEP. These include sites containing elevated levels of mercury, dioxins, lead, and other industrial contaminants. USACE worked with USEPA, NJDEP, and others to identify the extent and status of remediation for all known contaminated sites that may be remediated under the authority of the CERCLA (Superfund), Resource Conservation and Recovery Act, and other laws. Different levels of remediation have occurred within portions of the study area to permit limited use by others. Based on coordination to date, there are no upland sites with known or likely contamination that are scheduled for remediation. One site has been remediated with the removal and capping of a less than a foot of soil; no other work is planned. Contamination within the project area must to be addressed before construction of the recommended plan can begin. In formulating alternative plans to the authorized project, the location of known HTRW sites is taken into consideration.
- Current and projected land use changes, resilience projects, and other development: The U.S. Federal Emergency Management Agency, U.S. Department of Housing and Urban Development and other agencies are investing hundreds of millions of dollars to increase storm resilience in the study area. In addition, major public and private developments are currently being planned and constructed. The study team coordinated with federal, state, and local agencies and stakeholders about the scope of their plans so significant changes are included in the future without-project condition to accurately account for costs and benefits.
- Interior drainage: Risk management areas behind floodwalls/levees are subject to interior flooding from stormwater runoff. The level and extent of interior drainage challenges are largely complex and unknown. It is important to develop an understanding of whether there is a relationship between interior surface runoff and exterior tidal events in both the with- and without-project conditions. A correlation analysis was performed to better understand the relationship between the interior and exterior stage conditions, which included a data analysis of the correlation, dependence, and coincidence of the interior and exterior stage relationship. The detailed interior drainage analysis can be found in Appendix F (Hydrology and Hydraulics).
- Potential impact of CSOs on interior drainage: There are many CSOs in the study area. The study team worked with local and state agencies to identify the location and capacity of CSOs, and how they affect local drainage patterns. This information is considered when considering potential ponding areas, pump station locations, and other interior drainage features.
- Climate and sea level change: As described in Section 4.1.1, while sea levels are expected to change, the rate at which they will rise is uncertain. For example, the 1-percent storm event in 2020 is associated with a 12.1 feet NAVD88 water surface elevation; this is expected to increase to 13.2 feet NAVD88 by 2070 under the USACE

"intermediate" rate sea level change scenario. Sea levels affect the design height performance and reliability of project alternatives.

4.4 Developing the Focused Array of Alternatives

The plan formulation approach for this coastal storm risk management feasibility study is to evaluate the 1987 authorized floodwall and levee alignment at three heights to include the authorized alignment elevation (13.8 feet NAVD88) and the authorized height plus two and four feet. Due to updated science and engineering standards and changes in study area conditions since 1987, the team assumed that realignment of the authorized project is likely to occur.

The dimensions of the 1987 authorized plan, adjusted by the 1995 General Design Memorandum, are presented in Table 23.

Table 23: Dimensions of the 1987 Authorized Alignment as Presented in the 1995 GDM

SEGMENT	LEVEE			FLOODWALL	
	AVERAGE HEIGHT* [FT]	AVERAGE BASE [FT]	LENGTH [FT]	AVERAGE HEIGHT* [FT]	LENGTH [FT]
Kearny Point	5.2	41	3,908	7.4	33,771
Lister/Turnpike/Doremus	5.5	44	5,599	8.1	17,657
South First Street	6.5	50	1,750	6.2	5,700

*Note: Height refers to height of the levee/floodwall that can be seen above ground

In consideration of study area changes and in order to avoid constraints, the alternatives developed for analysis differ slightly from the 1987 authorized alignment. The following changes to the authorized alignment were made to develop the new alternatives:

- The Harrison 2 floodwalls were added based on low ground elevations identified using updated topography.
- The floodwall near the Passaic Valley Sewerage Commission wastewater treatment plant was removed because the facility is building its own floodwall to 19 feet NAVD88 that this study's alternative alignments can tie into.
- In-water gates were replaced with on-land gates because it is simpler to build, operate, and maintain on-land gates.
- A floodwall near Minish Park was added to address newly identified low elevations found with updated topography.
- The Newark Flanking features were added to address newly identified low elevations and flood paths found with updated topography and hydrodynamic modeling.
- Levees were removed from consideration and replaced with floodwalls because HTRW may be encountered in the study area and floodwalls have a smaller footprint than levees; the smaller footprint can decrease the amount of remediation that may be needed. Additionally, the project area is highly urbanized and floodwalls take up less space.

The resulting focused array of alternatives includes the following three heights based on the authorized levee and floodwall project:

- 14 feet NAVD88 (height of the authorized project), about 14.8 miles long
- 16 feet NAVD88 (authorized height +2 feet), about 15 miles long
- 18 feet NAVD88 (authorized height +4 feet), about 15.6 miles long

The focused array of alternatives are represented in Figure 14. The red lines identify the 14 feet NAVD88 alignment alternative. The blue lines show the additional length that would need to be added to the 14 feet NAVD88 alignment to tie into ground that has an elevation of 16-feet NAVD88; for the 16 feet NAVD88 alternative, the red and blue lines would have an elevation of 16 feet NAVD88. The yellow line represents the additional length that would need to be added to the 16 feet NAVD88 alignment to tie into ground that has an elevation of 18 feet NAVD88; for the 18 feet NAVD88 alternative, the red, blue, and yellow lines would have an elevation of 18 feet NAVD88. The estimated costs associated with the focused array of alternatives is shown in Table 24.

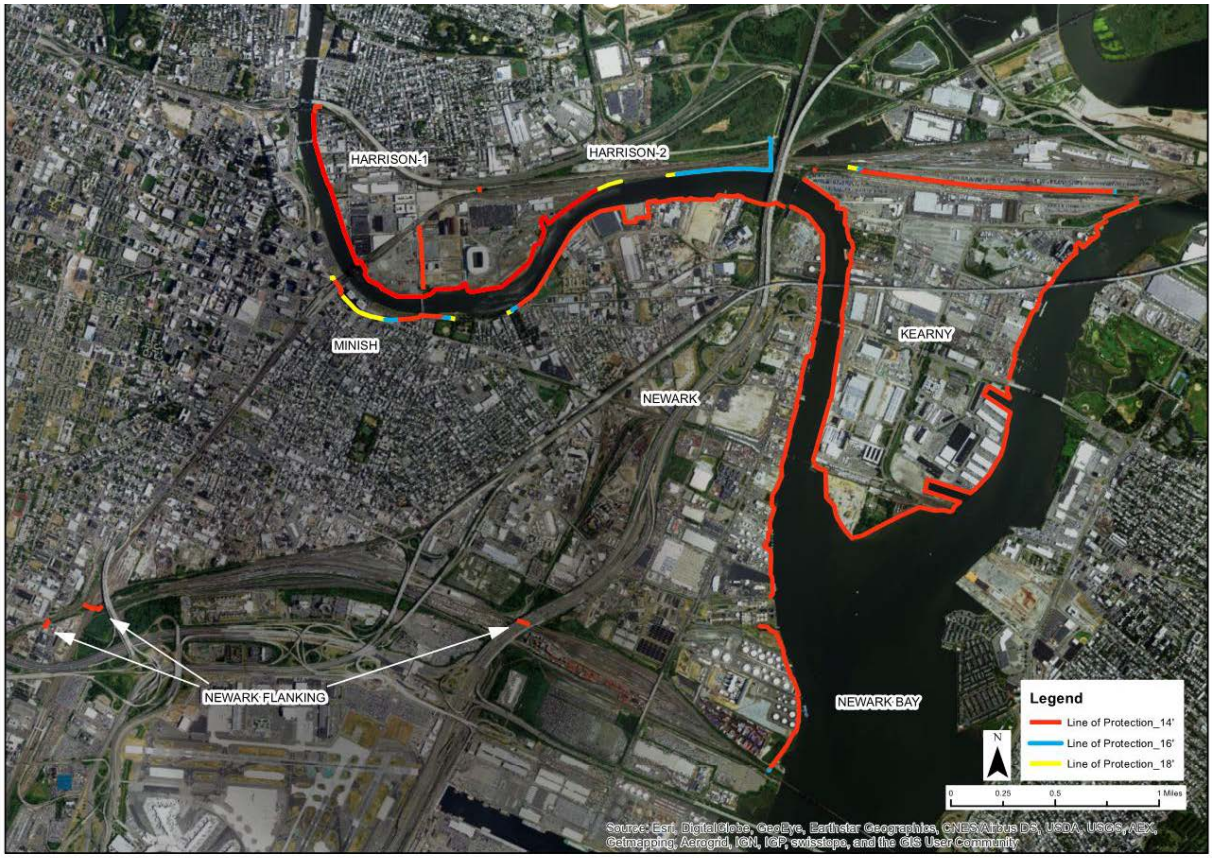

Figure 14: Focused Array of Alternatives

Note: The blue and yellow floodwalls represent the additional floodwall length required to supplement the 14 feet (red) floodwall to complete the 16 feet and 18 feet project alignment, respectively.

Table 24: Estimated Total Cost of the Focused Array of Alternatives

	14 ft NAVD88	16 ft NAVD88	18 ft NAVD88
Total Cost	$657,000,000	$740,000,000	$832,000,000
Annual Cost	$29,000,000	$32,000,000	$35,000,000

4.5 Identifying the National Economic Development Plan

The following analyses and data sets were used in formulation and plan selection:

- Use of NACCS depth-damage function to estimate economic losses

- HEC-FDA Version 1.4.1 (Flood Damage Reduction Analysis) modeling
- Geotechnical data
- Typical Cross Sections
- Cost data
- Benefit cost comparison
- Incremental assessments (height, segments)

Plans were evaluated with consideration of economic justification, environmental acceptability, policy compliance, and public acceptability.

HEC-FDA was used to estimate damages in the without-project and with-project conditions. Flood inundation benefits from the proposed alternatives were computed by comparing damages with and without the proposed measures under existing and future conditions. The damages that are prevented by a project are considered the benefits of the project. Alternatives incorporating floodwalls were analyzed, of elevations of 14, 16, and 18 feet NAVD88, and the results are presented by economic reach in Table 25.

The Harrison 2 reach has negative net benefits in all alternative floodwall elevations and was therefore excluded from the further consideration. Excluding Harrison 2 does not affect the performance of the remaining reaches because Harrison 2 is hydrologically independent from the other reaches due to topography.

Comparing average annual costs to average annual expected benefits of the remaining reaches in the alternatives results in the 18 feet NAVD88 alternative providing the greatest net benefits for four of five reaches.

In addition to the three stillwater design levels of 14, 16, and 18 feet NAVD88, an additional analysis was conducted to evaluate the effectiveness of an adaptable 16 feet NAVD88 plan. Under this alternative (referred to as 16A feet NAVD88) the floodwalls would be constructed initially to the 16 feet NAVD88 stillwater elevation design, but would be modified to raise the wall height to the 18 feet NAVD88 design in the future. Alternative 16A was analyzed and benefits were computed for the "intermediate" and "high" sea level rise conditions under the assumption that the wall height would be raised when the sea level rise matched the total 50-year sea level rise under the historic/lower bound condition (Table 26). This analysis shows that, while the 16A feet NAVD88 alternative is cost effective, the 16A feet NAVD88 alternative does not produce more net benefits than the 18 feet NAVD88 alternative. Therefore, the 16A feet NAVD88 alternative was removed from further consideration.

Table 25: Economics of Focused Array of Alternatives

(Price Level: FY19; Discount Rate: 2.875%; 50-year period of analysis; historic "low" sea level change scenario)

ECONOMIC REACH	ANNUAL	FLOODWALL ALTERNATIVE ELEVATIONS		
		14 FT NAVD88	16 FT NAVD88	18 FT NAVD88
HARRISON 1 SECTION	Future Without-Project Damages	$9,400,000	$9,400,000	$9,400,000
	Future With-Project Damages	$2,206,000	$1,063,000	$537,000
	Average Annual Benefits	$7,194,000	$8,337,000	$8,863,000
	Average Annual Costs	$3,355,000	$3,690,000	$3,755,000
	Average Annual Net Benefits	$3,839,000	$4,647,000	$5,108,000
	BCR	2.1	2.3	2.4
HARRISON 2 SECTION *Does not include residual interior drainage damage	Future Without-Project Damages	$1,864,000	$1,864,000	$1,864,000
	Future With-Project Damages	$483,000	$189,000	$69,000
	Average Annual Benefits	$1,381,000	$1,675,000	$1,795,000
	Average Annual Costs	$2,473,000	$2,931,000	$3,477,000
	Average Annual Net Benefits	-$1,009,000	-$1,157,000	-$1,564,000
	BCR	0.6	0.6	0.5
KEARNY SECTION	Future Without-Project Damages	$38,605,000	$38,605,000	$38,605,000
	Future With-Project Damages	$5,045,000	$1,972,000	$786,000
	Average Annual Benefits	$33,560,000	$36,633,000	$37,819,000
	Average Annual Costs	$12,175,000	$13,460,000	$14,346,000
	Average Annual Net Benefits	$21,385,000	$23,173,000	$23,473,000
	BCR	2.8	2.7	2.6
NEWARK SECTION	Future Without-Project Damages	$31,039,000	$31,039,000	$31,039,000
	Future With-Project Damages	$6,202,000	$3,265,000	$1,923,000
	Average Annual Benefits	$24,837,000	$27,774,000	$29,116,000
	Average Annual Costs	$10,852,000	$11,380,000	$13,039,000
	Average Annual Net Benefits	$13,985,000	$16,394,000	$16,077,000
	BCR	2.3	2.4	2.2
MINISH PARK SECTION	Future Without-Project Damages	$5,304,000	$5,304,000	$5,304,000
	Future With-Project Damages	$2,428,000	$1,146,000	$519,000
	Average Annual Benefits	$2,876,000	$4,158,000	$4,785,000
	Average Annual Costs	$358,000	$496,000	$832,000
	Average Annual Net Benefits	$2,518,000	$3,662,000	$3,953,000
	BCR	8.0	8.4	5.8
NEWARK FLANKING SECTION∞	Future Without-Project Damages	$9,776,000	$9,776,000	$9,776,000
	Future With-Project Damages	$8,492,000	$7,815,000	$7,539,000
	Average Annual Benefits	$1,284,000	$1,961,000	$2,237,000
	Average Annual Costs	$551,000	$621,000	$721,000
	Average Annual Net Benefits	$733,000	$1,340,000	$1,516,000
	BCR	2.3	3.2	3.1
TOTALS (excluding Harrison 2)	Future Without-Project Damages	$97,742,000	$97,742,000	$97,742,000
	Future With-Project Damages	$27,991,000	$18,879,000	$14,922,000
	Total Average Annual Benefits	$69,751,000	$78,863,000	$82,820,000
	Total Average Annual Cost	$27,291,000	$29,647,000	$32,693,000
	System Net Benefits	$42,460,000	$49,216,000	$50,127,000
	Selected as NED Plan		✓	

∞*Note: The Newark Flanking Section was thought to be hydrologically independent but it was later determined to be hydrologically connected to other sections and would need to be implemented with additional segments.*

Table 26: Expected Net Benefits of the Alternatives under Sea Level Change Scenarios

DAMAGES/ BENEFITS	CONDITION/ ALTERNATIVE	HISTORIC "LOW"	CURVE I "INTERMEDIATE"	CURVE III "HIGH"
EQUIVALENT ANNUAL DAMAGES	*Without-Project*	$97,741,000	$121,734,000	$199,902,000
	14 ft NAVD88	$27,991,000	$32,091,000	$44,734,000
	16 ft NAVD88	$18,879,000	$21,152,000	$29,405,000
	16A ft NAVD88	–	$19,010,000	$23,548,000
	18 ft NAVD88	$14,922,000	$16,052,000	$21,299,000
TOTAL BENEFITS	14 ft NAVD88	$69,750,000	$89,644,000	$155,168,000
	16 ft NAVD88	$78,862,000	$100,582,000	$170,497,000
	16A ft NAVD88	–	$102,724,000	$176,354,000
	18 ft NAVD88	$82,819,000	$105,682,000	$178,603,000
ANNUAL COSTS	14 ft NAVD88	$27,302,000	$27,302,000	$27,302,000
	16 ft NAVD88	$29,663000	$29,663,000	$29,663,000
	16A ft NAVD88	–	$31,828,000	$31,828,000
	18 ft NAVD88	$32,721,000	$32,721,000	$32,721,000
NET BENEFITS	14 ft NAVD88	$42,448,000	$62,342,000	$127,866,000
	16 ft NAVD88	$49,199,000	$70,919,000	$140,834,000
	16A ft NAVD88	–	$70,896,000	$144,526,000
	18 ft NAVD88	$50,098,000	$72,961,000	$145,882,000
BCR	14 ft NAVD88	2.6	3.3	5.7
	16 ft NAVD88	2.7	3.4	5.7
	16A ft NAVD88	–	3.2	5.5
	18 ft NAVD88	2.5	3.2	5.5

Per Section 5(a) of the 1983 Principles and Guidelines, "a plan that reasonably maximizes net national economic development benefits, consistent with the federal objective, is… to be identified as the [National Economic Development] plan." Table 25 that the increase in net benefits from the 16 feet NAVD88 plan to the 18 feet NAVD88 plan is within four percent under all relative sea level change scenarios. However, the 18 feet NAVD88 plan has a longer alignment which increases the possibility of encountering undocumented concentrations of HTRW, which would affect project implementation and potentially the net benefits. Therefore, the 16 feet NAVD88 plan is identified as the NED Plan.

The NED Plan consists of 13.5 miles of floodwall at an elevation of 16 feet NAVD88, and includes 64 closure structures as well as six pump stations. It is estimated to have an average annual cost of $29,663,000, provide $78,862,000 in average annual benefits, and provide average annual net benefits of $49,199,000. Figure 15 shows the updated NED as a result of further analysis and public coordination.

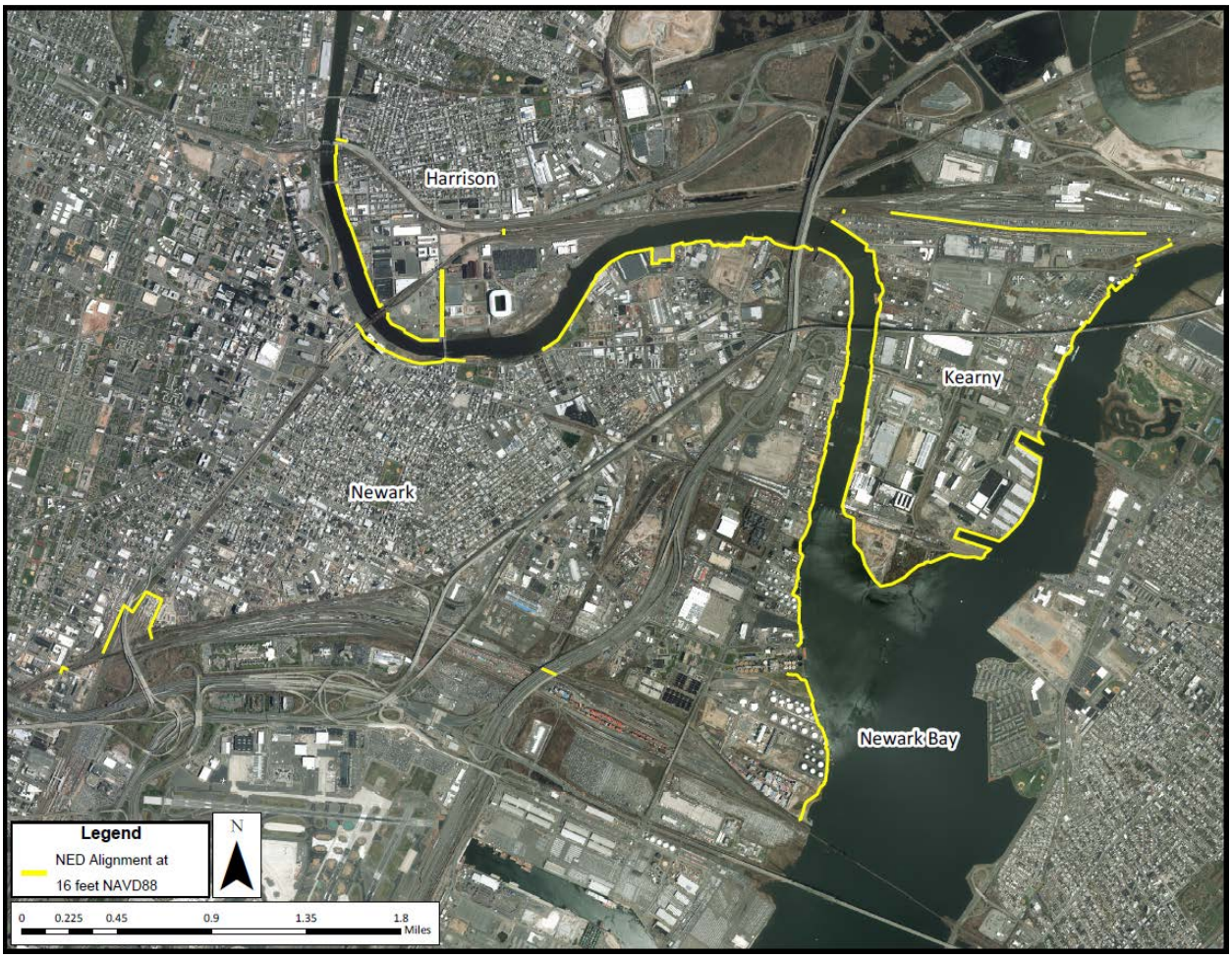

Figure 15: NED Alignment at 16 feet NAVD88

4.6 Developing the Locally Preferred Plan: Newark Flanking Plan

After reviewing the Passaic River Tidal Protection Area's NED Plan, the New Jersey Department of Environmental Protection sent USACE a letter dated November 18, 2016 stating their support for USACE's continued work on the Newark Flanking component of the NED Plan. The NJDEP proposed that the Newark Flanking component of the project be considered as a stand-alone flood risk management project, providing flood risk management to the South Ironbound area of Newark and other parts of Newark by cutting off inland storm surge flow paths. NJDEP stated the high benefit cost ratio and the decreased probability of encountering HTRW within the project footprint as their reasons for supporting the Newark Flanking component.

The Newark Flanking component of the NED plan consists of the three inland segments that prevent storm surge from flanking from the South Ironbound area of Newark, entering the Perimeter Ditch around Newark Liberty Airport. These features were not part of the authorized plan but would have been constructed, had the project been implemented in the 1990s, because updated mapping used in the design phase would have identified the need to address the southern flanking.

The proposed segments in each study reach were originally thought to be incrementally justified and hydraulically independent. However, further hydrologic analysis showed that the Newark Flanking segments cannot stand alone once the Newark Section and Minish Park Section floodwalls are eliminated from the plan. Additional areas of low elevations allow for flooding near I-95. The updated analysis also shows the Minish Park Section and the Newark Flanking Section connecting due to low topography between the two segments (Figure 16). Therefore, in order for the Newark Flanking segments to function, additional segments are needed.

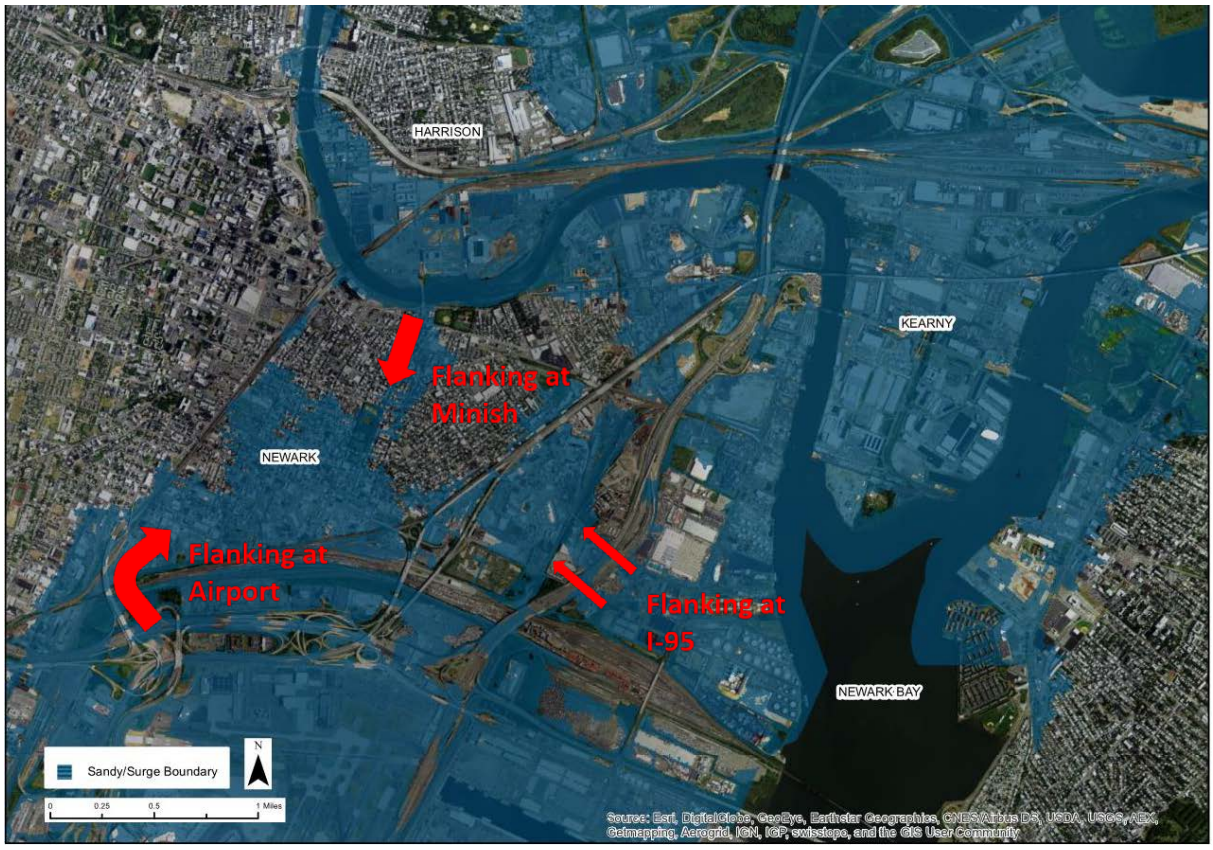

Figure 16: Flood Pathways into Newark

In order to provide a functioning flood risk management plan for the Newark area, the plan must include both the Minish Park and the Newark Flanking Section project features, including the three additional floodwall segments under I-95; south of Delancy Street, at Delancy Street, and at Wilson Avenue. The narrow flow path along Raymond Plaza at Newark Penn Station was addressed by investigating two options, 6A and 6B. Option 6A is larger component closer to the Passaic River and 6B is a smaller section further up NJRR Avenue where the flow path is narrower. The first iteration of the Newark Flanking Plan is depicted in Figure 17.

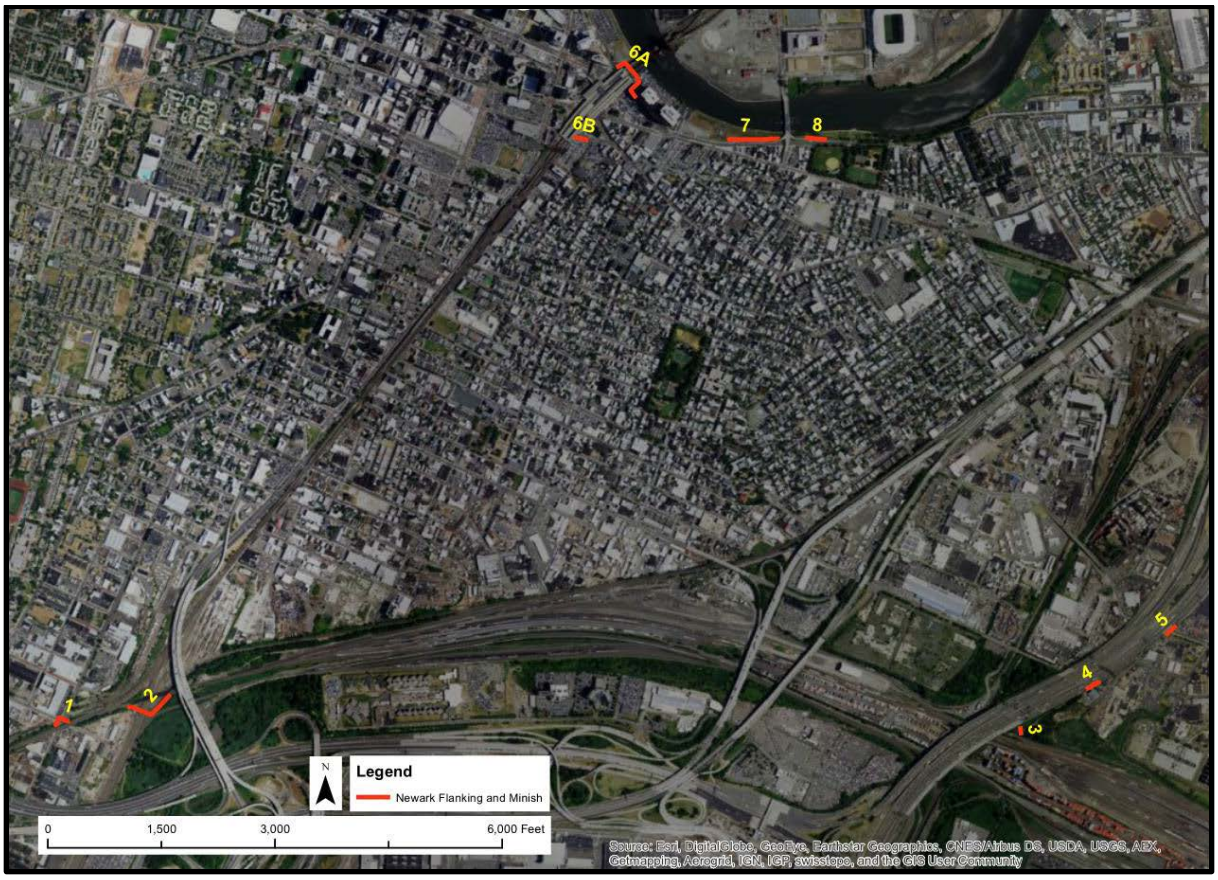

Figure 17: The First Iteration of the Newark Flanking Plan

After investigating 6A and 6B, 6B was chosen for further study and design because 6B provides higher net benefits. Segments 7 and 8 lie within the Newark Riverfront Park. As part of the Newark Passaic Riverfront Revitalization project, the City of Newark and the Trust for Public Land are redesigning and completing construction at the park. Part of the plan for the park included placing fill in the area. After reviewing the City's plans, the District made suggestions to increase the ground elevation to the height of the floodwall proposed in the area. The City incorporated the suggestions into their designs and completed construction in 2017. Surveys were conducted and the ground elevation now meets the Newark Flanking Plan's design height. By increasing the elevation of the park and meeting the proposed elevation grade, the low-lying areas were removed and the need for Segment 7 was eliminated.

Economic analyses showed that net benefits maximize at higher elevation and scale plans. The maximum practical height for the Newark Flanking Plan alignment is 14 feet NAVD88 due to the limited availability of high ground for the segments to tie into; the Newark Flanking Plan incorporates existing landforms in the flood risk management alignment that have a maximum height of 14 feet NAVD88. Increasing the height of the Newark Flanking Plan's floodwalls would require significant increases to the length of floodwalls and associated features by several hundred feet to reach controlling elevations for tie-in. This additional length would also increase the risk of encountering Hazardous, Toxic, and Radioactive Waste. Therefore, the Newark Flanking Plan is proposed at an elevation of 14 feet NAVD88.

Further analyses and coordination resulted in additional adjustments to the Newark Flanking Plan. The study team refined the hydraulic, hydrologic, structural, and economic analyses and coordinated with NJDEP, City of Newark, Port Authority of New York and New Jersey, Conrail, and environmental agencies. Adjustments include increasing the length of Segment 2 and realigning it to cross one track instead of the originally proposed nine tracks, as well as changing Segment 3 from a floodwall to a levee.

The NJDEP chose the Newark Flanking Plan as the Locally Preferred Plan. The Locally Preferred Plan consists of six floodwalls and one levee segment totaling 4,850 linear feet with an elevation of 14 feet NAVD88 (Figure 18).

Figure 18: The Locally Preferred Plan

4.7 Selecting the Recommended Plan

The study team selected the Newark Flanking Plan/Locally Preferred Plan as the Recommended Plan. This section explains the differences between the NED Plan and Locally Preferred Plan and the rationale for selecting the Locally Preferred Plan as the Recommended Plan.

A primary reason for selecting the LPP as the Recommended Plan is because of the NJDEP's concerns about the cost associated with addressing Hazardous, Toxic, and Radioactive Waste along the NED Plan's 13.5 mile alignment. There are many known contaminated sites along the NED Plan's alignment. Non-federal sponsors are required by law to provide the USACE with

'clean' sites before a project can be implemented; the cost associated with the cleanup required to implement the NED Plan would be significant. There are no known contaminated sites along the LPP's 4,850 linear feet alignment and, if contaminated sites are found, the potential cleanup required would be achievable by the NJDEP. Coordination regarding the Newark Flanking Plan occurred with the Newark, Harrison, and Kearny cities, in which no objections to the plan were voiced. The Recommended Plan will not impact known contaminated areas and will enable substantial coastal surge flood risk reduction at a positive Benefit Cost Ratio.

The NED Plan and the Recommended Plan are compared in Table 28 below. Subsequent to the formulation of alternatives described in previous sections, more detailed costs were developed for the NED Plan and the Recommended Plan using the MII cost estimating system. The detailed project estimates of the NED and Recommended Plan listed below in Table 27 are developed in more detail using a combination of MII's 2016 English Cost Book, 2016 Region 1 equipment book, estimator-created site specific cost items, local historic quotations, and quotations from local material suppliers.

Table 27: Final, Refined, Total Equivalent Annual Damages and Benefits of NED Plan and Recommended Plan

ANNUAL	RECOMMENDED PLAN	NED PLAN
FIRST COST	$39,640,000	$809,035,000
ANNUALIZED COST	$1,656,000	$37,652,000
ANNUALIZED BENEFITS	$4,160,000	$78,862,000
NET BENEFITS	$2,504,000	$41,210,000
BCR	2.5*	2.1

*Note: The LPP has a BCR of 2.5 under the historic "low" sea level change scenario. Under the Curve I "intermediate" and Curve III "high" scenarios, the BCR increases to 4.4 and 9.6, respectively.
Price Level: FY19; 2.875% Discount Rate; 50-year period of analysis.

The NED Plan and the Recommended Plan are further compared in Table 28 below. The NED Plan is extensive and about 15 times the length of the Recommended Plan. The first cost of the NED Plan is approximately $809,035,000, which is over 20 times more than the Recommended Plan's estimated first cost of approximately $39,640,000. The Recommended Plan's lesser length and lesser cost also comes with greater residual risk. Section 4.7.1 discusses the differences and trade-offs between the NED Plan and the Recommended Plan/ Locally Preferred Plan; Table 28 displays the information in tabular format.

4.7.1 Trade-Off Analysis

Residual damages

The flood risk to people and structures at any location in a floodplain is the function of flood hazard at the location, and their exposure and vulnerability to the flood hazard. Residual risk is the flood risk that remains after the selected plan is in place. It is the exposure to loss remaining after other known risks have been countered, factored in, or eliminated. No coastal storm risk management project will ever eliminate all coastal flood risk to life and property. The residual risk of the NED Plan and Recommended Plan can be compared using both the overall study area, which includes Newark, Harrison, and Kearny, and within the respective project areas.

- The NED Plan's study and project areas are the same, with an estimated $97.7 million in average annual without-project damages. If the 13.5-mile NED Plan were implemented, the plan would reduce the risk of coastal flooding to an estimated 40,000 people and 6,000 structures, with an estimated $78.9 million in average annual benefits. It is estimated the NED Plan would have $18.9 million in average annual residual damage in both the study and project areas. Figure 19 shows the risk management area of the NED Plan.
- The 4,850 linear foot (0.9 mile) long Recommended Plan has a smaller project area, which includes only a portion of Newark. In Newark, it is estimated that the average annual without-project damages are about $15.1 million. The Recommended Plan is a substantial project for Newark, reducing risk to 15,000 people and 2,300 structures, primarily in Newark's residential Ironbound Section, and providing an estimated $4.2 million in average annual benefits. The residual risk of the Recommended Plan in the project area is about $10.9 million in average annual damage, while the overall study area residual risk is about $93.6 million in average annual damage. Figure 20 shows the risk management area of the Recommended Plan.
- The Recommended Plan was also analyzed at the NED elevation of 16 feet NAVD88; this alternative could further decrease the average annual residual risk. However, increasing the floodwalls from 14 feet NAVD88 to 16 feet NAVD88 would require tie-off locations further away and include more segments; adding several hundred feet of additional floodwall would create additional costs and increased risk of encountering HTRW.

Life-Safety and Community Impacts

- The Recommended Plan is estimated to decrease coastal flooding risk to 15,000 people and 2,300 structures while the NED is estimated to decrease coastal flooding risk to 40,000 people and 6,000 structures. The Recommended Plan reduces risk primarily in Newark's residential Ironbound Section. While the NED Plan would reduce coastal flood risk in Kearny and Harrison in addition to Newark, these areas are primarily industrial with newer residential areas that are taking their own risk management measures to reduce storm surges' risk to life safety. Discussions on the Newark Flanking Plan were held with officials from Newark, Harrison, and Kearny; no objections to the plan were voiced.
- Both the Recommended and NED Plans would contribute to community resilience by reducing the risk of damages in their respective risk management area, as well as by increasing the speed and decreasing the cost of recovery efforts after storm surge events.
- Both plans reduce the risk of flooding to roads used to access evacuation routes such as I-95, also known as the New Jersey Turnpike.
- The NED Plan would significantly limit the community's access to the waterfront; this is a major concern for the community. The Recommended Plan would preserve the community's access to the waterfront while simultaneously reducing the risk of storm surge.

Table 28: NED Plan and LPP Comparison

	NED PLAN	RECOMMENDED PLAN /LPP
FEATURES		
ELEVATION OF FLOODWALLS [NAVD88]	16 feet	14 feet
ALIGNMENT LENGTH	13.5 miles	0.9 mile (4,850 feet)
CLOSURE STRUCTURES	64	8
PUMP STATIONS	6	0
COMMUNITY BENEFITS		
PEOPLE DIRECTLY BENEFITED	40,000	15,000
STRUCTURES DIRECTLY BENEFITED	6,000	2,300
HOSPITALS	2	1
POLICE FACILITIES	9	3
FIRE STATIONS	9	4
COLLEGES AND UNIVERSITIES	11 just outside	11 just outside
SCHOOLS	3	3
STORAGE FACILITY TANK FARMS	6	0
RISK		
WITHOUT-PROJECT FUTURE EXPECTED AVERAGE ANNUAL DAMAGES IN *STUDY AREA*	$97,742,000	$97,742,000
WITHOUT-PROJECT FUTURE EXPECTED AVERAGE ANNUAL DAMAGES IN *PROJECT AREA*	$97,742,000	$15,080,000
RESIDUAL RISK WITHIN *STUDY AREA*	$18,879,000	$93,582,000
RESIDUAL RISK WITHIN *PROJECT AREA*	$18,879,000	$10,920,000
ECONOMICS		
FIRST COST (with construction, contingency, Preconstruction Engineering Design, supervision and administration, real estate)	$809,035,000	$39,640,000
AVERAGE ANNUAL BENEFITS	$78,862,000	$4,160,000
AVERAGE ANNUAL COSTS (with IDC and OMRR&R)	$37,652,000	$1,656,000
SYSTEM NET BENEFITS	$41,210,000	$2,504,000
BENEFIT COST RATIO (low/historic sea level change scenario)	2.1	2.5

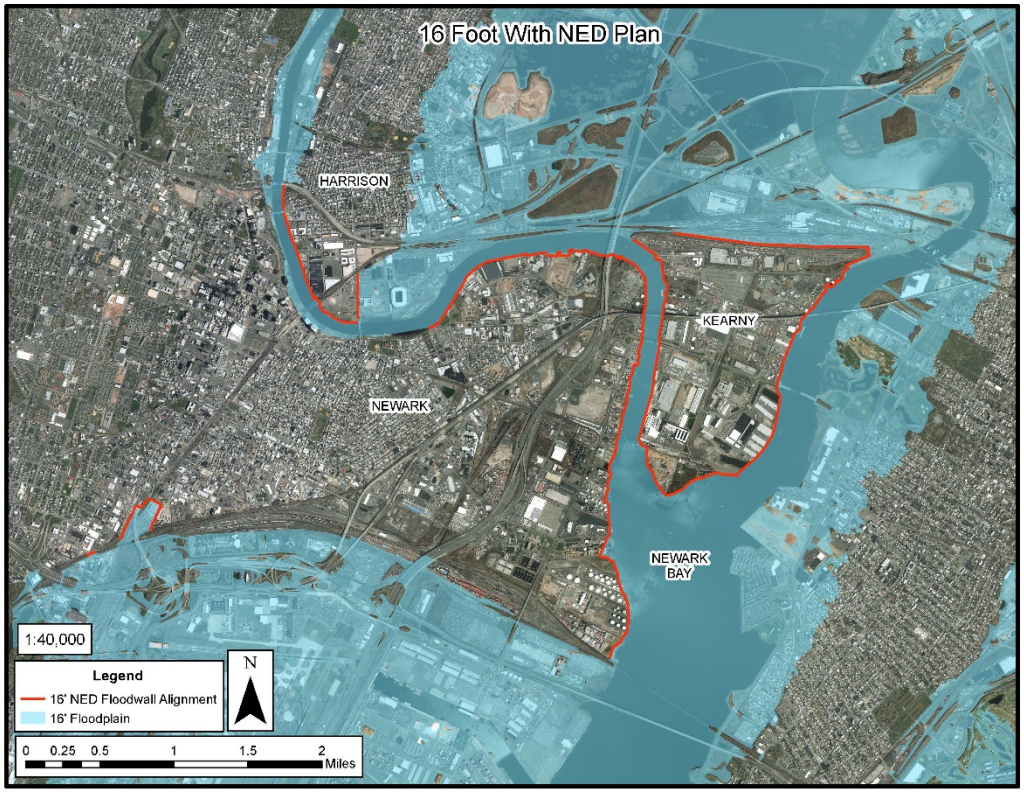

Figure 19: Risk Management Area of NED Pan with 16-feet NAVD88 Floodplain

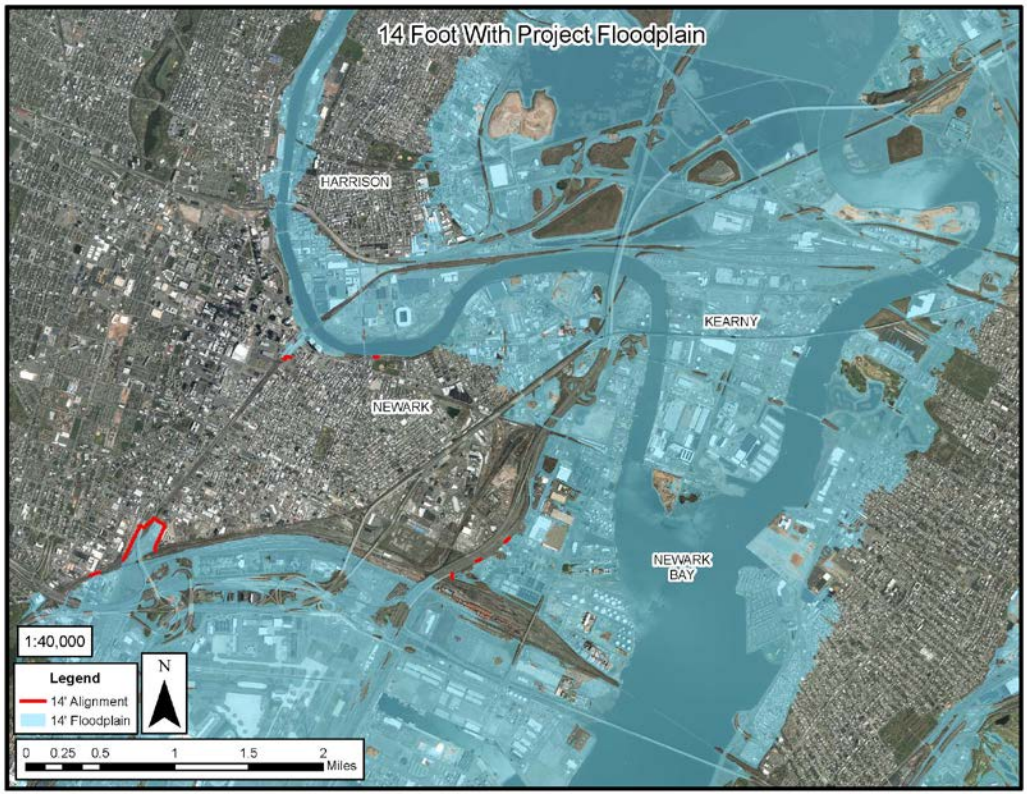

Figure 20: Risk Management Area of Recommended Plan with 14-feet NAVD88 Floodplain

4.7.2 1983 Principles and Guidelines Criteria

The 1983 Principles and Guidelines require that plans are formulated in consideration of four criteria: **completeness**, **effectiveness**, **efficiency**, and **acceptability**.

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective.

The alternatives in the final array were evaluated with consideration of necessary investments and other actions. The plans were looked at for environmental, traffic, and cultural resource impacts, as well as the costs associated with mitigating those impacts and acquiring the required real estate for implementation.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.

Both the NED Plan and Locally Preferred Plan alleviate the problem of flooding from storm surge and achieve the study opportunities to reduce coastal storm damages to residents, property, and infrastructure, as well as reduce the risk of isolation from flooded roads.

Efficiency is the extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.

Efficiency was measured through a comparison of BCRs, reduced damages, and benefits from the project, as shown in Table 28. Both the NED Plan and Locally Preferred Plan are efficient ways of reducing the risk of coastal storm damages for their respective risk management areas.

Acceptability is the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public and compatibility with existing laws, regulations, and public policies.

The study team formulated the alternatives in accordance with applicable laws and regulations. One important facet of acceptability is implementability, which is the feasibility of a plan in the technical, environmental, economic, social, and similar senses. Both the NED Plan and Locally Preferred Plan are acceptable.

Chapter 5: Recommended Plan*

5.1 Proposed Action/ Recommended Plan Components

The Recommended Plan is the Locally Preferred Plan. The Recommended Plan consists of the construction and operation of a series of floodwalls, a levee, and closure gate with integrated interior drainage system. A total of six floodwall segments and one levee segment would be constructed within low lying areas of the City of Newark to reduce the risk of flooding in flood prone areas of the Ironbound section of the study area. The Recommended Plan would be designed to preform to an elevation of 14 feet NAVD88. The seven segments total a length of approximately 4,850 linear feet (lf) and includes eight closure gates and three 36-inch culverts (see Engineering and Design Appendix J for more information):

Segment 1: 170 linear feet (LF) of floodwall with one closure gate: a 140 LF gate across the intersection of Frelinghuysen Avenue and East Peddie Street. The gate would be approximately 4.0 feet high above ground. The floodwall height above ground would range from approximately 2.6 to 4.0 feet and tie into the adjacent railroad embankment.

Segment 2:

Segment 2a (western part of Segment 2): 1,990 LF of floodwall located between the main rail line to Newark Penn Station and the southern tie-off of the alignment. Segment 2A ties into the railroad embankments on each end of the wall. The Segment 2A alignment accommodates the proposed PATH railway extension from Newark Penn Station to the Newark Liberty Airport transit hub. Relocation of the Poinier Street ramp to McCarter Highway is planned to accommodate the PATH extension.

Segment 2B (eastern part of Segment 2): 1,450 LF of floodwall from the tie-in at the NJ Transit/Amtrak railroad to the southern alignment tie-in. This segment includes a gate at New Jersey Railroad (NJRR) Avenue and the southern rail line, and an additional gate north of the rail line for stormwater drainage during extreme rainfall events. Floodwall and gate height above ground along this segment would vary from 4.8 to 8.2 feet.

Segment 3: 135 LF of levee with three 36-inch culverts, headwalls, sluice gates, and backflow prevention devices. The levee crosses an unnamed tidal drainage ditch just east of the New Jersey Turnpike. The levee height above ground of this segment will be a maximum of approximately 9.4 feet.

Segment 4: 190 LF of floodwall across Delancy Street just east of the New Jersey Turnpike. The closure gate across Delancy Street would be approximately 70 LF and the floodwall height would range from approximately 4.1 to 4.8 feet. This segment ties into the New Jersey Turnpike.

Segment 5: 240 LF of floodwall across Wilson Avenue just east of the New Jersey Turnpike. The closure gate across Wilson Avenue would be approximately 85 LF and the floodwall height would range from approximately 3.1 to 3.2 feet above ground. This segment ties into the New Jersey Turnpike.

Segment 6: 330 LF of floodwall along Edison Place and NJRR Avenue, and crossing NJRR Avenue to tie into the railroad embankment. The closure gate across NJRR Avenue would be approximately 30 LF. A closure gate was proposed along Edison Place at the Edison

ParkFast. The height of the floodwall would range from approximately 0.9 to 3.1 feet above ground.

Segment 8: 150 LF of floodwall along the side of the off ramp from Raymond Boulevard to Jackson Street. This segment borders the sidewalk adjacent to Riverfront Park and would have a height ranging from approximately 1.3 to 3.4 feet above ground.

Features incorporated by NJDEP into the design of the newly created Minish Park complete the alignment. The features in the park consist of a short length of floodwall along Raymond Boulevard, west of Jackson Street with heights ranging from approximately 1.3 to 3.4 ft, and regraded berms to an elevation of 14 feet NAVD88. These park features are separate and complimentary actions and are not considered part of the Recommended Plan. If the NJDEP project had not incorporated a floodwall and regarding in their design, the features would have been included in the Recommended Plan as Segment 7.

The locations and elements associated with each segment are illustrated in Figure 21, Figure 22, and Figure 23 for Segments 1 and 2, Segments 3, 4 and 5, and Segments 6 and 8, respectively. Elements include the floodwalls, closure gates, a tide gate, and construction easements associated with the segments that make up the Recommended Plan. When in the open position, the roadway closure gates would be wide enough to accommodate normal vehicular traffic as well as pedestrian passage along the sidewalks. A 15-foot wide temporary construction easement would be required around all segments. For areas with a wall height of six feet or less the wall, a concrete I-wall would be constructed. This applies to Segments 1, 4, 5, 6, and 8. Segments 2 and 3 would require wall heights greater than six feet; a pile supported concrete T-wall would be constructed in these locations.

The Recommended Plan's interior drainage plan is the plan that maximizes the net excess benefits over cost. The interior drainage component for each sub-basin is shown in Figure 24 and presented in Table 29. Selection of these features is discussed in Appendix F, Hydrology and Hydraulics.

The Proposed Action would impact 35 parcels totaling 7.8 acres within the City of Newark. Approximately 4.4 acres would be permanent easements and approximately 3.4 acres would be temporary easements. Twenty-nine of the impacted parcels are privately-owned and six parcels are publicly-owned. If Public Law 113-2 funds become unavailable, the Recommended Plan will require a new construction authorization either by Congress or by Public Law 113-2.

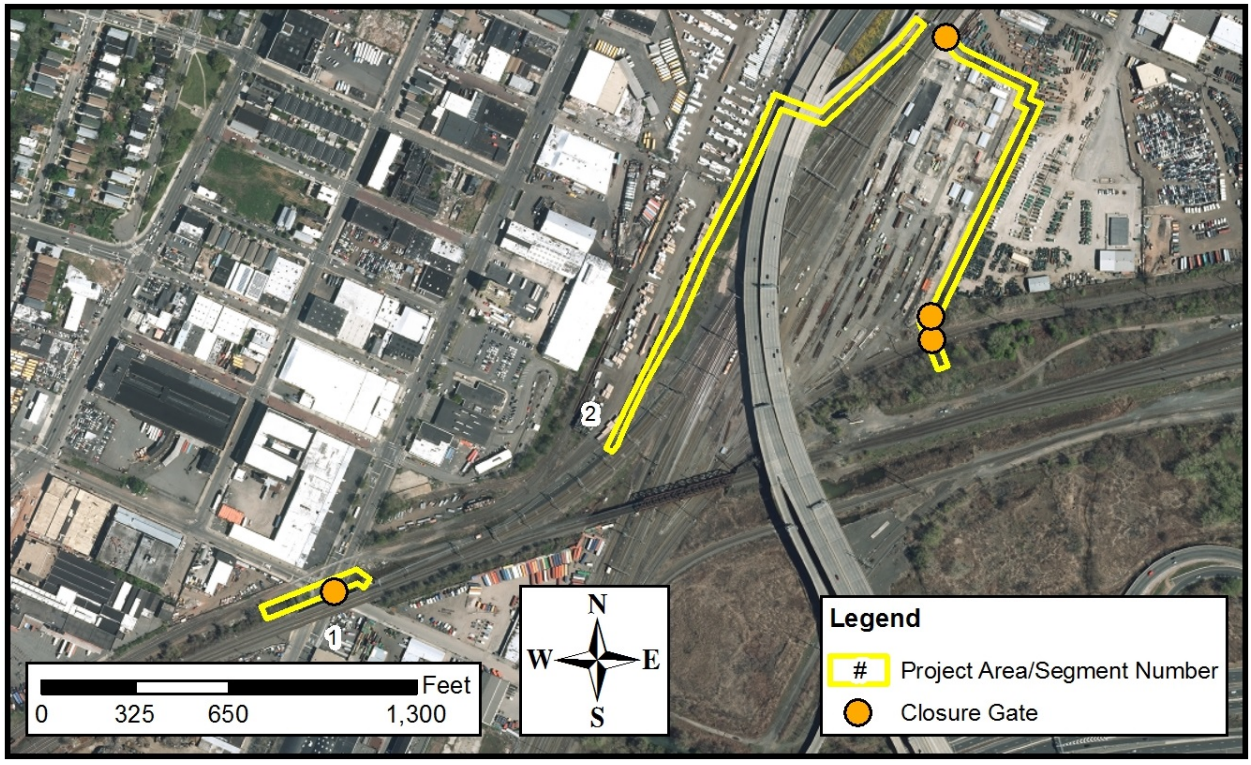

Figure 21: Recommended Plan Segments 1 and 2

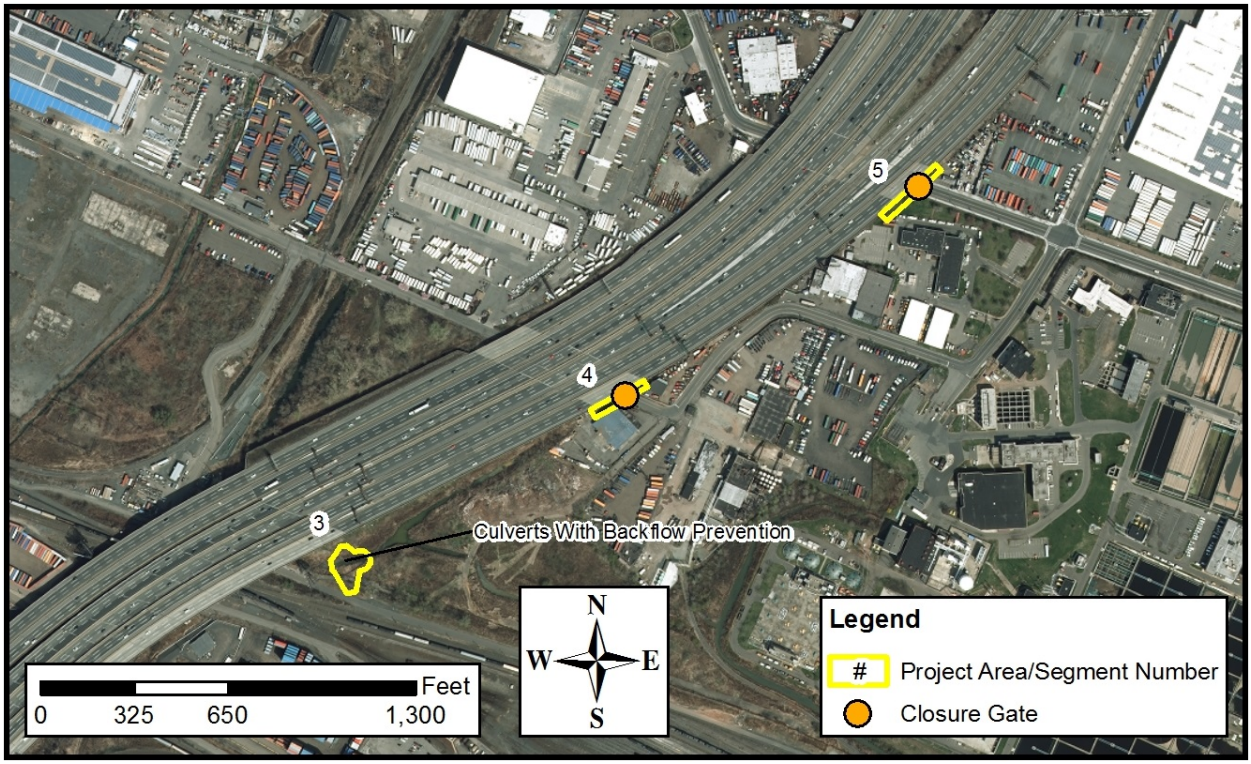

Figure 22: Recommended Plan Segments 3, 4, and 5

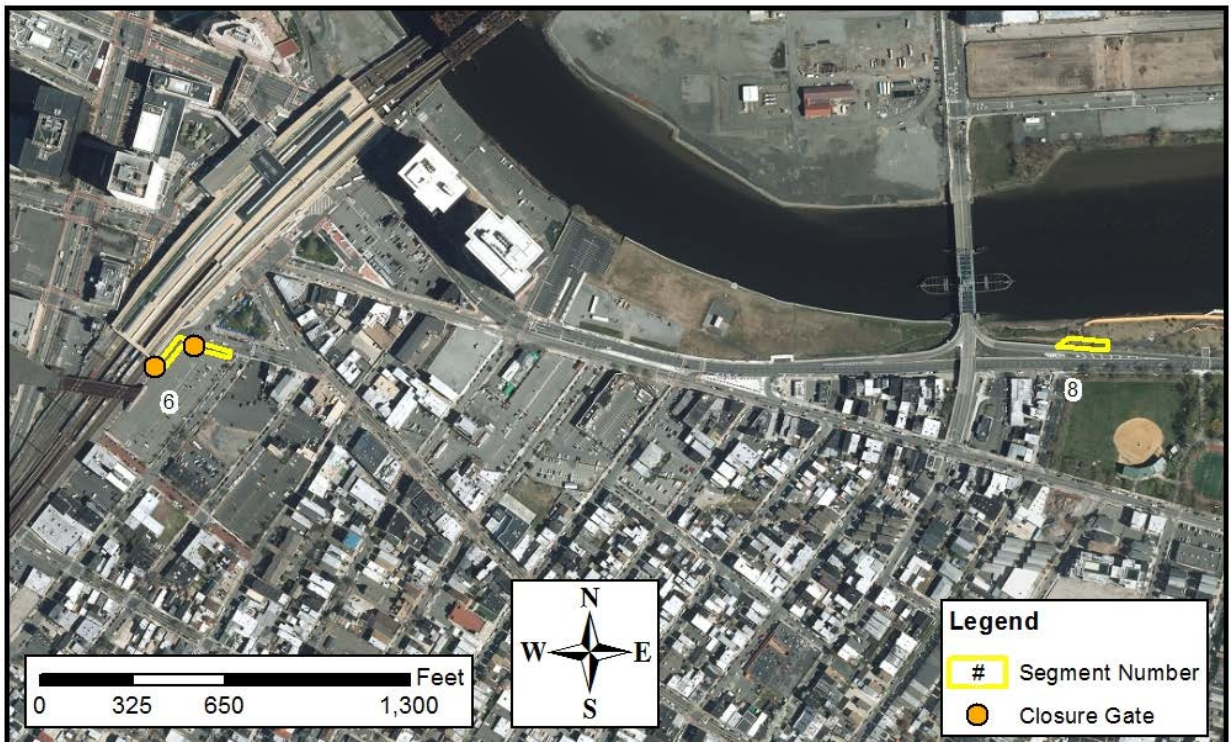

Figure 23: Recommended Plan Segments 6 and 8

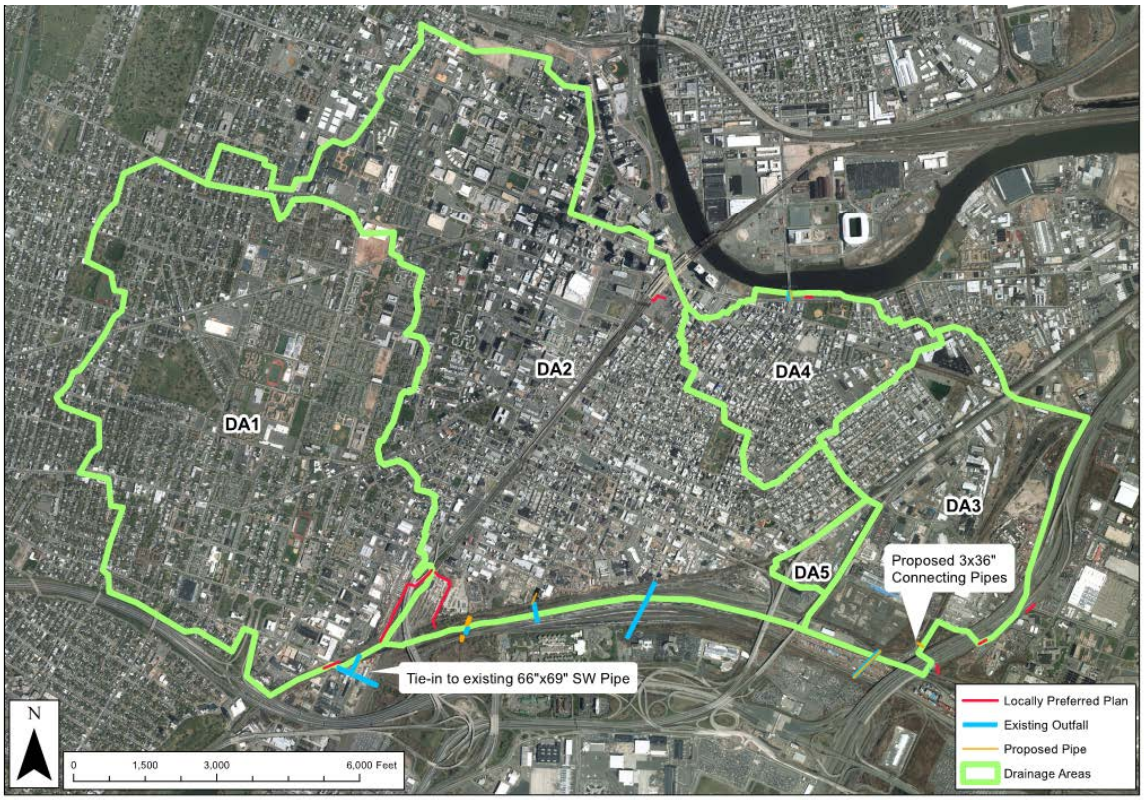

Figure 24: Passaic Tidal Project Existing and Recommended Interior Drainage Features

Table 29: Recommended Plan Interior Drainage Plan Summary

BASIN	DESCRIPTION
DRAINAGE AREA 1	Tie low areas into existing 66" x 69" stormwater line
DRAINAGE AREA 2	50-foot gate adjacent to railroad
DRAINAGE AREA 3	3x36" Culverts in Segment 3 levee; 3x36" culverts under access road for drainage conduit
DRAINAGE AREA 4	No Additional Features
DRAINAGE AREA 5	No Additional Features

5.2 Operation, Maintenance, Repair, Rehabilitation, and Replacement Considerations

The annual Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) cost includes annual inspections and maintenance of the project including gate chambers, closure gates, sluice gates, and backflow prevention. Total annual OMRR&R costs are $132,000. For more details see the Appendix H (Cost Engineering).

5.3 Recommended Plan Refined Cost Estimate

A summary of the costs of the Recommended Plan is presented in Table 30.

Table 30: Recommended Plan Refined Cost Estimate

	COST
FIRST PROJECT COST	$39,640,000
INTEREST DURING CONSTRUCTION	$520,000
ANNUALIZED INVESTMENT COST	$1,524,000
OPERATION, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION (OMRR&R) COST	$132,000
TOTAL ANNUALIZED COST	$1,656,000

The Project First Cost is $39,640,000; this is the constant dollar cost of the Recommended Plan at current price level and is the cost used in the authorizing document for a project. Total Project Cost is the constant dollar cost fully funded with escalation to the estimated midpoint of construction; this is the "cost of money" because costs are expected to escalate over time due to various factors. Total Project Cost is the cost estimate used in Project Partnership Agreements for implementation of design and construction of a project. The Total Project Cost of the Recommended Plan is $43,734,000 with monitoring. These costs include construction, lands and damages, design, supervision, and associated administration costs. The material costs were based on a combination of MII database, RSMeans, quotes, and some historical information. Equipment rates were obtained from region 1, and Davis Bacon Wage Rates for Hudson and

Essex Counties, NJ were utilized for labor costs. The contingencies were developed using Abbreviated Risk Analysis program. The summary of the results of this risk analysis, and more detail on the cost estimate, can be viewed in the Cost Engineering Appendix.

5.4 Refined Annual Cost and Benefit of Recommended Plan

The benefits of implementing coastal storm risk management measures are the estimated cost of flood damages that would be avoided by implementing the project. Benefits were calculated as the difference in damages before and after project implementation. Benefits were then amortized over a 50-year period to identify equivalent annual benefits using January 2018 price levels and an interest rate of 2.875%. Table 31 provides a summary of the costs and benefits of the plan under the "low" sea level rise scenario.

Table 31: Summary of Refined Costs and Benefits of Recommended Plan

	VALUE
FIRST COST	$39,640,000
EQUIVALENT ANNUAL COST	$1,656,000
EQUIVALENT ANNUAL BENEFITS	$4,160,000
ANNUAL NET BENEFIT	$2,504,000
BENEFIT COST RATIO	2.5*

*Note: The LPP has a BCR of 2.5 under the historic "low" sea level change scenario. Under the Curve I "intermediate" and Curve III "high" scenarios, the BCR increases to 4.4 and 9.6, respectively.

5.5 Risk and Uncertainty Analysis

Risk is a measure of the probability and consequence of uncertain future events; risk is the chance of an undesirable outcome. The following subsections outline the risks associated with the proposed project.

5.5.1 Performance Risk

As described in Section 4.1.1, while sea levels are expected to change, the rate at which they will rise is uncertain. Sea level change affects the design height performance and reliability as sea level changes and high intensity storms become more frequent; the reliability of the Recommended Plan decreases as sea levels rise (Table 32 and Figure 25).

The engineering performance of the recommended project is to be reported in terms of the annual exceedance probability, the long-term risk of exceedance, and assurance. The annual exceedance probability is the probability that flooding will occur at a given location in any given year. The long-term risk of exceedance is the probability that the design stage will be exceeded at least once in the specified durations; this accounts for the repeated annual exposure to flood risk over time. The long-term risk of exceedance for the Recommended Plan is 4% in 50 years under the historic "low" sea level rise scenario. Assurance, also called Conditional Non-Exceedance Probability, measures the likelihood that the project will not be exceeded by a specified hydrologic event. The conditional non-exceedance probability of the Recommended Plan over the 50 year planning horizon is 100% for the 1% flood event for the "low" and "intermediate" sea level change scenarios; this means that if sea levels do not rise above the

"intermediate" sea level rise scenario's predicted levels, the project would not be overtopped by the 1% flood event within the 50 year planning horizon.

As described in Section 4.6, the design height of the Recommended Plan is 14 feet NAVD88 because of the controlling elevations of the land embankments that the alignment ties into. The design height of the Recommended Plan cannot easily be increased; therefore, the Plan lacks adaptability in the face of sea level rise. While the reliability of the Recommended Plan decreases as sea levels rise, the Recommended Plan is expected to continue to perform effectively and benefit the community.

Table 32: Project Performance Analysis of the Recommended Plan under the Low, Intermediate, and High Sea Level Change Scenarios

PERFORMANCE AND RELIABILITY CRITERIA		SEA LEVEL CHANGE SCENARIO		
		HISTORIC "LOW"	CURVE I "INTERMEDIATE"	CURVE III "HIGH"
Annual Exceedance Probability of Target Stage	Median	0.05%	0.1%	0.3%
	Expected	0.07%	0.2%	0.4%
Long-Term Exceedance Probability	10 Years	0.7%	2%	4%
	30 Years	2%	5%	12%
	50 Years	4%	8%	18%
Assurance/ Conditional Non-Exceedance Probability	10%	100%	100%	100%
	4%	100%	100%	100%
	2%	100%	100%	100%
	1%	100%	100%	94%
	0.4%	99%	94%	63%
	0.2%	95%	76%	30%

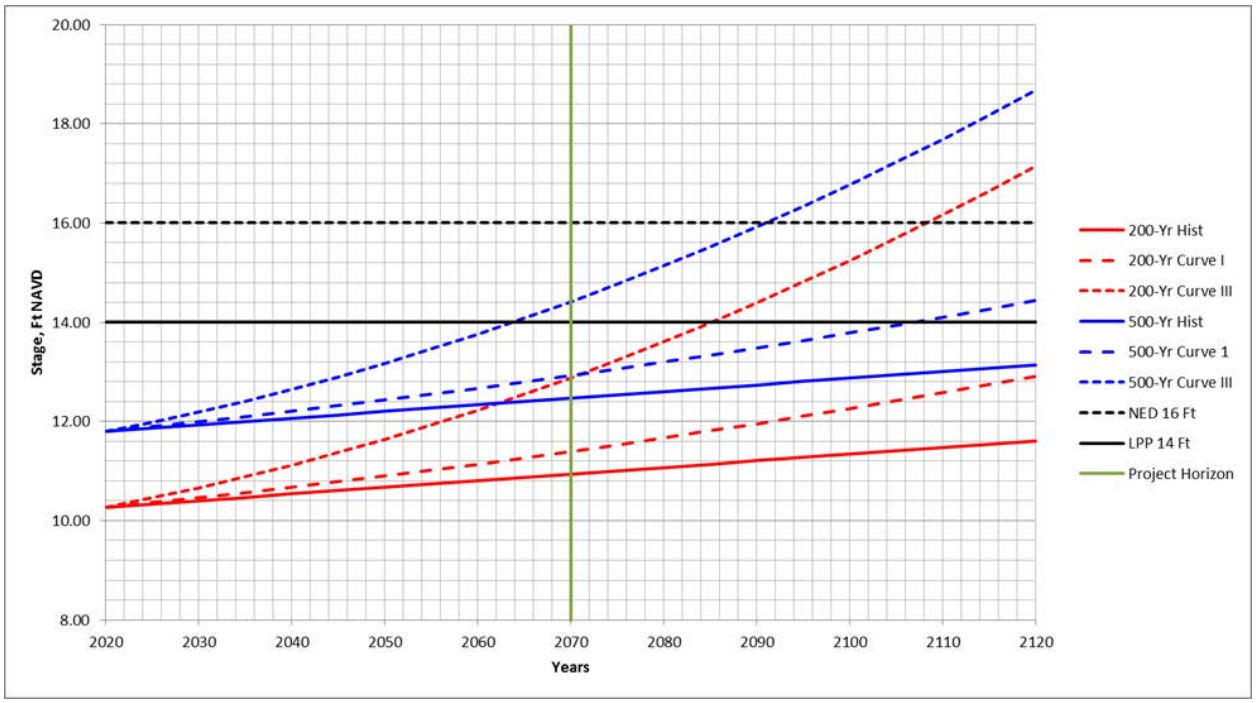

Figure 25: Alignment Design Heights Against Sea Level Change Curves; FEMA Stage Frequency as applied to the Newark Flanking Section

5.5.2 Residual Risk

The flood risk to people and structures at any location in a floodplain is the function of flood hazard at the location, and their exposure and vulnerability to the flood hazard. Residual risk is the flood risk that remains after the selected plan is in place. It is the exposure to loss remaining after other known risks have been countered, factored in, or eliminated. No coastal storm risk management project will ever eliminate all coastal flood risk to life and property.

The Recommended Plan reduces the risk of flood damages associated with coastal storm surge events, but does not reduce the risk of flood damages caused by rainfall events. The Recommended Plan includes interior drainage features to mitigate the risk of rainwater ponding behind the proposed segments; these features include gravity outfalls and a gate (see Appendix F for more details). The risks associated with high intensity rain events and Newark's aging combined sewer overflow system remain.

The Recommended Plan would reduce the equivalent average annual damages caused by storm surge by $4,160,000 as compared with the future without-project scenario. The residual risk can be compared using both the overall study area, which includes Newark, Harrison, and Kearny, and within the respective project areas (Table 33). The overall study area is the NED Project Area while the Recommended Plan's study area includes only a portion of Newark. The residual risk of the Recommended Plan in the project area is $10.9 million, or about 72% of without-project average annual damages, while the residual risk in the study area is $93.6 million, or about 96% of without-project average annual damages. The Recommended Plan is still a substantial project, reducing risk to 15,000 people and 2,300 structures in a large portion of residential areas in Newark.

The Recommended Plan would reduce the risk of flooding to people and structures primarily in the Ironbound Section of Newark. Figure 26 shows the 14 feet NAVD88 floodplain in Newark without any project features. Figure 27 shows the risk management area of the Recommended Plan with the 14-feet NAVD88 floodplain.

Table 33: Residual Risk in Study and Project Areas

	RECOMMENDED PLAN
WITHOUT-PROJECT FUTURE EXPECTED AVG. ANNUAL DAMAGES IN *STUDY AREA*	$97,742,000
WITHOUT-PROJECT FUTURE EXPECTED AVG. ANNUAL DAMAGES IN *PROJECT AREA*	$15,080,000
AVG. ANNUAL BENEFITS	$4,160,000
PEOPLE DIRECTLY BENEFITED	15,000
STRUCTURES DIRECTLY BENEFITED	2,300
RESIDUAL RISK WITHIN STUDY AREA	$93,582,000
RESIDUAL RISK WITHIN PROJECT AREA	$10,920,000

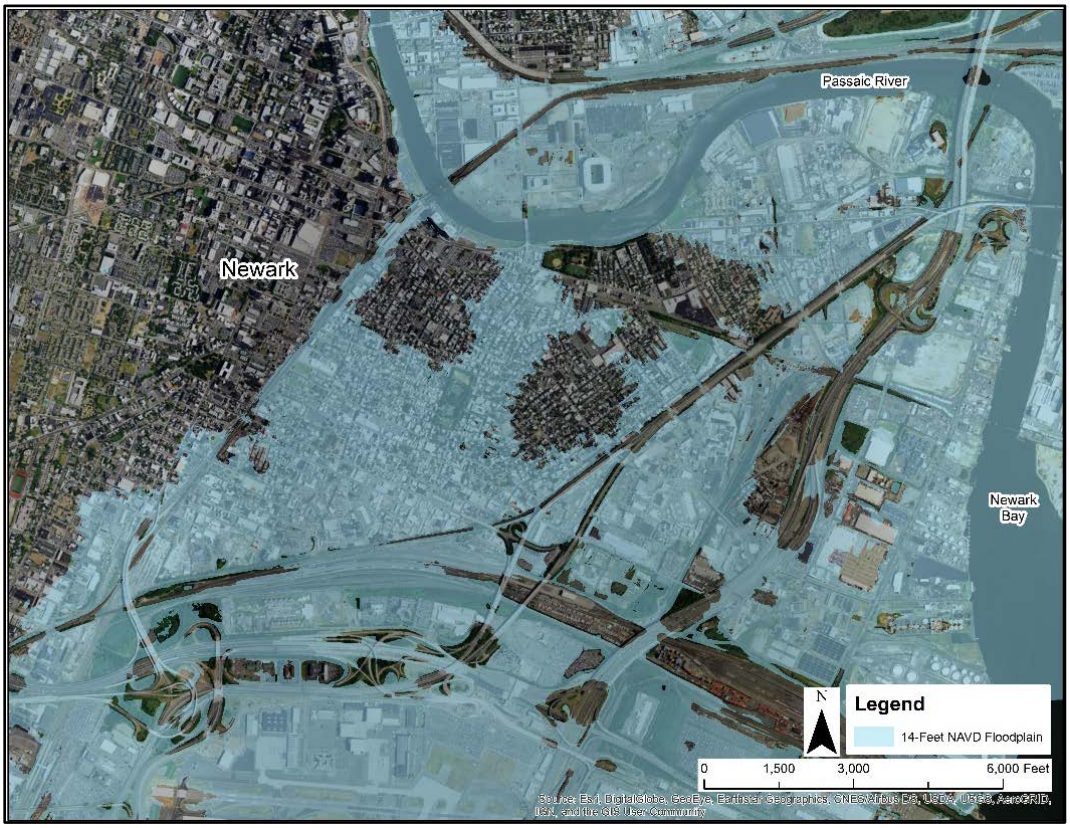

Figure 26: 14 feet NAVD88 Floodplain

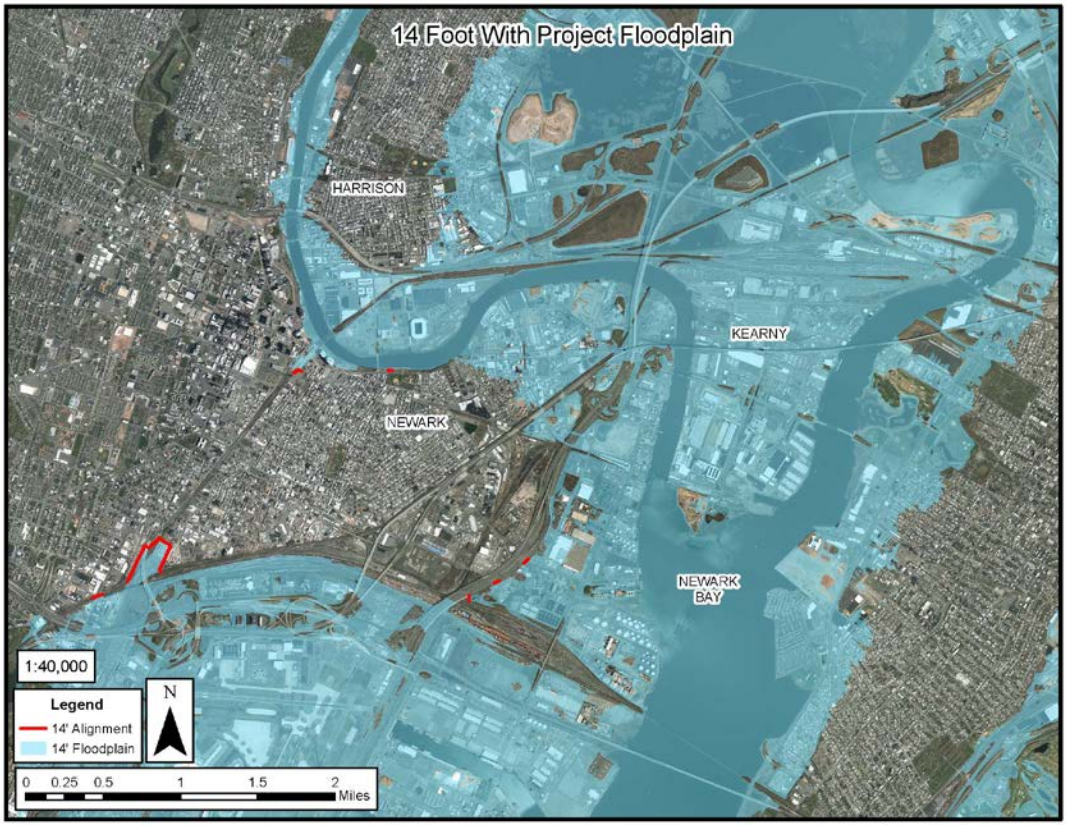

Figure 27: Risk Management Area of Recommended Plan

5.5.3 Study/ Preconstruction Engineering and Design/ Implementation

The study team used existing data to make assumptions about geotechnical characteristics and the presence of cultural resources and HTRW. Contamination within the project footprint must be addressed by the Non-Federal Sponsor, in accordance with ER1105-2-100 and ER 1165-2-132, before any construction of the Recommended Plan can begin. While there are currently no known contaminated sites along the Recommended Plan's alignment, the location and extent of possible contaminated sites along the Recommended Plan's alignment is a risk because the discovery of unidentified contaminated sites during Preconstruction Engineering and Design may require redesign of the project, cause costs to increase, or cause a delay in implementation.

Current and projected land use changes, resilience projects, and other development is a risk because the future characteristics of the study area can alter the benefits and costs of the proposed project. However, new development within the study area will be constructed higher, above the floodplain, and will therefore have minimal impact on benefits. Additionally, other projects that are planned within the alignment of the recommended plan could have implementation implications.

There are risks associated with real estate. For a project to be implemented, the Non-Federal Sponsor must acquire real estate interests needed for the construction, operation and maintenance of the recommended plan. Thirty-five properties are impacted by the Recommended Plan and

coordination with the property owners, including Conrail and Amtrak, is ongoing. Their support of the project is imperative for successful implementation of the project; without their support, implementation may be delayed or halted.

The Recommended Plan relies on existing landforms as well as railroad and highway embankments as tie-ins for the floodwalls and levee. The study team assumes that the existing landforms and embankments meet the USACE levee standards and geotechnical investigations will occur in Preconstruction Engineering and Design. If the landforms and embankments are found not to be meet USACE levee standards, the project may have to be redesigned, costs may increase, or implementation may be delayed or halted.

To maintain continuity from feasibility phase into implementation, the project planner will be responsible for communicating the rationale behind planning level decisions to the designers and builders, and for documenting the assessment of impacts of design modifications, refinements, and alignment changes with respect to the construction authority.

5.5.4 Economics

Risk and uncertainty has been explicitly factored into the economic analysis of this project. A statistical risk based damage model, HEC-FDA, was used in this study to formulate and evaluate the project in a life-cycle approach. HEC-FDA integrates the engineering and economic analyses and incorporates uncertainty in both physical parameters and storms, which enables quantification of risk with respect to project evolution and economic costs and benefits of project implementation. For more information please refer to Appendix G (Economics).

Table 34 shows the economic effects sea level change has on the on Recommended Plan using the refined annualized costs detailed in Table 30. With all sea level change scenarios, the Recommended Plan is economically justified with Benefit Cost Ratios ranging from 2.5 with the "low" scenario, 4.4 with the "intermediate" scenario, to 9.6 with the "high" scenario.

Table 34: Effects of Sea Level Change Scenarios on Refined Economics of Recommended Plan

	SEA LEVEL CHANGE SCENARIO		
	HISTORIC "LOW"	CURVE I "INTERMEDIATE"	CURVE III "HIGH"
ANNUALIZED BENEFITS	$4,160,000	$7,300,000	$15,826,000
REFINED ANNUALIZED COSTS	$1,656,000	$1,656,000	$1,656,000
NET BENEFITS	$2,503,000	$5,644,000	$14,170,000
BCR	2.5	4.4	9.6

5.6 Economic, Environmental, and Other Social Effects

USACE guidance requires that study alternatives be evaluated under the following accounts: the NED, regional economic development (RED), other social effects (OSE), and environmental quality (EQ). National Economic Development effects have been addressed above and in the Economics Appendix. In reducing damages from future coastal storm events, the proposed project would contribute to NED.

The Regional Economic Development effects are the impact of project spending, either directly or indirectly, on the local economy. Implementation of the project could induce RED benefits in the area as residents and business owners may be able to allocate resources and spending on goods and services other than on repairing and replacing structures or goods damaged by flooding.

Other Social Effects include the effects that are not covered in the NED, RED, and EQ. Community resilience is the measure of the sustained ability of a community to utilize available resources to respond to, withstand, and recover from adverse situations. The proposed project would contribute to community resilience, as damages in the study area may not occur as frequently or as severely.

In reducing damages from future events, the Recommended Plan contributes to National Economic Development. National Environmental Restoration considerations are addressed in Chapter 6 (Environmental Impacts) of this report. As for OSE, the project would maintain the viability of routes of transportation, including emergency and other vital services. Implementation of the project could induce RED benefits in the area as residents and business owners may be able to allocate resources and spending on other goods and services than repairing and replacing structures or goods damaged by flooding. The Recommended Plan provides risk reduction to the vulnerable population in Newark, three police department facilities, four fire stations, one hospital, two clinics, and multiple colleges, universities, and schools. The majority of the residual risks from the Recommended Plan occur in Harrison and Kearny since the proposed segments are in Newark. Residual risks associated with the Recommended Plan includes remaining average annual damages of $93,582,000 out of a total average annual damage pool of $97,742,000.

5.7 Consistency with the North Atlantic Coast Comprehensive Study

The North Atlantic Coast Comprehensive Study report was released in January 2015, and provides a risk management framework designed to help local communities better understand changing flood risks associated with climate change and provide tools to help those communities better prepare for future flood risks. In particular, it encourages planning for resilient coastal communities that incorporates wherever possible sustainable coastal landscape systems that takes into account, future sea level and climate change scenarios (USACE 2015). The process used to identify the Recommended Plan utilized the NACCS Risk Management framework that included evaluating alternative solutions, and considering future sea level change and climate change. Recognizing the Federal Government's commitment to ensure no inducement of development in the floodplain, pursuant to Executive Order (E.O.) 11988, this project will identify in the Project Partnership Agreement (PPA) the need for the non-Federal sponsor to develop a Floodplain Management Plan, and a requirement for the sponsor to certify that measures are in place to ensure the project does not induce development within the floodplain. Compliance with E.O. 11988 is further documented in Chapter 8.0. The Non-Federal Sponsor, NJDEP, is to prepare a Floodplain Management Plan designed to reduce the impacts of future flood events in the project area within one year of signing a PPA and to implement the plan not later than one year after completion of construction of the project.

Chapter 6: Environmental Impacts of the Recommended Plan*

This section provides an analysis of anticipated adverse effects or environmental consequences anticipated for each resource as a result of the No Action Alternative and the Proposed Action within the Project Area. The Proposed Action would avoid adverse project impacts during project construction and operations and maintenance to the fullest extent possible. Mitigation measures would be implemented to minimize or offset unavoidable impacts. Compensatory mitigation would be conducted in accordance with applicable rules and permit conditions and in cooperation with the appropriate agencies.

In the impact assessment, the duration of impact (temporary or permanent) is identified, along with the type (beneficial or adverse) and expected intensity of the impact.

Impact assessment magnitude/levels are defined as follows:

- **No Impact:** No effects on the resource.
- **Negligible Impact:** These beneficial or adverse effects would not be observable or measurable.
- **Minor Impact:** These beneficial or adverse effects would be observable or measurable but would not differ substantially from existing conditions or would be localized and would not change the character of the resource. Minor impacts may be minimized with mitigation measures and would not result in an exceedance of regulatory thresholds.
- **Moderate Impact:** These beneficial or adverse effects would be observable or measurable and would differ noticeably from existing conditions. Adverse moderate impacts may be minimized with mitigation measures and may result in an exceedance of regulatory thresholds.
- **Major Impact:** These beneficial or adverse effects would be very obvious, significant and would differ substantially from existing conditions. Major adverse impacts are generally associated with a loss of resource integrity, would require mitigation, and would result in an exceedance of regulatory thresholds.

6.1 Physical Setting

Potential environmental impacts on each resource resulting from the No Action Alternative and the Proposed Action are discussed in each resource section.

6.1.1 Geology and Physiography

No Action Alternative

There would be no impact on geology and physiography as a result of the No Action Alternative. The Project Area would continue to be subject to storm-induced flooding. Underlying geology and physiography would not be impacted from these events.

Proposed Action

Geology and physiography would not be adversely affected by construction and maintenance of the Proposed Action. No permanent impacts on geology or physiography would occur. Structural components of the project would tie-in to bedrock formations as needed for structural integrity; however, there would be no impact on these geologic features.

6.1.2 Topography

No Action Alternative

There would be no impact to the topography of the study area as a result of the No Action Alternative. The study area would continue to be subject to periodic storm-induced flooding. Changes in topography would be localized, resulting from erosion and deposition, but would not change the character of the underlining topography in the study area.

Proposed Action

The vast majority of the study area would be untouched in terms of topographic alteration as a result of the Proposed Action. Minor impacts on topography would be limited to those within the Project Area. Changes in topography would be localized along the floodwalls. The Proposed Action would have an elevation of 14 feet NAVD88 (e.g., if the existing ground elevation is 10 feet the new floodwall would be 4 feet high). Height of the floodwall segments above the existing ground would be variable depending on the surrounding terrain, ranging from less than one to a maximum of approximately 9.4 feet where Segment 3 crosses an unnamed tributary to Jasper Creek which drains to Newark Bay.

6.1.3 Soils

No Action Alternative

There would be no or minor impact on soils within the study area as a result of the No Action Alternative. The study area would continue to be subject to periodic storm-induced flooding, resulting in localized soil erosion and deposition.

Proposed Action

The proposed action would result in minor impacts to soils within the Project Area portion of the study area. Temporary minor impacts would occur during construction within the limit of disturbance as a result of clearing and grading activities. Loss of access to native soils (where present) within the project footprint would result in minor adverse impact to this resource for the duration of the project life and would be considered permanent. Much of the Project Area consists of existing impervious surfaces; soils in these locations would not be impacted by Proposed Action. With the implementation of Best Management Practices (BMPs), including adherence to applicable requirements of the New Jersey Standards for Soil Erosion and Sediment Control (N.J.S.A. 4:24-39 et seq.) and the Stormwater Management Rules (N.J.A.C. 7:8), soil erosion during construction is expected to be minimal. Changes in soils would be localized along the floodwall alignment and within the temporary construction easement.

6.2 Climate and Weather

No Action Alternative

There would be no impact on climate or weather within the study area as a result of the No Action Alternative.

Proposed Action

There would be no impact on climate or weather within the Project Area as a result of the Proposed Action.

6.3 Floodplains and Coastal Processes

The following includes the environmental impacts of the floodplains and coastal processes in the study area.

6.3.1 Floodplains

No Action Alternative

There would be no direct impact on floodplains within the study area as a result of the No Action Alternative. The parts of the study area that are within the floodplain would continue to be subject to periodic flooding during storm events. Based on predicted sea level change (SLC), which is estimated to increase from between 0.64 to 2.61 feet over the next 50 years, the extent of flooding is expected to increase (USACE Climate Preparedness and Resilience, 2017). Therefore, an indirect impact of the No Action Alternative would be a larger floodplain area and increased depth of flooding. Impacts associated with increased flooding are expected to be adverse and moderate to major.

Proposed Action

A total of seven separate segments that consist of structural elements are proposed in the Newark portion of the study area to cut off inland storm surge paths and prevent inundation of the floodplain. During non-storm conditions there would be no impact on the flow of the rivers in the study area. The Proposed Action would reduce the potential for flooding of the Newark portion of the study area. Interior drainage systems would address flooding on the interior side of the floodwall, with pumping stations as needed to transfer stormwater to the river side of the floodwall. The Proposed Action has been designed to avoid induced flooding upstream or downstream of the Project Area and therefore, would have no impact beyond the study area. The Proposed Action would result in a major beneficial impact by reducing flooding in the Newark portions of the study area that are within the floodplain.

Presence of the structural elements in the segments would minimally alter the existing drainage patterns for stormwater runoff to the rivers. The Proposed Action includes flood walls, closure gates and a tide gate as depicted on Figure 21, Figure 22, and Figure 23. The Proposed Action would include an interior drainage system, consisting of a combination of gravity outlets, backflow prevention on existing outlets, and pump stations as needed, to manage stormwater runoff on the protected side of the flood walls/gates. During storms that exceed the design criteria of the pump stations, some ponding of stormwater in the interior portions of Newark would occur, resulting in localized residual flooding. This is expected to be an infrequent occurrence; however, any residual flooding is expected to be far less than any associated storm surge when compared to the No Action Alternative. In cases of excessive rainfall without an accompanying storm surge, the residual flooding may result in minor to moderate impact to the communities within the drainage areas.

6.3.2 Coastal Processes

No Action Alternative

There would be no impact on coastal processes within the study area as a result of the No Action Alternative. Sea Level Change would continue as per the current trend, with predicted increases from 0.64 to 2.61 feet over the next 50 years (USACE Climate Preparedness and Resilience,

2017). This increase in sea level would exacerbate the effect of coastal processes in the study area, with increased erosion due to wave action and tidal fluctuations, resulting in moderate adverse impact to the area due to coastal processes.

Proposed Action

The Proposed Action would result in reducing the potential for flooding of the Newark portion of the study area during storms. The design elevation of the structural elements would provide flood risk management for surges in conjunction with SLC, providing a benefit to the community. Because the Proposed Action is located landward of the shoreline, there would be no change in Coastal Processes as compared to the No Action Alternative.

6.4 Water Resources

The following profile of water resources in the study area focuses on tidal surface waters, fresh surface waters, and regional hydrogeology and groundwater. Potential environmental impacts to each of these resources resulting from the No Action Alternative as well as construction and maintenance of the Proposed Action follow.

6.4.1 Surface Waters

No Action Alternative

There would be no direct impact on surface waters within the study area as a result of the No Action Alternative. Sea Level Change would continue as per the current trend, with predicted increases from between 0.64 to 2.61 feet over the next 50 years (USACE Climate Preparedness and Resilience, 2017). As a result, the normal water levels of surface areas within the study area would be higher than existing conditions, and the area of surface water may increase where this higher elevation causes waters to expand beyond existing banks or shorelines.

Proposed Action

The Proposed Action would result in reduced potential for flooding of the Newark portion of the study area during severe storm events thus cutting off inland storm surge paths and constraining the increased storm flow to the river channels. Therefore, the Proposed Action would result in a minor temporary increase in the flow of the river channels. As discussed under “Floodplains,” ponding of surface water would occur as a result of stormwater accumulation on the interior side of the structural elements. The interior drainage system will direct this stormwater to the river side of the structural elements; however, during storm events which exceed the design criteria of the interior drainage system, localized fluvial flooding may occur. This is expected to be an infrequent occurrence when compared to the No Action Alternative, resulting in minor to moderate impact to the communities within the drainage areas.

6.4.2 Water Quality

No Action Alternative

Under normal flow conditions, there would be no impacts on water quality within the study area as a result of the No Action Alternative. Surface water classifications, flow characteristics and uses and impairments would not be changed. During extreme flood events, there would be temporary major adverse impacts on water quality. These impacts would result from the transport of unsecured materials and contaminants by floodwaters. Potential sources of

contaminants and unsecured materials include oils, gasoline and de-icing salts/chemicals from road runoff, household chemicals, and hazardous wastes, commercial and industrial chemicals, raw sewage, and miscellaneous trash, debris, and floatables. As a result of SLC, with water levels predicted to increase by between 0.64 and 2.61 feet over the next 50 years, the frequency and extent of flooding, and associated transport of contaminants to surface waters, is expected to increase, resulting in minor to moderate adverse impacts to water quality.

Proposed Action

Most of the structural elements in the segments are located in developed/disturbed areas such as paved roads, railroad tracks and disturbed upland vegetated areas. The only in-water structure associated with the Proposed Action is the tide gate in a small unnamed creek crossed by Segment 3. This small unnamed creek is a tributary to Jasper Creek, which is a tributary to Newark Bay. A tide gate at the mouth of Jasper Creek prevents tidal fluctuation in these surface waters upstream of the bay (FEMA 2015). During construction of the proposed tide gate there would be a potential for temporary, minor impacts on water quality in the vicinity of the Project Area. These water quality impacts could include temporary increases in turbidity and suspended solids, decreased dissolved oxygen, and increased biological oxygen demand. These temporary impacts would be limited to the construction phase and would be mitigated through implementation of BMPs. Additionally, impairments to water quality during construction due to increased suspended sediments would be minimized to the fullest extent possible by strict implementation of a sediment and erosion control plan, as well as meeting all requirements of state and local permits necessary for construction.

The land uses in the study area consist of dense urban residential development, industrial areas including sewerage treatment plants and transportation corridors along with hazardous waste sites. The proposed structural elements would have a moderate beneficial impact on water quality in that they would reduce the likelihood of floodwaters inundating the Newark portion of the study area and the subsequent transport of unsecured materials such as household chemicals, sewage, etc., by floodwaters and the associated negative impact to water quality.

Outfalls from the interior drainage system will be designed to avoid disturbance of the sediments in the receiving water bodies and avoiding associated water quality impacts from sediment resuspension, including increased turbidity and contaminant transport. Concentrated discharge velocities would be addressed by adding energy dissipaters or stilling basins before the discharged water entered the river, thus eliminating the potential for sediment resuspension.

6.4.3 Regional Hydrogeology and Groundwater

No Action Alternative

There would be no impact on regional hydrology or groundwater within the Project Area as a result of the No Action Alternative.

Proposed Action

The Proposed Action would have no adverse impacts on regional hydrogeology and groundwater resources.

6.4.4 Tidal Influences

No Action Alternative

There will be no impact on tidal fluctuations within the study area as a result of the No Action Alternative. The water bodies in the study area would continue to be subject to semi-diurnal tidal fluctuations as well as the full extent of tide surge during storm events. As a result of SLC, with water levels predicted to increase by 0.64 to 2.61 feet over the next 50 years tidal fluctuations will also rise accordingly.

Proposed Action

Most of the structural elements in the segments are located in developed/disturbed areas such as paved roads, railroad tracks and disturbed upland vegetated areas outside of areas inundated by the tide. The only in-water structure associated with the Proposed Action is the tide gate that is part of Segment 3. The channel crossed by Segment 3 is an unnamed tributary to Jasper Creek. An existing tide gate at the mouth of Jasper Creek on Newark Bay prevents tidal influence upstream. There would be no change in tidal influence to existing waters or wetlands as a result of the Proposed Action (see Section 3.8.2 for additional discussion on wetlands).

6.5 Land Use and Zoning

The study area is currently dominated by industrial and urban land uses and also includes some residential areas and limited suburban developments. Current land use in the Project Area is a combination of: (1) urban land uses (2) industrial land uses, and (3) transportation corridors.

No Action Alternative

There would be no direct impact on land use within the Project Area as a result of the No Action Alternative. Any proposed land development projects would need to comply with state, regional and local land use and zoning rules and regulations that are in place at the time the project is proposed. Sea level rise would result in moderate to major impacts on land use, because low-lying areas subject to increased frequency and severity of flooding may no longer be able to sustainably support existing land uses.

Proposed Action

The Proposed Action would not adversely affect the current land use in the Project Area. The areas of economic growth and development would not be restricted by the floodwalls since they have been specifically located along roadways and other transportation corridors adjacent to industrial/commercial uses. The Proposed Action includes seven Segments, with floodwalls ranging from 139 lf to 705 lf in length that incorporate closure gates to accommodate vehicular and pedestrian passage. These spatially separate, relatively sort segments would not adversely impact land use in the Project Area. The permanent easements required for the Proposed Action would be approximately one acre, with an additional acre of temporary easement area. The easements areas would be distributed between 47 separate parcels and would impact public, exempt, commercial, and industrial and railroad properties. Considering the small size of the permanent easement area, the Proposed Action would have minor direct impacts on these land uses. Implementation of the Proposed Action would have major beneficial impacts on land uses in the study area by offering improved flood risk management to homes, businesses, roads, churches, schools, parks, stores, and various other community services located in these flood-prone areas.

6.6 Socio-Economics

The study area falls within Essex and Hudson counties, specifically the City of Newark, Town of Harrison, and Town of Kearny. In general, the study area contains predominantly industrial facilities with a mix of residential development. Impacts to the three communities within the study area are presented below.

No Action Alternative

There would be no direct impact on socio-economics within the project area as a direct result of the No Action Alternative. The No Action Alternative would potentially have a major indirect adverse impact on socio-economics within the Project Area as there would be no reduction in the potential for future flooding and storm damage to remaining properties and the associated costs to repair such damages. Future growth and development opportunities may also be limited under the No Action Alternative, resulting in additional moderate indirect impacts to socio-economics of the study area.

Proposed Action

The Proposed Action would not directly, as a result of its physical construction, greatly alter or influence existing or future demographic characteristics because the area is almost completely developed and the project segments are primarily located along roads. However, a resulting reduction in the frequency and intensity of flooding in the Project Area may impact the number, density, or racial composition of residents living within the Project Area, as the reduction in flooding may lead to increased interest in residential or commercial development and redevelopment.

The Proposed Action would have major, beneficial economic impacts on existing businesses in the study area due to the reduced potential for future flooding and storm damages as well as improved accessibility to the area during storm events. The larger metropolitan region would benefit from the protection of the regional transportation centers in the study area and maintenance of regular or near regular transportation services during and following major storm events. There also would be a minor, beneficial economic impact on the local economy during construction as a result of the introduction of construction workers and the resulting purchase of supplies and food during the construction phase.

Major, beneficial impacts on housing and structures in the study area would also occur due to a reduction in the potential for future flooding and storm damage to existing properties, and the subsequent reduction in associated costs to repair such damages. In locations where the floodwalls block roadways or alter travel routes when the closure gates are shut, businesses may be negatively impacted. However, without the project, these businesses would continue to be directly and negatively impacted by flooding. The building inventory and flood damage model for the project area identified 951 commercial or industrial buildings that flooded above the main floor during Superstorm Sandy, with estimated damages of approximately $500 million. Under the existing conditions, there are over 1,400 commercial and industrial buildings in the 1-percent annual chance of exceedance floodplain. Accordingly, the end result of the Proposed Action is a benefit to local businesses.

6.6.1 Environmental Justice Summary

No Action Alternative

The No Action Alternative would potentially have a major indirect adverse impact on the community within Project Area as there would be no reduction in the potential for future flooding and storm damage to properties and the associated costs to repair such damages. Future growth and development opportunities may also be limited under the No Action Alternative. Areas within the "island" of the Ironbound, Harrison, and Kearny will have no actions implemented due to the presence of HTRW.

Proposed Action

No adverse human health impacts are anticipated to result from the implementation of the Proposed Action. No residential relocations would be required for implementation of the Proposed Action. The Proposed Action would provide an increased level of flood protection to the Project Area and flood prone communities in the surrounding study area. Residents of the Project Area neighborhoods would experience beneficial impacts in terms of protection of property and life. No disproportionately high and adverse impacts to minority and low-income populations would be expected from the Proposed Action. The implementation of flood control measures in Newark will not result in increased flooding potential in adjacent unprotected areas as the project will not induce flooding. The project would not result in a deteriorated condition from combined sewers in the areas not benefited from the flood protection. As noted above, the reduction in frequency and intensity of flooding in the Project Area may result in a secondary effect of increased interest in residential or commercial development and redevelopment. This interest may lead to increased housing costs that may negatively affect the future affordability of housing.

<u>Temporary Impacts during construction</u>

Based on input from the public meetings and correspondence with community leaders and stakeholders, the primary areas of concern during the two and a half year construction period focus on access to waterfront parks, noise impacts, air quality impacts and traffic and transportation impacts. Each is described below in detail. While temporary impacts are probable, they will be mitigated and therefore impacts are not expected to be significant, nor result in a disproportionate impact to low income and/or minority communities.

Temporary Waterfront Access Impacts - Segment 8 of the Proposed Action includes the construction of 297 linear feet of floodwall along the side of the off ramp from Raymond Blvd to Jackson Street, bordering the sidewalk adjacent to Riverfront Park, with a height of approximately 1.3 to 3.4 feet. Construction of the floodwall is expected to take approximately six months. While the floodwall maintains permanent access to the parks and the adjoining waterfront, temporary access to Minish Park from Jackson Street may be temporarily restricted during construction. Sidewalk detours to the park would be provided to permit pedestrian access to the waterfront park during construction. As a result, temporary impacts to waterfront access would not be significant, and there would be no permanent impact to the park or park users.

Temporary Noise Impacts – The Proposed Action would have no adverse impact on residential properties during construction. Impacts to Minish Waterfront Park would last approximately 6 months during the construction of Floodwall Section 8. Noise levels within the park would exceed local and state criteria, ranging from 70 to 90 decibels. Construction would be limited to weekdays with no evening or weekend work, where possible, to minimize impacts to park users. As a result, impacts are not expected to be significant, nor disproportionately felt by Environmental Justice populations.

Temporary Air Quality Impacts –While the construction of the Proposed Action would have a *de minimis* regional impact on air quality emissions during construction, localized areas have the potential to be impacted by diesel emissions from construction vehicles and construction dust (particulate matter). Best Management Practices will be required, along with adherence to soil erosion control permits, to minimize particulate matter emissions. Construction contractors will be required to use newer equipment and vehicles with low emission controls. Vehicle idling will not be permitted during construction. As a result, air quality impacts are not expected to be significant and would not have a disproportional impact on Environmental Justice populations.

Temporary Transportation Impacts- There would be a potential temporary disruption of transportation systems and infrastructure along roads in the study area during construction activities. Construction would result in temporary, minor impacts on vehicular traffic flow and volume, which may include commuter bus service. Construction of Segment 2 consists of five closure gates across the railroad tracks between MacArthur Highway and the I-78 corridor, which may result in adverse impacts to commuter and freight rail service.

Traffic and railroad impacts would be minimized through the implementation of Maintenance and Protection of Traffic plans and early and ongoing coordination with local transportation officials, and railroad companies. As a result, impacts are not expected to be adverse, nor would they have a disproportional impact on Environmental Justice populations.

6.7 Coastal Zone Management

No Action
The No Action Alternative would be consistent with CZM.

Proposed Action
The Proposed Action is consistent to the extent practicable with applicable policies detailed in the New Jersey CZM Rules. Coastal Zone Management policies would be adhered to during the construction and maintenance of the Proposed Action. If required in addition to the Federal Consistency, appropriate coastal permits/authorization would be obtained from the NJDEP, including an Individual Waterfront Development Permit and Section 401 Water Quality Certification. For policies that strict compliance is not feasible, such as public access/public open space and scenic resources, mitigation will be implemented to satisfy the intent of the policy. Additional details regarding the consistency of the Proposed Action with applicable coastal policies is provided in Appendix A.

6.8 Vegetation

The study area is largely developed with commercial, industrial, and residential land uses where vegetation is limited to disturbance tolerant species that are typical of an urban/industrial setting. Vegetated areas are limited to maintained transportation corridors, lawns, and parks. These vegetative communities have been degraded as a result of centuries of anthropogenic disturbance. The wetland and upland habitats that comprise these communities are described below.

6.8.1 Upland Habitat

No Action Alternative

Under the No Action Alternative, coastal storm flooding would continue to periodically affect the study area, inundating and damaging upland vegetation that is not adapted or otherwise resistant to saturation and/or saline waters. Because coastal storms are predicted to be more frequent and severe due to climate change, under the No Action Alternative inundation of upland vegetation areas due to storm surge would be expected to increase gradually over time in direct relation to sea level change.

Proposed Action

The Proposed Action would result in minor temporary and permanent impacts to upland vegetation as a result of changes to vegetation cover types associated with construction of the Proposed Action. The majority of the elements would be located in existing developed areas along paved roadways and railroad tracks, avoiding vegetated areas and riparian zones. However, vegetated upland areas are found along roadways and railroads at Segments 1 and 5, and Minish Park along Segment 8. A 50-foot riparian zone is also present along the Passaic River at Segment 8 and the unnamed tributary to Jasper Creek at Segment 3. Temporary minor impacts to these areas would be associated with construction access and staging. There would also be minor permanent impacts to vegetation associated with the construction of the Proposed Action. A total of approximately 0.12 acres of permanent and 0.29 acres of temporary disturbance to vegetated upland habitat are anticipated, as outlined in Table 35. Approximately 0.09 acres of temporary and 0.01 acres of permanent disturbance to the regulated riparian zone are also proposed. Additional impacts to upland vegetation and riparian zones may result from construction of pump stations and other interior drainage features. The extent of these impacts will be determined as the interior drainage design is finalized.

Table 35: Area of Impacts to Vegetated Upland Habitat

COMMUNITY TYPE[1]	PERMANENT IMPACT	TEMPORARY IMPACT
Mowed Roadside Pathway	0.01 ac	0.03 ac
Urban Vacant Lot	0.02 ac	0.04 ac
Mowed Lawn	0.09 ac	0.22 ac

Note: Community types determined using aerial photographs of the plan segments.

[1]Communities categorized based on the Ecological Communities of New York State, Second Edition (Edinger et al. 2014)

Because invasive species dominate the small, isolated urban habitats occurring within the footprint of the Proposed Action, they are considered to be of low ecological value. Impacts to these upland communities are minor adverse impacts and would be minimized to the furthest extent practicable. All areas impacted by temporary construction activities would be revegetated with native species. Additionally, impacts to vegetation occurring within 50 feet of the riverbank that falls within the NJDEP designated riparian zone, would require compensatory mitigation. Mitigation would be conducted in accordance with applicable rules and permit conditions and in cooperation with the appropriate agencies.

6.8.2 Wetlands Habitat

No Action Alternative

Under the No Action Alternative, coastal storm flooding would continue to periodically affect the study area, inundating areas and damaging coastal wetlands and freshwater wetlands that are not adapted or otherwise resistant to saline waters. Because coastal storms are predicted to be more frequent and severe due to climate change, under the No Action Alternative inundation of wetland habitat due to storm surge would be expected to be more frequent; thereby disrupting these habitats more often. Additionally SLC will cause wetlands to migrate landward gradually over time where space is available. Where landward migration is not possible wetland habitats will become inundated and submerged, eventually converting to open water habitat. Considering the limited extent and low functional value of wetlands in the study area, wetland impacts associated with the No Action Alternative would be adverse and moderate resulting from conversion of wetlands to open water.

Proposed Action

The project was designed primarily in uplands and previously developed sites to avoid and minimize impacts to wetland areas to the extent practicable. However, due to engineering and/or feasibility constraints avoidance of all wetland impacts would not be possible. Based on the existing wetland mapping, the Proposed Action would result in 0.08 acres of temporary and 0.18 acres of permanent impacts to wetlands, as outlined in Table 36.

Table 36: Area of Impacts to Mapped NWI and NJDEP Wetland Habitat

SEGMENT	COMMUNITY TYPE	PERMANENT IMPACT	TEMPORARY IMPACT
3	Tidal Wetlands	0.07 ac	0.03 ac
	Freshwater Wetlands	0.11 ac	0.05 ac

Following construction, temporarily disturbed wetland areas would be revegetated with native species and wetland functions would quickly reestablish. Permanent minor impacts to wetlands would result from construction of Segment 3 (Figure 28). The wetland area at Segment 3 includes a drainage feature that is an unnamed tributary to Jasper Creek which drains to Newark Bay. Based on NWI maps this feature is tidal up to a point near Segment 3 where it changes to a riverine feature. Construction in Segment 3 includes a tide gate that would allow for upstream reaches of the ditch to continue to drain into Newark Bay, but would prevent storm surge and tidal flow from the bay to affect areas upstream of the segment.

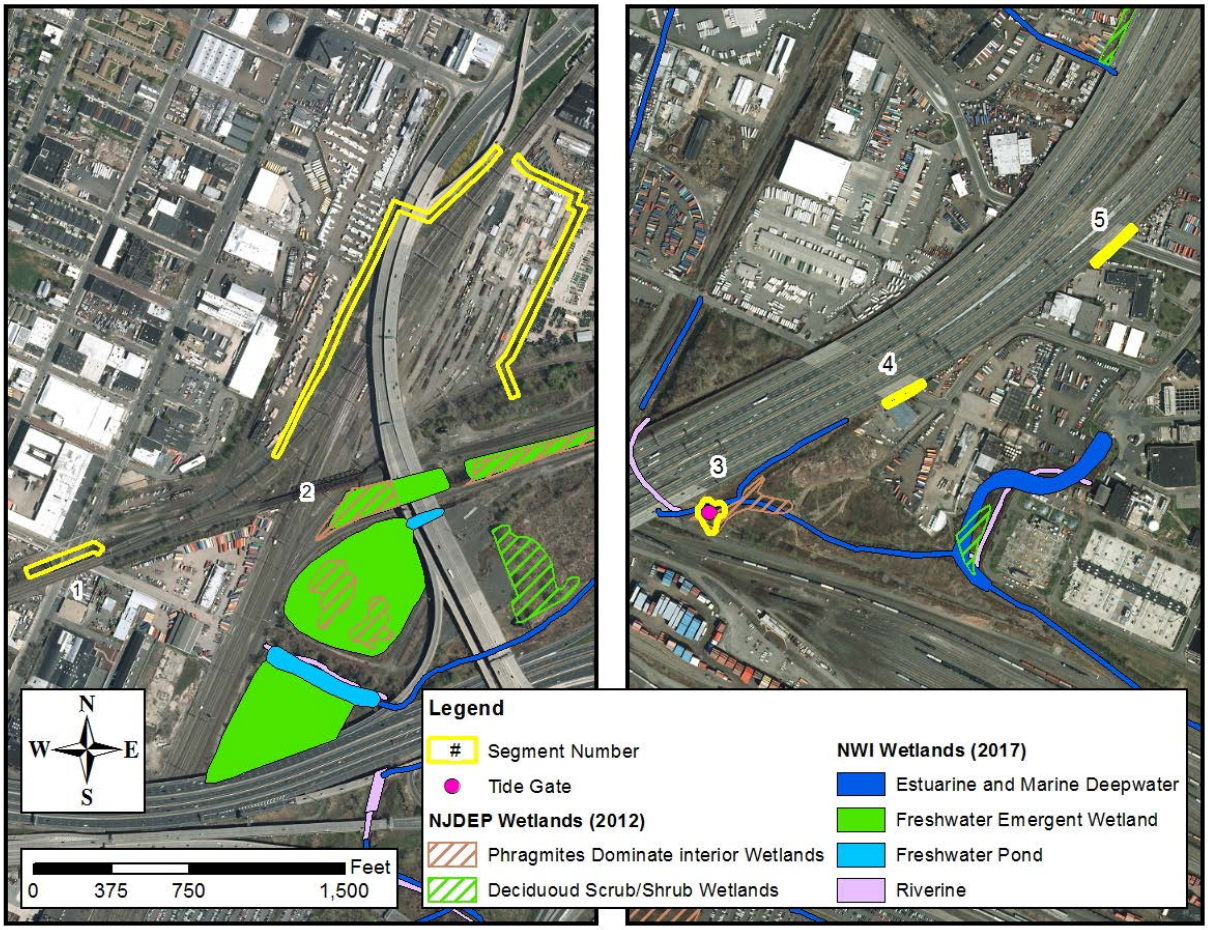

Figure 28: Detail of NJDEP and NWI Mapped Wetlands at Segments 1, 2, 3, 4, and 5

Additional impacts to wetlands and watercourses may result from construction of pump stations and other interior drainage features. The extent of these impacts will be determined as the interior drainage design is finalized. Impacts to wetlands and watercourses have been minimized to the greatest extent possible by siting most of the project footprint in upland areas and installing a tide gate across the tributary at Segment 3 to allow for continue downstream flow.

There would be no other anticipated impacts to wetlands and watercourses during the operation and maintenance phase. The tide gate at Segment 3 would prevent coastal storm influence to riparian wetland areas and watercourses upstream of the gate; however, precipitation events would continue to contribute to the hydrologic cycle within the Project Area, with minimal disruption of inflows and outflows.

Impacts to wetlands and watercourses would be mitigated through implementation of a compensatory wetland mitigation plan consistent with NJ Freshwater Wetland permit program and the 2008 Final Rule on Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR Parts 325 and 332 and USEPA 40 CFR Part 230). Mitigation would be conducted in accordance with applicable rules and permit conditions and in cooperation with the appropriate agencies.

6.9 Fish and Wildlife Resources

6.9.1 Shellfish

No Action Alternative

Under the No Action Alternative, future flooding events due to coastal storms would increase in frequency and intensity, resulting in degradation of shellfish habitats due to sedimentation and scour resulting from increased flow velocity of coastal waterways and causing a major impact to shellfish. In addition, contaminated sediments are present throughout the study area.

Proposed Action

Construction of the Proposed Action would have no direct impacts on shellfish species within the Project Area because in-water construction activities are limited to Segment 3, within an unnamed tributary to Jasper Creek which drains to Newark Bay. The unnamed tributary is part of a network of drainage features constructed to convey surface water to the bay. Shellfish resources are unlikely to occur in this tributary for the following reasons: 1) the presence of multiple culverts between Segment 3 and Newark Bay that limit shellfish movement; 2) presence of a tide gate at the mouth of Jasper Creek at Newark Bay; 3) an overall lack of shellfish found in Newark Bay; and 4) the distance of Segment 3 to the Bay, which is approximately 1.4 miles. As such, no adverse impacts to shellfish resources are expected as a result of the construction of the Segment 3.

6.9.2 Finfish

No Action Alternative

Under the No Action alternative, sea level would continue to rise and coastal storms would occur with more frequency and intensity. Rising sea levels would flood coastal wetlands and shallow marshes that provide the limited habitat for young fish species present in the study area. Because the study area is highly developed up to the boundary of most watercourses and wetlands, there is no room for wetlands to migrate landward. Existing wetlands and mudflats would become open water habitat having moderate permanent impacts in the study area. These impacts would be beneficial for species utilizing open water habitats and adverse for young and small fish species that utilize wetlands and shallow intertidal and subtidal habitats. Considering the limited extent of wetland and mudflats in the study area, both types of impacts would be minor.

Proposed Action

Finfish habitat within the project area is limited to the unnamed tributary to Jasper Creek at Segment 3 and its adjacent wetlands which may offer nursery and foraging habitat for fish species. While many finfish species are present in Newark Bay, it is unlikely that large fish are able to enter the Project Area at Segment 3. There are multiple culverts along the unnamed tributary to Jasper Creek, as well as a tide gate at the mouth of Jasper Creek and the Segment is located 1.4 miles upstream of the bay. Small fish species such as mummichog or silversides (*Menidia* spp.) could potentially enter the Project Area during significant high tides or storm events. Construction of the Proposed Action would have temporary, minor, adverse impacts on fish habitat and populations occurring in the Project Area at Segment 3. Because adult fish are highly mobile, fish potentially present in the Project Area would be able to find comparable

habitat in the vicinity during construction. If fish species requiring seasonal restrictions on in-water work are present within the unnamed tributary to Jasper Creek at Segment 3, construction would be completed in accordance with the specified windows to avoid impacts to fish species.

Potential minor indirect impacts during construction include changes in water quality due to sediment resuspension in the water column and adjacent wetlands. However, suspended sediment would settle quickly out of the water column thus causing only temporary minor impacts to water quality. This impact would be minimized by the use of BMPs such as erosion and sediment control measures during construction activities The tide gate at Segment 3 would prevent fish from swimming upstream into the drainage network; however, the tributary does not appear to extend very far upstream from the tide gate; therefore, this impact would be minor. Fish would continue to be able to pass downstream during low tides. Additional minor permanent impacts would be sustained from the loss of nursery and foraging habitat potentially present within the wetlands adjacent to the floodwall segment. Under the Proposed Action the impacts of SLC, including habitat conversion from wetlands and shallows to open water, would still be incurred downstream of Segment 3 and the other plan segments.

Permanent impacts to EFH designated habitats within the study area would be anticipated due to the loss of benthic habitat and potential food sources at Segment 3, where the floodwall and tide gate would be placed within the unnamed tributary to Jasper Creek. Based on the minimal area of permanent impact and the habitat present within the project area, the Proposed Action would yield minor permanent adverse impact to finfish species and EFH designated habitat.

6.9.3 Benthic Resources

No Action Alternative

Under the No Action Alternative future flooding events resulting from coastal storms would increase in frequency and intensity, resulting in increases in sedimentation and scour from increased flow velocities. Based on the low abundance of benthic species, impacts resulting from scouring and sedimentation would be minor.

Proposed Action

Construction of the plan segments would be limited to the upland areas with the exception of Segment 3. Segment 3 involves construction of a floodwall with a tide gate across an unnamed tributary to Jasper Creek. Construction of Segment 3 would result in minor permanent and temporary impacts to benthic species resulting from construction of the floodwall and tide gate within benthic habitat. Erosion and sediment control measures would be implemented during construction to minimize any potential downstream sedimentation impacts on aquatic resources resulting from construction.

The proposed project would minimize coastal storm flooding events upstream of the floodwall segments. As such, the benthic community located upstream of the floodwall segments would sustain minor benefits as a result of the Proposed Action, which would minimize high velocity coastal flooding during storm events.

6.9.4 Reptiles and Amphibians

No Action Alternative

Under the No Action Alternative, coastal storm flooding is expected to become more frequent and intense, inundating areas and damaging coastal habitats utilized by reptile and amphibian species. These habitats include wetlands, open waters, and vegetated uplands. Permanent impacts to these habitats will result from habitat conversion due to SLC. Due to a lack of area for wetlands to migrate landward, most existing wetlands and shallow water habitats will be lost and become open water. Considering the limited extent of habitat in the study area, associated indirect impacts to reptiles and amphibians would be minor, adverse, and permanent.

There would be no direct impacts on reptiles and amphibians in the Project Area as a result of the No Action Alternative, because the proposed project would not be constructed.

Proposed Action

Construction of the Proposed Action may have minor adverse temporary and permanent impacts on amphibian and reptile populations potentially occurring in the Project Area. Construction activities may result in the temporary and permanent loss of habitat and possible direct mortality of less mobile species. However, amphibian and reptilian mortality and habitat loss is expected to be minimal since a majority of the Project Area lacks habitat for these species. At Segment 3 where impacts to the unnamed tributary to Jasper Creek are anticipated, species would be able to migrate to comparable habitats in the vicinity (i.e. further upstream or downstream). Based on the lack for potential habitat areas for reptiles and amphibians, and the developed nature of the study area with commercial, residential, and industrial uses, it is anticipated that impacts from interior drainage features would be minimal. The extent of these impacts will be determined as the interior drainage design is finalized.

The proposed project would minimize coastal storm flooding events upstream of the floodwall segments. As such, the reptile and amphibian community located upstream of the floodwall segments would sustain minor benefits as a result of the Proposed Action, which would minimize high velocity coastal flooding during storm events.

6.9.5 Birds

No Action Alternative

Under the No Action Alternative, coastal storm flooding is expected to become more frequent and intense due to SLC, inundating areas and damaging coastal habitats utilized by bird species. These habitats include wetlands, open waters, and shorelines. Permanent impacts to these habitats will result from habitat conversion due to SLC. Due to a lack of area for wetlands to migrate landward, most existing wetlands and shallow water habitats will be lost and become open water. This would be a permanent minor adverse impact for certain bird species utilizing wetlands and shallow shorelines, and a benefit for those species utilizing open waters.

Proposed Action

The Proposed Action would have minor temporary and permanent, adverse impacts to birds in the Project Area. During construction, increased noise and heavy machinery activity could cause

displacement of individuals, or nest disruption resulting in minor temporary impacts. Species that use the existing wetland and upland habitats would be impacted by a potential decrease in this habitat type; however, these species can utilize comparable suitable habitat in the vicinity. Therefore, the permanent impact would be minimal. The indirect impacts related to seal level rise as discussed under the No Action Alternative would also occur with the Proposed Action.

6.9.6 Mammals

No Action Alternative

Under the No Action Alternative, coastal storm flooding would likely become more frequent and intense, inundating areas and potentially damaging upland habitats utilized by mammals. This would be a temporary indirect moderate adverse impact, but if storms are more frequent and intense species may not recolonize flood prone areas leading to major impacts resulting from permanent habitat loss.

There would be no direct impacts on mammals in the Project Area as a result of the No Action Alternative, because the proposed project would not be constructed.

Proposed Action

The Proposed Action would have temporary and permanent, minor, adverse impacts on mammals in the Project Area. During construction, heavy machinery activity could cause direct mortality of less mobile small mammal species, or cause displacement of individuals near construction activities because of increased noise levels. Construction activities would result in the temporary and permanent loss of habitat and possible mortality of burrowing or denning wildlife species such as small rodents. However, most of the mammals likely to occur in the Project Area are mobile and highly tolerant of human activities. Therefore, while disturbances from construction activities would temporarily displace mammals from construction areas, these individuals would likely avoid direct mortality. Therefore, impacts to mammal species are anticipated to be minor and temporary resulting from project construction. Additional impacts to mammals may result from construction of pump stations and other interior drainage features. Based on the lack for potential habitat areas for mammal species, and the developed nature of the study area with commercial, residential, and industrial uses, it is anticipated that impacts from interior drainage features would be minimal. The extent of these impacts will be determined as the interior drainage design is finalized. The same indirect moderate adverse impacts attributable to SLC as described for the No Action Alternative would occur with the Proposed Action.

6.10 Threatened and Endangered Species

No Action Alternative

Under the No Action Alternative, coastal storm flooding is expected to become more frequent and intense, inundating areas and damaging coastal habitats utilized by listed species. These habitats include vegetated uplands, wetlands, open waters, and shorelines. Permanent impacts to these habitats will result from habitat conversion due to SLC. Due to a lack of area for wetlands to migrate landward, most existing wetlands and shallow water habitats will be lost and become

open water. This is a minor permanent adverse impact for certain species and a benefit for those species utilizing open waters.

There would be no direct adverse impacts on federal or state listed endangered, threatened, and special concern species or areas of designated critical habitat in the study area a result of the No Action Alternative.

Proposed Action

The state-listed species identified as potentially occurring in the vicinity of the Project Area are generally piscivore avian species that utilize open water and near-shore habitats to forage. Potential minor impacts to foraging species may occur as a result of construction of Segment 3 within an unnamed tributary to Jasper Creek. While many forage species are found in the study area within the Passaic River and Newark Bay, forage species within this drainage feature are likely to be low in numbers. Therefore, impacts resulting from construction are anticipated to be minor and temporary, and piscivore species would be able to utilize comparable forage habitat in the vicinity of the Proposed Action. No impacts to federally listed or state listed species resulting from operation of the Proposed Action are anticipated.

Minor permanent adverse impacts and benefits resulting from SLC and the conversion of wetlands and shallows to open water would also occur as part of the Proposed Action.

6.11 Cultural Resources

No Action Alternative

There would be no cultural resource impacts as a result of the No Action Alternative.

Proposed Action

The APE is considered to be located along the floodwall alignment in Segments 1 – 8, as currently proposed. The APE for archaeology, historic structures and historic landscapes has been defined as those areas along the proposed alignments that would likely be directly impacted by project construction. The APE for historic structures and historic landscapes includes also those locations that would be anticipated to have impacts visually from the completed project. At this time, there are no staging areas, access roads, or other ancillary features defined for the study but these areas will be considered within the APE once they are defined. Interior drainage may be achieved by modifying existing storm sewers. Once the location and design of the interior drainage measures are better defined they will become part of the APE.

A number of NRHP-listed or eligible properties are located within the APEs identified above. Several potentially eligible properties have been identified for which further study is required. It is anticipated that project actions may have direct and/or indirect impacts to several of these properties. Potential impacts to specific historic properties are outlined below by project segment and summarized in Table 37.

Table 37: Identified and Potential Historic Properties within the APE and Need for Further Study

SEGMENT	ABOVE GROUND	FURTHER STUDY	BELOW GROUND	FURTHER STUDY
1	a. Lehigh Valley RR HD (NAE)	a. no	a. Newark City Sewer System b. Peddie's Ditch c. LVRR-related resources	a. yes b. yes c. yes
2	a. Lehigh Valley RR HD (NAE) b. Pennsylvania RR HD (NAE) c. Pennsylvania RR NYBB (NAE)	a. no b. yes c. no	None	no
3	a. Lehigh Valley RR HD (NE) b. Lehigh Valley RR Oak Is. Yard (NE) c. Passaic Valley Sewerage Commission Newark Bay Outfall Sewerage Works (NE)	a. no b. no c. no	None	no
4	a. 106 Rutherford Pl. (NE) b. Passaic Valley Sewerage Commission/Newark Bay Outfall Sewerage Works (NE)	a. yes b. no	None	no
5	Passaic Valley Sewerage Commission/Newark Bay Outfall Sewerage Works (NE)	no	None	no
6	a. Pennsylvania RR HD (NAE) b. Newark Penn Sta. (NAE w/ TP) c. Second Reformed Dutch Church & Rectory (NE) d. Ironbound Trust Co. (NE)	a. yes b. yes c. no d. no	Robinson & Roders Company Factory site	yes
8	a. Jackson Street Bridge (NE) b. Riverbank Park & Fieldhouse (NE)	a. no b. no	a. Morris Canal HD b. Site 28-Ex-129 c. Newark City Sewer System	a. yes b. yes c. yes
Interior Drainage	TBD	yes	TBD	yes
Other Features	TBD	yes	TBD	yes

NAE = No Adverse Effect, NE = No Effect, AE= Adverse Effect, TP = Treatment Plans, TBD= To Be Determined

The proposed action intersects several times with the LVRR and the PRR HDs however it is not anticipated that the construction of protection measures will have adverse effects on the historic railroads. The construction of walls and closure gates will likely have effects but they will not be adverse given that the work will be limited to selected locations along these lengthy rail lines.

These corridors have already experienced extensive modifications themselves, as well as changes to the surrounding communities, over the decades in this highly urban area. It is not anticipated that construction of any proposed measure will structurally impact any of the contributing railroad bridges although there may be visual impacts to these structures from the construction of floodwalls and gates. The District will work with the NJHPO on finishing treatments as determined necessary. The individually eligible Newark Penn Station will be directly impacted by construction. The District will develop treatment plans that minimize effects through design and finish. Potential effects to the LVRR and PRR are outlined below by project segment.

6.11.1 Above Ground Resources

Segment 1: Two walls of the proposed measure tie into the NRHP-eligible LVRR northern embankment near the abutments of the plate girder bridge carrying the rail line over Frelinghuysen Avenue. Approximately seventy feet of alignment is proposed adjacent to the southern edge of the at-grade LVRR spur which runs to the railyard just north of Peddie Street. The proposed action will directly impact the LVRR HD as it ties into the railroad embankment near the bridge abutments. The construction of three segments of 3-foot high wall and gates will have an indirect effect on the HD but it will not be adverse as the work will not alter the eligibility of the LVRR line or its contributing elements; the at-grade spur and the bridge over Frelinghuysen Avenue. No other above ground historic resources are present.

Segment 2: Segment 2 is adjacent to and/or under the PRR New York to Philadelphia HD (now Amtrak's Northeast Corridor), and the PRR New York Bay Branch HD; all of which are NRHP-eligible resources.

The proposed wall will be located where the PRR New York Bay Branch branches off the main PRR line and heads east towards the New Jersey waterfront. Although this alignment is considerably shorter in length than the PRR HD the presence of a 6-foot wall at its junction with the main PRR line will have an effect and addition work will be needed to determine if this effet will be adverse.

There may be ancillary historic railroad features extant such as catenary, lamps, etc., within the Segment 2 vicinity. As plans are developed an access to the railroad corridor is obtained a survey may be conducted to identify any such historic features.

Segment 3: A 9-foot high wall running across a small stream, is proposed just north of the LVRR HD and LVRR Oak Island Yard HD and immediately east of the New Jersey Turnpike overpass. The stream is well below grade of the railyard. The construction, as presently proposed, is to tie into an access road that runs between the stream and the historic rail lines, and will not directly impact these districts. The wall will be located approximately 100 feet north of the western end of the LVRR Oak Island Yard, where the LVRR rail lines begin to fan into the rail yard. The proposed action will have no effect on the LVRR Oak Island Yard HD or the LVRR HD. The proposed action will have no effect on the Passaic Valley Sewerage Commission Newark Bay Outfall Sewerage Works which is located approximately 1,000 feet east of Segment 3. No other above ground historic resources are present. No additional work will be conducted.

Segment 4: The Quonset hut-like "Butler Building" structure at 106 Rutherford Street may be eligible for the NRHP. The construction of an adjacent wall and closure gate to a height of 4 feet

above ground surface will have no direct effect on the structure. The setting has already been heavily modified by the presence of the NJ Turnpike overpass. The District will conduct additional research on the structure to determine eligibility and will prepare a NJHPO Architectural Survey Base Form and Eligibility Worksheet for the structure in the next phase of the project. The proposed action will have no effect on the Passaic Valley Sewerage Commission Newark Bay Outfall Sewerage Works which is located approximately 1,000 feet east of Segment 4. No other above ground historic resources are present.

Segment 5: The proposed action, here a 200 foot long wall with a maximum height of 3.2 feet above grade and one road closure structure, will have no effect on the Passaic Valley Sewerage Commission Newark Bay Outfall Sewerage Works which is located approximately 1,000 feet east of Segment 5. No other above ground historic resources are present. No additional work will be conducted.

Segment 6: The construction of a 3-foot high wall one a block to the west of the Second Reformed Church and across a park from the Ironbound Trust Company will have no effect on these properties.

The wall and closure gate may tie-off at Newark Penn Station and the PRRR HD which will have a direct effect on these historic properties. The effect will not be adverse on the lengthy PRR HD but construction will directly impact the individually eligible train station. Project plans will be developed to minimize direct effects to the historic fabric of the station, as feasible. Mitigations measures for any unavoidable impacts will be coordinated with NJHPO. The District will work with NJHPO and other interested parties to develop a treatment plan that leads to no adverse effects to the structure.

Segment 8: As currently proposed, a 5-foot high wall will run along the sidewalk on the north side of Raymond Boulevard for 690 feet beginning approximately 100 feet east of the NRHP-eligible Jackson Street Bridge. There is a low wall with a fence already in place along the entrance ramps to the bridge. The construction of the wall 100 foot east will have no effect on this historic property or its setting given the major changes to the bridge approaches and surrounding landscape over time.

The LOP was initially proposed to run within Riverbank Park but was relocated based on input from the local community. The wall, as now proposed, will run along the sidewalk near the road. This wall will have a direct effect on the NRHP-listed Riverbank Park however the park has already undergone major renovations on the riverside of Raymond Boulevard and the addition of a low wall along the sidewalk is not considered an adverse impact. The District has been working with the local community as part of the overall planning of the project and the final wall design will be informed by community input. The proposed action will have no effect on the Riverbank Park Field House which located on the south side of the playing field and across Raymond Boulevard from the APE or on Riverbank Park as a whole.

6.11.2 Below Ground Resources

Segment 1: Project plans, as they are developed, will be compared with detailed maps of the historic City of Newark Sewers to ensure that the historic sewer is not impacted by the proposed measures. If impacts are anticipated, measures to minimize or mitigate them will be developed. Additional research on Peddie's Ditch will be undertaken to confirm it will not be impacted by

construction. Pending final design archaeological monitoring during construction for remains of railroad gate mechanism and railroad embankment may be undertaken.

Segment 2: The walls will tie into the PRRR railroad embankment which will create a similar impact as the construction of the walls in Segment 1. Monitoring of Segment 2 construction may will be required.

Segment 3: No archaeological resources anticipated and no further work will be undertaken.

Segment 4: No archaeological resources anticipated and no further work will be undertaken.

Segment 5: No archaeological resources anticipated and no further work will be undertaken.

Segment 6: Archaeological evidence of the Robinson & Roders Company plant are likely to be encountered. Historic research will determine the need for, and direction of, archeological investigations.

Segment 8: This area is sensitive for remains from the industrial development of the Passaic River waterfront and in particular evidence of the Morris Canal may be encountered. As project plans are developed the need for, and extent of, archaeological investigations will be coordinated with NJHPO and other interested parties. The plans will also be compared with detailed maps of the historic City of Newark Sewers to ensure that the historic sewer is not impacted by the proposed measures. If impacts are anticipated, measures to minimize or mitigate them will be developed. As plans are developed the potential for encountering remains of the Balbach Works (Site 28-Ex-129) will be assessed.

Interior Drainage: Plans, as they are developed, will be compared with detailed maps of the historic City of Newark Sewers to ensure that the historic sewer is not impacted by the proposed measures. If impacts are anticipated, measures will be developed to minimize or mitigate for adverse impacts. The need for archaeological investigations will be determined in coordination with NJHPO for measures proposed outside the sewer system.

Other Project Features (access roads, staging areas, etc.): As project plans are developed, and locations for these ancillary features are proposed, the need for archaeological investigations will be determined in coordination with NJHPO.

6.11.3 Section 106 Coordination and Mitigation

Agreement documents were developed previously by the District for two projects along the Passaic River whose study areas encompass all or part of the Passaic Tidal APE. As part of the Passaic River Basin study a Programmatic Agreement (PA) was signed in 1993 by the District, the NJHPO and the Advisory Council on Historic Preservation to address the need for further cultural resource investigations. A Memorandum of Agreement (MOA) was developed and signed in 1997 by the District, the NJHPO and the Advisory Council on Historic Preservation to address historic properties identified in the Joseph G. Minish Passaic River Waterfront Park and Historic Area in the City of Newark. Several stipulations of the MOA have been completed to date including stipulations implemented in part by the City of Newark with regards to their work on Riverfront Park. These agreements served as useful tools for preparing Section 106 documents for the Passaic Tidal study.

The District project archaeologist reached out by telephone and/or email to the following local community members or experts to get their input on cultural resources within the APE:

- David Robinson, City of Newark, Office of Planning, Zoning & Sustainability, Landmarks & Preservation Commission and Ironbound Community Corporation
- Nancy Zak, Ironbound Community Corporation
- Scott Dvorak, Trust for Public Land
- Ulana Zakalak, architectural historian, Newark
- Caroline Scott, New Jersey railroad historian

Attempts were also made to contact Newark Preservation and Landmarks Committee by phone but no response was given. Additional outreach to them will be made.

In order to address the anticipated adverse impacts that may result from the proposed action the District has prepared a Case Report summarizing the research, findings and potential impacts. Also prepared was a preliminary draft PA which stipulates the actions the District will take with regard to cultural resources as the project proceeds. The Draft PA is available for public review as Appendix E and will serve as the District's Section 106 public coordination. The Case Report and Draft PA has been provided to the NJHPO, the Delaware Nation, the Delaware Tribe of Indians, the Eastern Shawnee Tribe and the Shawnee of Oklahoma for their review and participation. Consultation was also initiated with other interested parties including the City of Newark Landmarks & Historic Preservation Commission (Appendix D – Pertinent Correspondence). The Advisory Council on Historic Preservation will be provided an opportunity to participate. The final PA will incorporate comments received on the draft document, as appropriate, and will be used to ensure that the District satisfies its responsibilities under Section 106 of the NHPA and other applicable laws and regulations.

6.12 Air Quality

The Proposed Action was evaluated to determine the applicability of the General Conformity regulations pursuant to Section 176 of the Clean Air Act. The assessment determined that the requirements of this rule due not apply because the total direct and indirect emissions from the project would be significantly less than the threshold that triggers applicability. In a Record of Non-Applicability (RONA), the USACE NYD determined that the project presumes to conform with the General Conformity requirements and is also exempted from Subpart B under 40 CFR§93.153(c)(1). The RONA is provided in Appendix B-2 of the Integrated General Reevaluation Report and Environmental Assessment for the project. Post construction, the Project would not noticeably increase air emissions above existing levels.

Construction projects within Newark must be particularly sensitive to how these projects affect air quality within the city. Although the Proposed Action are well below *de minimus* levels for the criteria pollutants, cumulatively any emissions adds to an already overburdened system. To minimize impacts, construction contractors will be required to use newer equipment and vehicles with emission controls. No equipment idling will be allowed at any of the segments.

The operation of the pump stations and any mechanized gates would be designed using the most up-to-date equipment that will avoid to adversely contributing to poor air quality. The location of the pump stations need to consider the locations where they would optimally function without impacting neighborhoods or community resources. Pump stations are typically designed to be non-descript, maintained structures that fit into the community and should not adversely impact the neighborhood.

6.13 Noise

No Action Alternative

There would be no noise impacts as a result of the No Action Alternative.

Proposed Action

Construction of the Proposed Action would last approximately 2.5 years for all of the segments, and would involve the construction of floodwalls and other elements of the plan segments. Construction would involve the use of heavy construction equipment, including pile hammers, mechanical cranes, excavators, front end loaders, and dewatering pumps, resulting in a temporary increase in noise. Sensitive land uses directly adjacent to the Project Area which could be affected by construction noise include community open spaces along the waterfront in Newark.

Based on USEPA estimates, noise levels associated with site preparation and construction activities at a distance of 50 feet from the source and within the urban environment are likely to be in the range of 70 to 90 dBA for each piece of equipment (FHWA 2006). Blasting is not anticipated to occur, and minimal demolition may occur as a result of construction of the Proposed Action.

An increase in noise levels may be experienced during the operation of the pump stations proposed as part of the interior drainage plan. The increase in noise levels would be minor due to the infrequent operation during emergency storm events. If operation is required outside of emergency storm situations, a noise variance may be required if sensitive resources are identified

in proximity to the pump stations. Maintenance and operation of the proposed manual storm gates, and floodwalls would have a minimal impact on noise.

6.14 Recreation

No Action Alternative

If substantial flooding occurred as a result from a hurricane or storm, some waterfront parks could be severely damaged, resulting in direct, adverse impacts to recreation in the Project Area as a result of the No Action Alternative. Even if the park features were not damaged, while inundated with floodwaters, parks would not be available for use, resulting in a minor to moderate impact to the recreational users of the park.

Proposed Action

The Proposed Action maintains access to the parks and the adjoining waterfront. The floodwall in Segment 8 would be aligned adjacent to the north side of Raymond Boulevard north of Minish Park. Access to Minish Park in this location may be temporarily restricted during construction of Segment 8, resulting in temporary minor impact. There would be no permanent impact to the park or park users. The Project would protect interior parks within the study area, from storm surges, floods, and erosion. By protecting the park facilities from coastal storms, the Proposed Action would yield a moderate beneficial impact to recreation.

6.15 Aesthetics and Scenic Resources

No Action Alternative

Under the No Action Alternative, the risk of coastal storm flooding would continue and the potential for damaging flooding of scenic resources including the riverfront parks located within the Project Area would be expected to increase gradually over time in direct relation to sea level change.

Proposed Action

The visual effects of construction-related activity would be minor and temporary. These temporary, minor impacts would affect pedestrians and bicyclists primarily on the roadways along Segments 1, 4, 5, 6, and 8, and within the public parks and boaters on the river along Segment 8. Construction-related visual effects may result from the presence and usage of construction materials, signage, barriers, and various types of heavy machinery at construction locations. These visual impacts would be temporary and would cease upon completion of construction.

Impacts to the viewshed of the Passaic River and viewshed of the waterfront from the river were analyzed for Segment 8. Due to the location of Segment 8 along the edge of Minish Park along the lower Passaic River, the Proposed Action would result in minor benefits to the aesthetic and visual character of the Project Area once construction is complete. The proposed floodwall would extend approximately 300 feet along Raymond Boulevard and would be a maximum of 3.4 feet in height.

Under the proposed alignment of Segment 8, the maximum height of the floodwall will be 3.4 feet above ground. The viewshed from Minish Park, which includes visibility of open water and mudflats, would be maintained. Views of Minish Park from the water would also be maintained

and the proposed floodwall would potentially provide a structural backdrop that incorporates a context sensitive design that would complement the user experience and blocks views of the roadway adjacent to the park, resulting in benefits to the aesthetics of the park.

6.16 Hazardous, Toxic, and Radioactive Waste

No Action Alternative

Under the No Action Alternative, impacts would be the same as currently exist; the contaminated soil remains in place. If contaminated soil is identified within the proposed TSP/LPP footprint, the Non-Federal Sponsor will have the responsibility for any required action in accordance with ER1105-2-100 and ER 1165-2-132, prior to any project construction.

Proposed Action

Of the known contaminated sites within Newark there are six sites located near (4 city blocks or less) or adjacent to the proposed action. These include:

- PI 497543 Passaic River Waterfront Park
- PI 005878 Conrail Oak Island Yard 611 Delancy Street
- PI 709101 283 299 Frelinghuysen Avenue
- G000001420 ADCO Chemical Company 49 Rutherford Street
- PI 537551 ATCO Products 189 195 Frelinghuysen Avenue
- PI 033104 Clinton Square Auto Parts Corp 221 Frelinghuysen Avenue
- PI 017945 CSS Realty 57 75 Peddie Street
- PI 703333 LEMCOR Inc 170 Frelinghuysen Avenue
- PI 554994 Metal Parts Processing Co. Inc. 182 Frelinghuysen Avenue
- G000000606 Zamelsky Scrap 307 Frelinghuysen Avenue

Segment 1 is within the intersection that is adjacent to city block within which the CSS Realty site at 57 75 Peddie Street. The Conrail Oak Island Yard is located immediately adjacent to Segment 3. Segment 8 is along a short length of the Jackson Avenue Bridge downstream abutment and sidewalk along the southern edge of the Passaic River Waterfront Park. As part of construction, soil testing will be able to determine if any of the contaminant concerns from any of these sites has affected each individual segment location.

Figure 29: Location of known contaminated sites identified near different segments: A-Passaic River Waterfront Park; B-Conrail Oak Island Yard; C-283/299 Frelinghuysen Avenue; D-ADCO Chemical Company 49 Rutherford St; E-ATCO Products 189/195 Frelinghuysen Avenue; F-Clinton Square Auto Parts 221 Frelinghuysen Avenue; G-CSS Realty 57/75 Peddie Street; H-LEMCOR Inc 170 Frelinhuysen Avenue; I-Metal Parts Processing Co. 182 Frelinghuysen Avenue; and J-Zamelsky Scrap 307 Frelinghuysen Avenue.

In addition, Sites 283 299 Frelinghuysen Avenue, ATCO Products, Clinton Square Auto Parts, LEMCOR Inc., Metals Parts Processing Co., and Zamelsky Scrap are located nearby Segment 1. The ADCO Chemical Co. is situated one block east of Segment 4, between Segment 4 and 5. It is recommended that soil testing be conducted prior to construction to determine if there is any associated contamination. The Pierson's Creek National Priority List site is located about one mile west of Segment 5, on the other side of the New Jersey Turnpike.

Given the areas industrial history and use of contaminated fill in the past, soil testing prior to the construction of segments is recommended to determine if any undocumented contamination exists.

6.17 Transportation and Other Infrastructure

No Action Alternative

Under the No Action Alternative the risk of coastal storm flooding would continue and the potential for damaging flooding of existing transportation and other critical infrastructure would be expected to increase gradually over time in direct relation to sea level change.

Proposed Action

There would be a potential temporary disruption of transportation systems and infrastructure along roads in the study area during construction activities. Construction would result in temporary, minor impacts on vehicular traffic flow and volume, which may include commuter bus service. An increase in large, slow-moving construction vehicles needed for construction of the Proposed Action would temporarily decrease traffic flow and increase traffic volume in the area between the hours of approximately 7:00 am and 4:00 pm. Increased construction traffic volume would also occur at staging areas and along routes between staging areas and the project segments, resulting in potential minor temporary impacts during construction. To help alleviate the temporary impacts associated with construction activities, the selected construction contractor would be required to develop a Maintenance and Protection of Traffic plan, in coordination with local transportation officials, to minimize traffic impacts. Construction crews would be encouraged to carpool or use alternative modes of transportation (e.g., shuttles, commuter rail, etc.) to reduce the project-generated vehicle trips in the Project Area.

During construction there would be potential temporary, major impacts on commuter and freight rail service, particularly along Segment 2, which consists of five closure gates across the railroad tracks. Proper implementation and planning with key stakeholders would be used to minimize the potential temporary impacts and construction in these areas referenced above will require close coordination with the local railroad companies.

There would be no impact on the navigation channels in the Passaic and Hackensack Rivers in the study area, as construction would not occur navigable waterways. Construction would have no impacts on the local water infrastructure in the Project Area. Pump stations would be designed to prevent sewer backflow during storm events.

Upon completion of construction, no adverse impacts on local modes of transportation would occur. Construction would have no long term impacts on the existing transit and road infrastructure systems. Upon completion of construction the plan segments and associated structures would allow the local roadways and pedestrian pathways to remain accessible. During storm and flood events, Segments 1, 2, 4, 5, and 6 would disrupt rail transit and road infrastructure system as the flood gates would be closed to prevent flooding. Gate closures would result in temporary impacts the transportation systems; however, the protection offered by the Proposed Action would also benefit transportation modes and would allow non-gated roadways to remain unflooded and open to vehicular and pedestrian travel. The gates would be opened and transportation corridor connectivity would be restored when flood conditions become safe. Once completed, the Proposed Action would reduce the incidence and cost of existing transportation infrastructure damage due to flooding.

Upon completion of construction the Proposed Action would have no adverse impacts on infrastructure in the Project Area. Substantial population growth or concentration in the Project Area would not occur as a result of the proposed project. Therefore, the Proposed Action would not require the extension of local infrastructure, such as roadways or water and sewer infrastructure. Equally, the Proposed Action has the opportunity to improve interior drainage in the Project Area. The plan segments and associated drainage structures would reduce the amount of stormwater that enters the combined sewer system in the Project Area during storm and flooding events. This would help reduce the frequency and duration of CSO events in the Project Area.

6.18 Summary: Environmental Impacts of Hurricane and Storm Risk Management Measures

A summary of impacts on each resource category associated with the each alternative evaluated is provided in Table 38.

Table 38: Summary of Impacts Associated with the Proposed Action

Note: This table extends across three pages

RESOURCE	ENVIRONMENTAL IMPACT SUMMARY
Geology and Physiography	No impact.
Topography	Permanent, minor impact overall.
Soils	Permanent, minor impact overall.
Climate and Weather	No impact.
Floodplains	Permanent, major beneficial impacts associated with reduced flooding.
Coastal Processes	No impact
Surface Waters	Temporary, minor to moderate impacts during storm events that exceed the design criteria of the interior drainage system resulting in stormwater accumulation on the interior of the floodwall.
Water Quality	Temporary, minor impacts during construction, resulting in negligible impacts as an end result.
Regional Hydrogeology and Groundwater	No impact.
Tidal Influences	No impact.
Land Use and Zoning	Permanent, major beneficial impacts to future land use associated with flood protection. Minor direct impact on land use within permanent easement footprint.
Socio-Economics	Temporary, minor beneficial economic impacts on existing business and the local economy during construction. Permanent, major beneficial economic impacts on existing businesses and protection of regional transportation centers in the larger metropolitan region.
Coastal Zone Management	No impact. Proposed Action consistent with Coastal Zone Management regulations.

RESOURCE	ENVIRONMENTAL IMPACT SUMMARY
Upland Habitat	Temporary, minor impacts associated with construction and permanent minor impacts associated with operation resulting from changes to vegetation cover type. The project would result in the permanent loss of approximately 0.09 acres of mowed lawn, 0.01 acres of maintained roadside, 0.02 acres of urban vacant lot habitat, and 0.01 acres of temporary disturbance to the regulated riparian zone. Mitigation would be conducted to offset minor adverse impacts to the riparian zone.
Wetlands Habitat	The project would result in approximately 0.2 acre of temporary, minor impacts associated with construction and 0.4 acre of permanent minor impacts associated with operation resulting from conversion of wetlands and open water to uplands. Compensatory mitigation would be conducted to offset minor adverse impacts to wetlands and watercourses.
Shellfish	The project would result in permanent and temporary loss of approximately 0.38 less than 0.1 acres of tidal wetlands and watercourses habitat for shellfish. Compensatory mitigation would be conducted to offset minor adverse impacts to wetlands and watercourses.
Finfish	No direct impacts are anticipated. Negligible impacts caused by sediment suspension resulting from operation of pump stations.
Benthic Resources	Potential minor temporary impacts associated with construction stormwater and minor permanent impacts from habitat conversion.
Reptiles and Amphibians	Potential minor temporary impacts associated with construction and permanent habitat conversion. Negligible impacts from operation of pump stations.
Birds	Potential temporary and permanent, minor impacts associated with construction and habitat loss.
Mammals	Potential temporary and permanent, minor impacts associated with construction and habitat loss.
Threatened and Endangered Species	Potential temporary and permanent, minor impacts associated with construction and habitat loss.
Cultural Resources	Potential permanent impacts to above and below-ground historic properties are addressed through a Programmatic Agreement.

RESOURCE	ENVIRONMENTAL IMPACT SUMMARY
Air Quality	Temporary minor increase in air emissions due to construction vehicles however well below *de minimis* levels.
Noise	Temporary minor increase in noise as a result of the use of construction equipment, as well as infrequent operation of the pumps during storm events.
Recreation	Temporary minor impacts associated with construction. Long term moderate benefit from flood reduction to interior parks.
Aesthetics and Scenic Resources	Temporary, minor impacts associated with construction. Permanent, benefits from blocking view of roadway from the park and Passaic River.
Hazardous, Toxic, and Radioactive Waste	Potential temporary impacts associated with construction and the potential to encounter compromised or contaminated soils.
Transportation and Other Infrastructure	Potential temporary minor disruption of transportation systems and infrastructure during construction activities. No impact on commuter or freight rail service during or after construction. Post construction, no impact to transportation during normal conditions. During flood events, closure gates would temporarily impact transportation by blocking gated transportation routes; however, these routes would otherwise be covered by floodwaters.

6.19 Relationship between Short-Term Uses and Long-Term Productivity

The Proposed Action would entail a short-term commitment of resources, including construction equipment, labor, public monies to fund the Project and to purchase property easements, and equipment necessary for minimization and mitigation of environmental impacts.

Some areas within the Project Area would be subject to removal of vegetation, disruption of associated habitat, and ground disturbance during construction. There would be a temporary disruption of transportation systems and infrastructure along roads in the Project Area during construction. A temporary disruption of the availability of recreational and scenic uses would also occur. These disruptions would preclude the use of local recreational facilities and transportation routes by local residents and tourists, and habitats by indigenous animal species.

To contrast this short-term commitment of resources, there are several long-term enhancements in productivity that would result from the Proposed Action. Beneficial impacts on the local economy would occur, such as decreased cleanup and repair costs to local residents and businesses as hurricane and storm damages are reduced. There may also be a greater economic attraction to the community resulting from a decreased potential for flooding.

In the long-term, the Proposed Action is anticipated to result in a more economically and environmentally stable community, both in the immediate Project Area and in the surrounding

municipalities. Therefore, the long-term productivity of the overall region may experience benefits from this short-term impact of the environment.

6.20 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources would have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and mineral) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species).

Irreversible and irretrievable resources would be committed to the Project Area by the federal government, the Non-Federal Sponsor, and any involved local agencies and municipalities. Resources committed include construction and mitigation materials and costs; labor costs for project planning; natural resources such as soil, and water, and energy resources such as fossil fuels (gasoline, petroleum products, and lubricants) and electricity; and land to accommodate the Coastal Storm Risk Management features.

Not all of these resources are irretrievable. The monies committed to the Proposed Action would be offset through savings in municipal, residential, and commercial hurricane and storm damage costs in the future, and potentially through increased, resultant commercial viability in the community from reduced flooding. This may also result in an increase in the revenues of the local municipalities in the event of increasing property tax values.

Chapter 7: Cumulative Impacts*

Industries located along the waterfront have in the past and will continue to construct flood mitigation structures and measures to protect their infrastructure. In addition, NJDEP has issued funding in the form of grants in the waterfront area to enhance and increase public access and enjoyment of waterfront resources. Procurement of these funds will likely spur interest in development along the waterfront. NJDEP and the U.S. Department of Housing and Urban Development are also evaluating alternatives for the construction of flood risk reductions measures within the Boroughs of Little Ferry, Moonachie, Carlstadt and Teterboro, and the Township of South Hackensack in nearby Bergen County as part of the Rebuild by Design (RBD) Meadowlands Flood Protection Project (NJDEP 2018). The RBD Meadowlands plan consists of a series of gray infrastructure improvements, improvements and additions to public parks, including vegetation plantings, and new pump stations and drainage improvements to 18 achieve improved protection from inland and coastal storm surge flooding of the Hackensack River. These measures would be implemented as part of the short-term build plan and could be incorporated into the plan when additional funding became available.

The NJDEP and U.S. Department of Housing and Urban Development have also evaluated alternatives for flood risk reduction along the Hudson River, specifically within the City of Hoboken, as part of the RBD Hudson Flood Protection Project (NJDEP 2017). The Preferred Alternative for the RBD Hudson Project would consist of a series of "resist structures" such as floodwalls and closure gates and integrated landscaping features to provide protection to the design elevation. The Final EIS for the RBD Hudson project was published in June 2017 (NJDEP, 2017). When evaluated in conjunction with the Proposed Action, the RBD Meadowlands and RBD Hudson coastal storm risk management project, as well as the USACE Passaic River Main Stem Storm Risk Reduction Project, would result in beneficial impacts to communities, socioeconomic conditions, recreation/open space, and transportation in their respective project areas and the overall region resulting from flood and coastal storm protection enhancements. Individually, these projects would result in primarily temporary impacts to the various natural and built environment resources evaluated in the respective Environmental Impact Statements (EISs). Temporary impacts would occur during construction and the resources would recover shortly following project completion. Because of the temporal differences in project construction schedules, there would be no cumulative aspect associated with temporary impacts as the resources temporarily impacted by one project would recover before the temporary impact associated with another was incurred. In addition, because of the spatial differences between the projects, even if construction of two projects occurred simultaneously or consecutively, the temporary impacts would not cumulatively impact the resources.

The Proposed Action for the Passaic River Tidal Protection Area would result in minor permanent impacts to physical resources, such as soils and topography; however, due to the spatial distance between the projects, these resources would not be cumulatively impacted. Cumulatively, the Proposed Action and the RBD Hudson and RBD Meadowlands projects would permanently impact just over one acre of wetlands (0.38 acre for Passaic Tidal Proposed Action; 0.80 acre for RBD Meadowlands; <0.01 acre for RBD Hudson). Wetlands that would be permanently impacted have been previously disturbed by human activity. The impacts would be addressed through compensatory mitigation that would yield equal or greater acreage of wetlands

dominated by native species and would provide equal or greater functional value as the impacted wetlands. Accordingly, the cumulative impacts to wetlands would be offset through compensatory mitigation. Wildlife that utilize the permanently impacted wetlands, as well as any permanently impacted areas of upland vegetation, would also be permanently impacted by this loss of available habitat. Considering the small size of permanent impacts, the park improvements proposed which include native species plantings, particularly with the RBD Meadowlands project, and the predominantly urban land use throughout the region, the cumulative impact on wildlife, including protected species, would be minor. Overall, the cumulative impacts resulting from the Proposed Action and other flood protection and coastal storm risk management projects such as the USACE Passaic River Main Stem and the RBD Meadowlands and RBD Hudson projects would result in beneficial impacts within the Study Area and region resulting from flood and coastal storm protection enhancements.

Chapter 8: Coordination & Compliance with Environmental Requirements*

The Proposed Action would comply with all applicable environmental quality statutes and environmental review requirements. Following is a list of federal environmental quality statutes to which this project is in compliance:

- National Environmental Policy Act of 1969,
- Fish And Wildlife Coordination Act of 1958 (see Appendix C),
- Endangered Species Act of 1973,
- National Historic Preservation Act of 1966,
- Clean Water Act of 1972 (see Appendix B1),
- Clean Air Act of 1972,
- Section 307 of the Coastal Zone Management Act,
- Wild And Scenic River Act of 1968,
- Federal Water Project Recreation Act of 1965,
- Resource Conservation And Recovery Act of 1976,
- Toxic Substances Control Act of 1976,
- Executive Order (E.O.) 11988, Floodplain Management,
- E.O. 11990, Protection of Wetlands, and
- E.O. 12898, Environmental Justice.

Several regulatory programs which are explicitly pertinent to the project, including Floodplain Management and CZM, are discussed in detail in the remainder of this Section or in other sections of this EA. The following state permits are expected to be required to authorize construction of the Proposed Action:

- Individual Flood Hazard Area Permit,
- Individual Freshwater Wetlands Permit,
- Individual Upland Waterfront Development Permit,
- Section 401 Water Quality Certificate, and
- Green Acres Diversion.

The flood hazard area permit application would demonstrate project compliance with New Jersey's floodplain management regulations, including requirements for riparian zone mitigation, and would also address compliance with New Jersey Stormwater Management Rules. The Waterfront Development Permit application would demonstrate compliance with New Jersey's Coastal Permit Program Rules, constituting CZM Consistency. A Freshwater Wetland Permit would be required for any unavoidable impact to freshwater or coastal wetlands and would incorporate requirements for mitigation of any impacts.

8.1 Compliance with Executive Order 11988

Executive Order 11988 requires that Agencies avoid, to the extent possible, adverse impacts associated with the occupancy and modification of flood plains and to avoid support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities."

The Water Resources Council Floodplain Management Guidelines for implementation of E.O. 11988, as referenced in ER 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to, or are within the floodplain. The eight steps and project-specific responses to them are summarized below in Table 39.

Table 39: Project Response to E.O. 11988

EXECUTIVE ORDER 11988 STEP	PROJECT-SPECIFIC RESPONSE
Determine if a proposed action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year).	The proposed action is within the base floodplain. However, the project is designed to reduce damages to existing infrastructure located landward of the proposed project.
If the action is in the base flood plain, identify and evaluate practicable alternatives to the action or to location of the action in the base flood plain.	Practicable measures and alternatives were formulated and evaluated against USACE guidance, including nonstructural measures such as buy-outs (land acquisition and demolition of structures).
If the action must be in the flood plain, advise the general public in the affected area and obtain their views and comments.	The Integrated Feasibility Report and Environmental Assessment has been released to public review, and coordination with agency officials and the public have been held throughout the study.
Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial flood plain values. Where actions proposed to be located outside the base flood plain will affect the base flood plain, impacts resulting from these actions should also be identified.	The anticipated impacts associated with the Recommended Plan are summarized in Chapters 6 and 7 of this report. The project would not alter or impact the natural or beneficial flood plain values.
If the action is likely to induce development in the base flood plain, determine if a practicable non-flood plain alternative for the development exists.	The project will not encourage development in the floodplain because all properties available for development have been developed. The project provides benefits solely for existing development.

EXECUTIVE ORDER 11988 STEP	PROJECT-SPECIFIC RESPONSE
As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the "no action" alternative.	The project would not induce development in the flood plain. Chapter 4 of this report summarizes the alternative identification, screening and selection process. The "no action" alternative was included in the plan formulation phase.
If the final determination is made that no practicable alternative exists to locating the action in the flood plain, advise the general public in the affected area of the findings.	The Final Integrated Feasibility Report and Environmental Assessment documents the final determination.
Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order.	The Recommended Plan is the most responsive to all of the study objectives and the most consistent with the executive order.

8.2 Floodplain Management

All of the flood prone municipalities within the Passaic River basin participate in the National Flood Insurance Program and, as required for participation, have adopted floodplain management ordinances in their municipal codes. The 100- and 500-year flood elevations (in feet referenced NAVD88), which represent 1-percent and 0.2-percent annual chance of exceedance, are 10.8 and 14 feet in the study area, as established by FEMA based on Preliminary Flood Insurance Rate map and Flood Insurance Study data for Essex County (no Flood Insurance Study report available for Hudson County). In addition to local ordinances, the State of New Jersey regulates activity in floodplains under the NJ Flood Hazard Area Control Act and implementing regulations (N.J.A.C. 7:13).

Recent implementation of the FEMA buyout program, as executed by NJDEP through the NJDEP Blue Acres program, is consistent with floodplain management regulations. Within the Passaic Tidal Project, there are approximately 422 impacted properties that have been purchased or are being removed through the NJDEP Green and Blue Acres programs. These properties are the most flood-prone structures within Kearny, Harrison, and Newark and represent a loss of a portion of the potential flood risk reduction benefits for the Proposed Action.

Applicable requirements of floodplain management regulations have been considered in the design of the Proposed Action, which would be compliant with such regulations. The Proposed Action would not result in increases in flooding extent or depth nor would it induce flooding on other properties.

8.3 List of Report Preparers

Preparation of this Environmental Assessment included coordination with appropriate federal and state resource agencies. Requests for information and/or coordination were also sent to the

New Jersey Natural Heritage Program and USFWS to obtain information regarding protected species in the Project Area. Copies of pertinent correspondence are provided in Appendix D.

The following individuals were primarily responsible for preparation of this report:

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Karen Baumert, USACE (Plan Formulation)
Nancy Brighton, USACE (Environmental Resources)
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Lynn Rakos, USACE (Environmental Resources)
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Nicholas Kilb, USACE (Engineering)
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Chapter 9: Plan Implementation

As Non-Federal Sponsor, the NJDEP must sign a PPA that will carry the project through the Preconstruction Engineering and Design phase to project construction. A Project Management Plan will be prepared to identify tasks, responsibilities, and financial requirements of the Federal Government and the non-federal partner during Preconstruction Engineering and Design and construction. A project schedule has been estimated to serve as the basis of the cost estimate based on reasonable assumptions for the detailed design and construction schedules. It will be refined as more data are available in subsequent phases of the project.

9.1 Consistency with Laws and Policy

This draft feasibility report has been prepared in accordance with relevant laws and USACE policy. Specifically, this section of the report addresses:

- the specific requirements necessary to demonstrate that the project is technically feasible, economically justified and environmentally complaint;
- and the costs and cost-sharing to support a PPA.

Economics Justification and Environmental Compliance. The prior sections of this draft report demonstrate that the Recommended Plan is technically feasible. It also identifies the Recommended Plan at this point in the study to have benefits greater than costs. The draft Environmental Assessment has been prepared to meet the requirements of NEPA and demonstrate that the Recommended Plan is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

Resiliency and Consistency with the NACCS. The North Atlantic Coast Comprehensive Study was released in January 2015 and provides a risk management framework designed to help local communities better understand changing flood risks associated with climate change and to provide tools to help those communities better prepare for future flood risks. In particular, it encourages planning for resilient coastal communities that incorporate, wherever possible, coastal landscape systems that take into account future sea level and climate change scenarios (USACE, 2015).

The process used to identify the LPP/ Recommended Plan was a risk management approach that included evaluation of the benefits and costs two alternative solutions and took into account storm data, climate change, and rising sea levels consistent with NACCS.

9.2 Cost Sharing and Non-Federal Sponsor Responsibilities

The non-federal costs include the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas (LERRD), estimated to be $4,633,750.

In accordance with the cost share provisions in Section 103 of the Water Resources Development Act (WRDA) of 1986, as amended (33 U.S.C. 2213), project design and implementation are cost shared 65% federal and 35% non-federal.

The Recommended Plan First Cost is $39,640,000 and the Total Project Cost is $43,734,000.

Operation, maintenance, repair, replacement and rehabilitation requirements are considered in the economic analysis for the project. The non-federal sponsor is responsible for 100% of annual OMRR&R requirements. The Federal Government is responsible for preparing and providing an OMRR&R manual to the sponsor.

9.3 Real Estate Requirements

USACE projects require the Non-Federal Sponsor provide lands, easements, rights-of-way and relocations, and disposal/borrow areas (LERRDs) for a project. Currently, the Recommended Plan will require the Non-Federal Sponsor to acquire temporary and permanent easements for construction. The non-federal costs include the value of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas, estimated to be $4,633,750. Further details are provided in Appendix I (Real Estate Plan).

9.4 Financial Self-Certification

For purposes of executing the PPA, NJDEP has a source of funding for coastal storm risk management projects and has indicated its intent to enter into a PPA at the conclusion of the study. The Letter of Support from NJDEP is included in the Pertinent Correspondence Appendix.

9.5 Preconstruction Engineering and Design

Because Passaic Tidal has been included as an authorized but unconstructed project as part of the Public Law 113-2 response to Hurricane Sandy, Preconstruction Engineering and Design could be cost shared under a PPA (which typically only covers construction), if there are sufficient Public Law 113-2 funds to complete initial construction of the project. Initial construction does not include subsequent periodic nourishment of beach elements, if applicable, to the project. A separate Design Agreement for Preconstruction Engineering and Design is not required unless Public Law 113-2 funds are insufficient to complete initial construction of a project.

9.6 Construction Schedule

A draft schedule for plan implementation was developed for planning and cost estimating purposes. The project assumes a start date of November 2021 with an overall duration of one year with a completion date at the end of 2022. See Appendix J (Engineering and Design) for the proposed construction schedule.

9.7 Cost Sharing and Non-Federal Sponsor Responsibilities

The details behind the total first cost of implementing the Recommended Plan are shown in Table 40. The federal share of the project's total first cost is 65-percent of the total. The Federal Government will design the project, prepare detailed plans/specifications and construct the project, exclusive of those items specifically required of non-federal interests. The non-federal share of the estimated total first cost of the proposed project is 35-percent of the total. The non-federal share consists of a number of components including real estate (of which the non-federal portion is deducted from the non-federal cash contribution) and cost-sharing for Preconstruction

Engineering and Design and construction. The Total Project Cost, also known as the fully funded cost, is $43,584,000 and with monitoring is $43,734,000.

Table 40: Cost Apportionment

CATEGORY	COST
Federal Project Cost (65%)	**$28,427,000**
Non-Federal Project Cost (35%)	**$15,307,000**
LERR	
LER	$3,885,000
Relocations	$1,577,000
Cash Balance	$9,695,000
Monitoring	$150,000
Total Project Cost with Monitoring (100%)	**$43,734,000**

9.8 Views of the Non-Federal Partner and Other Agencies

The non-federal sponsor, the NJDEP, has indicated their support for releasing this report for public and agency input. The non-federal sponsor's support for the Recommended Plan will be confirmed through a Letter of Support.

The Ironbound Community Corporation and Community Advisory Groups for the Lower Passaic voiced their preference for little to low impact to existing park facilities along the Passaic River. The study team incorporated this request into the proposed plan and the groups have voiced their support.

9.9 Summary of Public Coordination

In January 2017, the District and NJDEP met with the mayors of Newark, Harrison, and Kearny to communicate the proposed plan before the draft report was released. During these meetings, the local officials supported the plan and accepted the residual risk associated with it.

The District coordinated with local, state, and federal stakeholders through Ironbound Community Cooperation, Community Advisory Group, and Urban Rivers meetings. The study team also coordinated with Port Authority of New York and New Jersey, Conrail, and environmental agencies. These meetings have aided in plan development as the community is heavily engaged as an Environmental Justice community.

A public meeting was held in Newark in November 2017 during the draft report review period to answer questions and address the concerns of the public.

Chapter 10: Local Cooperation Requirements

The Non-Federal Sponsor would need to provide their support of the recommendations presented in this report and agree that they intend to execute a PPA for the Recommended Plan before the Final Integrated Hurricane Sandy General Reevaluation Report and Environmental Assessment can move forward to the Civil Works Review Board Milestone or equivalent. A coordinated PPA package would be prepared subsequent to the approval of the Feasibility Report, which would reflect the recommendations of the report.

Federal implementation of the recommended project would be subject to the Non-Federal Sponsor agreeing to comply with applicable federal laws and policies, including but not limited to:

a. Provide a minimum of 35-percent of initial project costs assigned to coastal storm risk management:

    (1) Provide, during design, 35-percent of design costs allocated to coastal storm risk management in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

    (2) Provide all lands, easements, rights-of-way, and perform or assure performance of all relocations, including utility relocations, as determined by the Federal Government to be necessary for the initial construction or operation and maintenance of the project;

    (3) Provide, during construction, any additional amounts necessary to make its total contribution equal to 35-percent of initial project costs assigned to coastal and storm damage reduction plus 100-percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

c. Participate in and comply with applicable federal floodplain management and flood insurance programs; comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12); and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the coastal storm risk management features;

d. Operate, maintain, repair, replace, and rehabilitate the completed project, or function portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal and state laws and regulations and any specific directions prescribed by the Federal Government;

e. For so long as the project remains authorized, ensure continued conditions of public ownership and use of the shore upon which the amount of federal participation is based;

f. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

g. At least twice annually and after storm events, perform surveillance of the project area to inspect for condition and damages and provide the results of such surveillance to the Federal Government;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

i. Hold and save the United States free from all damages arising from the initial construction, operation, maintenance, repair, replacement, and rehabilitation of the project, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to state and local governments at 32 CFR, Section 33.20;

k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, operation and maintenance of the project;

l. Assume, as between the Federal Government and the Non-Federal Sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way required for the initial construction, or operation and maintenance of the project;

m. Agree, as between the Federal Government and the Non-Federal Sponsor, that the Non-Federal Sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42 U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, Public Law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C.

4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all effected persons of applicable benefits, policies, and procedures in connection with said act;

p. Comply with all applicable federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)); and

q. Not use funds from other federal programs, including any non-federal contribution required as a matching share therefore, to meet any of the Non-Federal Sponsor's obligations for the project unless the Federal Agency providing the funds verifies in writing that such funds are authorized to be used to carry out the project.

Chapter 11: Recommendations (DRAFT)

In making the following recommendations, I have given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires and capabilities of the State of Jersey and other non-federal interests.

I recommend that the selected plan for coastal storm risk management for the Passaic River Tidal Protection Area, New Jersey, Coastal Storm Risk Management General Reevaluation Study (Passaic Tidal), as fully detailed in this draft interim Hurricane Sandy General Reevaluation Report and Environmental Assessment, be authorized for construction as a federal project, subject to such modifications as may be prescribed by the Chief of Engineers. The Recommended Plan consists of six floodwalls and one levee at an elevation of 14 feet NAVD88; the plan is estimated to provide $4,160,000 in annual benefits and have a first cost $39,640,000. The plan has a Benefit Cost Ratio of 2.5 under the historic "low" sea level change scenario.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of highest review levels within the Executive Branch. Consequently, the recommendations may be modified (by the Chief of Engineers) before they are transmitted to the Congress as proposals for authorization and implementing funding. However, prior to transmittal to Congress, the partner, the State, interested Federal Agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Thomas D. Asbery
Colonel, U.S. Army
Commander and District Engineer
U.S. Army Corps of Engineers, New York

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