New York New Jersey Harbor Deepening Channel Improvements Navigation Study

Draft Integrated Feasibility Report and Environmental Assessment

October 2020

PORT AUTHORITY NY NJ
AIR LAND RAIL SEA

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U.S. Army Corps of Engineers
New York District

October 2020

Executive Summary

This New York New Jersey Harbor Deepening Channel Improvements (NYNJHDCI) Integrated Feasibility Report and Environmental Assessment documents the U.S. Army Corps of Engineers (USACE) feasibility study planning process for channel improvements of the existing New York New Jersey Harbor Deepening Project and documents compliance with the National Environmental Policy Act (NEPA) as incorporated into the planning process.

The New York and New Jersey Harbor Navigation Study of December 1999 that resulted in the completed Harbor Deepening Project's channels – the main navigation channels in the Port of New York and New Jersey that support the container terminals – is authorized by Section 435 of the Water Resources Development Act of 1996 (Pub. L. No. 104-303) to a depth of -50 feet mean lower low water (MLLW) or greater. Construction of the project was authorized in the year 2000 and was completed in 2016. The completed Harbor Deepening Project's channels are maintained at -50 feet MLLW and -53 feet MLLW in Ambrose Channel. The Port of New York and New Jersey is the busiest container port on the East Coast and the second busiest container gateway in the United States. The Port of New York and New Jersey is typically the first port of call for the largest container vessels calling on the U.S. East Coast (Port Authority of New York and New Jersey, 2020).

The completed Harbor Deepening Project's channels were designed for the vessel the *Regina Maersk* (1,044 feet long, 140 feet wide, has a static draft of 46 feet, and a capacity to carry 6,400 twenty-foot equivalent units (TEUs)). The fleet of container vessels regularly calling on the Port of New York and New Jersey now includes vessels that are depth constrained at the existing channel depth and experience maneuverability inefficiencies within the existing channel width. Recent growth in the volume of trade and the engineering capabilities of new vessels has facilitated the persistence of growth such that the vessels calling the Port of New York and New Jersey are larger than the *Regina Maersk* design vessel of the 1999 study. As a result, the completed Harbor Deepening Project's channel dimensions which are based off the *Regina Maersk* have been superseded. The superseding of the channel dimensions has a significant adverse effect on the economics and design of the completed Harbor Deepening Project's channels and their usage. Pursuant to Section 216 of the River and Harbor Act of 1970, the NYNJHDCI study evaluates proposed modifications to the completed Harbor Deepening Project's channels and bends.

In March 2018, the New York District completed an Initial Appraisal Report for Compliance with Section 216 of the River and Harbor Act of 1970 to determine if there is potential federal interest to undertake modifications to the completed Harbor Deepening Project's 50-foot channels. The Initial Appraisal Report states that the accelerating expansion of the volume of trade and the resulting fleet transition to larger vessels that has taken place since the 50-foot federal navigation project was authorized has led to the existing project's channel's dimensions being unsuitable for the current needs of the Port of New York and New Jersey. This has occurred sooner than was anticipated by the 1999 Study that had used the specifications from the design vessel of the *Regina Maersk*.

The need for this current feasibility level investigation arises from inefficiencies currently experienced by commercial vessels in the harbor where a significant share of the current fleet's

vessels exceed the maximum dimensions of the existing federal navigation channel. These inefficiencies are projected to continue in the future as vessel sizes increase to meet requirements for operational efficiencies and environmental compliance.

Utilizing the USACE Planning Process as specified in Engineering Regulation 1105-2-100, plan formulation was conducted with a focus on achieving the federal objective of water and related land resources project planning, which is to contribute to the Nation's national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. Plan formulation also considers all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (1983): national economic development, environmental quality, regional economic development, and other social effects.

This NYNJHDCI study's purpose is to determine if there is a technically feasible, economically justified, and environmentally acceptable recommendation for federal participation in a navigation improvements project in the New York and New Jersey Harbor. Based on a forecast of the future fleet, the study team which includes the Deep Draft Navigation Planning Center of Expertise has determined the design vessel for this study is a *Suezmax* containership, *Maersk Triple E Ultra Large Container Vessel Class* (1,308 feet long, 193.5 wide, has a static draft of 52.5 feet, and a capacity to carry 18,000 TEUs). USACE considered a range of nonstructural and structural measures that have the potential to improve navigation efficiencies within the New York and New Jersey Harbor. These measures include, but are not limited to, channel widening, channel deepening, bend easing, improving vessel scheduling, relocating navigation aids, and increasing tugboat assistance. Through an iterative planning process involving the incremental evaluation of deepening and efficiency components, a focused array of alternatives was identified, evaluated, and compared.

The preliminary analysis presented in this report identifies deepening the pathways from sea to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to a maintained depth of-54 feet MLLW[1] as the national economic development plan because it maximizes net benefits. Deepening the pathways to Elizabeth – Port Authority Marine Terminal by 4 feet (to a maintained depth of -54 feet MLLW) and Port Jersey – Port Authority Marine Terminal by 5 feet (to a maintained depth -55 feet MLLW), and deepening both the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 5 feet (to a maintained depth of -55 feet MLLW) also have considerable net benefits that are close to the net benefits provided by the national economic development plan. Further refinement of quantities, cost calculation assumptions, and benefit calculation assumptions may affect the alternative that produces the most net benefits. The

[1] The maintained depth, authorized channel level, and total (dredged) depth of the various channels may differ. The authorized channel level is used herein as it is defined in Engineering Regulation 1110-2-1613, and reflects the loaded summer salt water draft of the design vessel together with gross underkeel clearance (including allowances for squat, salinity, wave motion, and safety clearance). Maintained depth is understood in relation to the authorized channel level. The maintained depth only differs from the authorized channel level in areas in which the channel bottom is composed of rock or otherwise hard material. In rock-bottomed or hard-bottomed areas, an additional 2 feet of safety clearance is required. The total (dredged) depth of the channel is the sum of the authorized channel level and the dredging tolerance (paid overdepth). When 'maintained depth' is used in the text, it refers to the depth of the channels north of Ambrose Channel.

national economic development plan is subject to change as a result of further analyses and assumption refinements that will take place after the release of this draft integrated report.

Therefore, this draft integrated report presents the Tentatively Selected Plan as deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by *up to* 5 feet (up to a maintained depth of -55 feet MLLW). The Tentatively Selected Plan involves deepening Ambrose Channel, Anchorage Channel, the Kill Van Kull, Newark Bay Channel, South Elizabeth Channel, and Elizabeth Channel, and Port Jersey Channel. This includes the additional width required for structural stability and for the navigation of the design vessel to transit from sea to Elizabeth Port Authority Marine Terminal and Port Jersey Port Authority Marine Terminal. Channel configurations were designed to avoid and minimize environmental and cultural resource impacts while still meeting navigation safety requirements.

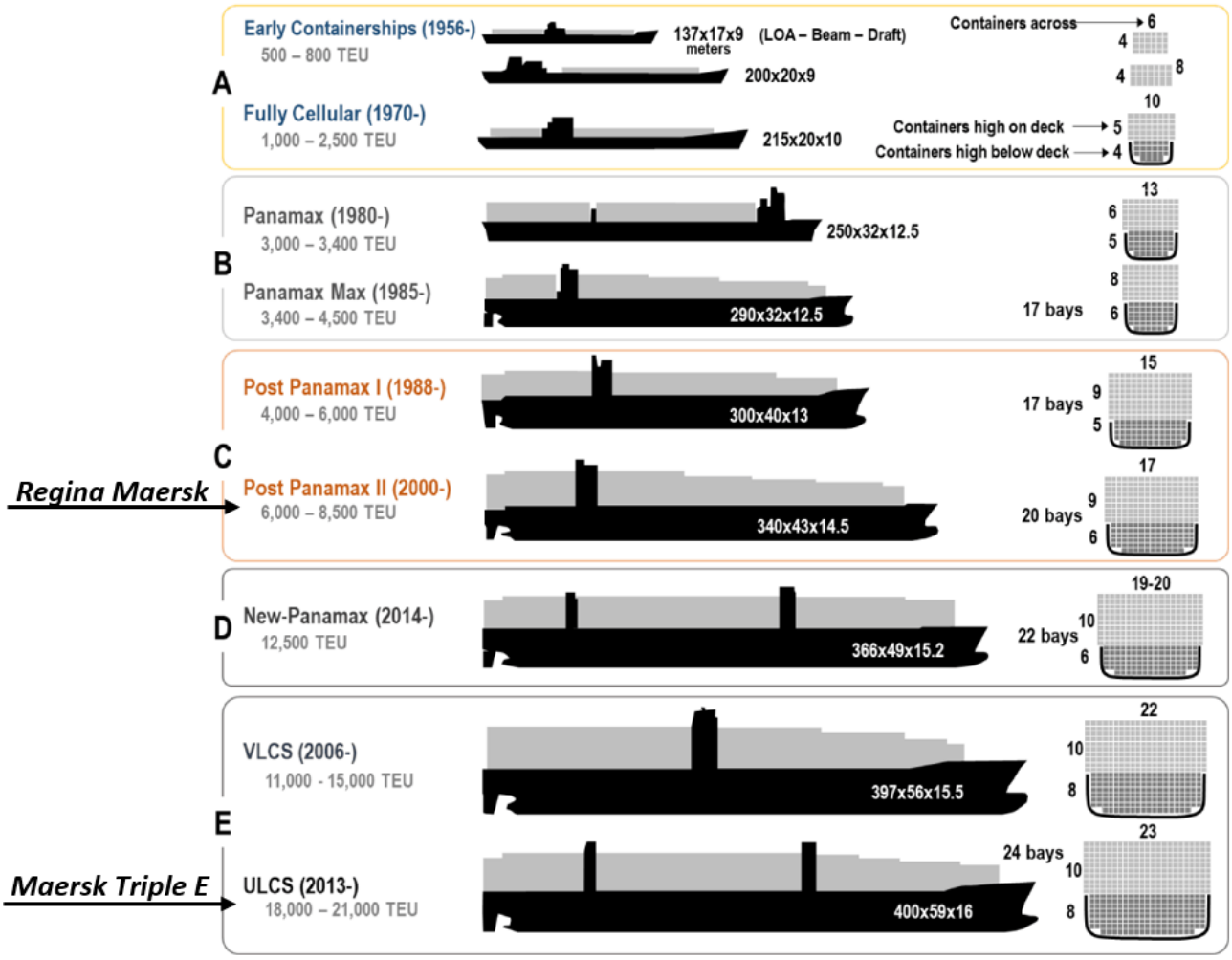
The Tentatively Selected Plan will not significantly adversely impact public health or safety, the quality of the human environment, threatened and endangered species, or state species of special concern. Less than 2 acres (approximately 1.92 acres) of shallow subtidal habitat (-6 feet MLLW or shallower) under the State of New Jersey's jurisdiction would be converted to deep water habitat, therefore, compensatory mitigation is required. The District will implement compensatory mitigation for the impacts to this shallow water or littoral (-6 feet MLLW or shallower) habitat, while also incorporating into the mitigation plan any benefits of the channel improvements, such as the creation or expansion of deep-water areas beneficial to other essential fish habitat species, such as migratory finfish, as well as the conversion of deep water habitat to shallower habitat associated widening of the side slopes. It is anticipated that the replacement of the existing essential fish habitat down to the 20-foot elevation with new 20-foot elevation habitat as a result of widening the side slopes to stabilize the newly deepened channel configuration would affect no more than a local and temporary impact since the habitat to -20 feet MLLW would be unavailable only during construction operations. The New York District's draft Finding of No Significant Impact is in Appendix A10.

At current price levels (Fiscal Year 2021 price level and 2.5% discount rate), deepening the from sea to pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet (to a maintained depth of -54 feet MLLW) has an estimated project first cost of $3,810.0 million, provides an estimate of $160.4 million in average annual equivalent net benefits, and has a benefit-cost ratio of 2.0. Deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 5 feet (to a maintained depth of -55 feet MLLW) has an estimated project first cost of $4,052.3 million, provides an estimate of $159.3 million in average annual equivalent net benefits, and has a benefit-cost ratio of 1.9. The non-federal costs for the value of lands, easements, rights-of-way, and relocations are estimated to be $328.3 million for the 4 foot deepening plan (to a maintained depth of -54 feet MLLW) and $328.7 million for the 5 foot deepening plan (to a maintained depth of -55 feet MLLW)[1]. The non-federal sponsor, the Port Authority of New York and New

[1] Any conclusion or categorization that an item is a utility or facility relocation to be performed by the non-federal sponsor as part of its lands, easements, rights-of-way, and relocations responsibilities is preliminary only. USACE will make a final determination of the relocations necessary for the construction, operation or maintenance of the project after further analysis and completion and approval of a Final Attorney's Opinion of Compensability for each of the impacted utilities and facilities.

Jersey, has indicated their support for releasing this report for public and agency input.

Executive Summary Figure 1: Tentatively Selected Plan Footprint



Executive Summary Figure 2: Containership Size Comparison
Source: The Geography of Transport Systems

Pertinent Data

Tentatively Selected Plan Features

The Tentatively Selected Plan is deepening the pathways from sea to Elizabeth Port Authority Marine Terminal and Port Jersey Port Authority Marine Terminal by *up to* 5 feet (up to a maintained depth of -55 feet mean lower low water [MLLW]). The Tentatively Selected Plan involves deepening Ambrose Channel, Anchorage Channel, the Kill Van Kull, Newark Bay Channel, South Elizabeth Channel, Elizabeth Channel, and Port Jersey Channel. The following table displays the proposed maintained depth, proposed authorized channel level, and proposed total depths for all channels in each of the pathways given a 4 foot deepening (to a maintained depth of -54 feet MLLW) and a 5 foot deepening (to a maintained depth of -55 feet MLLW).

	Proposed Authorized Channel Level[a] [ft MLLW]	Required Dredging Depth[b] [ft MLLW]	Quantity to be Dredged (cy)	Proposed Authorized Channel Levela [ft MLLW]	Required Dredging Depthb [ft MLLW]	Quantity to be Dredged (cy)
	4 FOOT DEEPENING TO -54 FEET MLLW			5 FOOT DEEPENING TO -55 FEET MLLW		
Ambrose Channel	57	57	4,137,000	58	58	6,389,000
Anchorage Channel	54	54	2,551,000	55	55	3,800,000
Port Jersey Channel	54	56[c]	2,744,000	55	57[c]	3,003,000
Kill Van Kull	54	56[c]	3,237,000	55	57[c]	4,451,000
Newark Bay	54	56[c]	13,181,000	55	57[c]	14,148,000
South Elizabeth Channel	54	56[c]	379,000	55	57[c]	423,000
Port Elizabeth Channel	54	56[c]	855,000	55	57[c]	1,024,000
Total Quantity Dredged	--	--	**27,084,000**	--	--	**33,238,000**

[a] This includes the summer salt water draft, squat, salinity, wave motion, and safety clearance. The channels will be maintained at this depth.

[b] Required dredging depth / design depth is needed for initial construction and includes any additional safety clearance needed for hard bottom.

[c] Includes needed 2 feet for hard or rock bottom which must be blasted for initial deepening.

The authorized depth is used as it is defined in Engineering Manual 1110-2-1613. Maintained depth only differs from authorized depth in areas in which the channel bottom is composed of rock or otherwise hard material. In rock bottom or hard-bottomed areas, an additional 2 feet of safety clearance is required, and is then allowed to fill in and be maintained at the same level as softer-bottom channels. Total depth is the depth of construction and is the sum of the authorized channel level and dredging tolerance (paid overdepth).

Construction

The project assumes a construction start date of October 2024 with an overall duration of up to 14 years, ending October 2038. Construction years are assumed for the economics evaluation in this study and are subject to report approval and project approval and funding requirements, including federal and non-federal funds.

Real Estate Requirements

U.S. Army Corps of Engineers projects require that the non-federal sponsor provide the lands, easements, rights-of-way and relocations necessary for a project[1]. The Tentatively Selected Plan has lands, easements, rights-of-way and relocation costs of $328.3 million for the 4-foot deepening plan (maintained depth of -54 feet MLLW) and $328.7 million for the 5-foot deepening plan (maintained depth of -55 feet MLLW). These costs will be borne by the Port Authority of New York and New Jersey who will serve as the non-federal sponsor for construction of this project.

Project Cost

Project first cost is the constant dollar cost at the current price level and is the cost used in the authorizing document for a project. The project first cost for deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to a maintained depth of -54 feet MLLW is estimated to be $3,810.0 million and deepening by 5 feet to a maintained depth of -55 feet MLLW is estimated to be $4,052.3 million. The associated costs for the project are the costs of deepening the berths that are needed to realize benefits. Associated costs are a non-federal sponsor responsibility and are not included in the project cost but are counted as an economic cost in the benefit-cost analysis. Associated costs for the 4-foot deepening plan to a maintained depth of -54 feet MLLW are estimated to be $169.9 million. The associated costs for the 5-foot deepening plan to a maintained depth of -55 feet MLLW are estimated to be $184.0 million.

ACCOUNT	DEEPEN PATHWAYS TO ELIZABETH-PORT AUTHORITY MARTINE TERMINAL AND PORT JERSEY-PORT AUTHORITY MARINE TERMINAL BY 4 FEET TO -54 FEET MLLW	5 FEET TO -55 FEET MLLW
Project First Cost		
01 LANDS AND DAMAGES	$0.6 million	$1.0 million
02 RELOCATIONS	$327.7 million	$327.7 million
06 FISH & WILDLIFE FACILITIES	$16.0 million	$16.4 million
12 NAVIGATION PORTS & HARBORS	$3,052.6 million	$3,267.6 million
18 CULTURAL RESOURCE PRESERVATION	$3.1 million	$3.1 million
30 PLANNING, ENGINEERING & DESIGN	$301.9 million	$321.4 million
31 CONSTRUCTION MANAGEMENT	$108.1 million	$115.1 million
Total Project First Costs	**$3,810.0 million**	**$4,052.3 million**
Associated Costs (Other Non-Federal Cost)[2]		
12 Navigation Aids[1]	$0	$0
12 Local Service Facilities[2]	$169.9 million	$184.0 million
Total Economic Cost	**$3,979.9 million**	**$4,236.3 million**

Fiscal Year 2021 Price Level and discount rate of 2.5%

[1] Responsibility of another Federal Agency (i.e. U.S. Coast Guard)

[2] Associated financial costs not part of the recommended Federal project but are necessary non-Federal responsibility

Note: Totals may appear off due to rounding

[1] Any conclusion or categorization that an item is a utility or facility relocation to be performed by the non-federal sponsor as part of its lands, easements, rights-of-way, and relocations responsibilities is preliminary only. USACE will make a final determination of the relocations necessary for the construction, operation or maintenance of the project after further analysis and completion and approval of a Final Attorney's Opinion of Compensability for each of the impacted utilities and facilities.

Table of Contents

Sections of the report that are required to implement the environmental assessment requirements of the National Environmental Policy Act (NEPA) of 1970 are marked with an asterisk (*) in the headings.

List of Figures

List of Tables

Appendices

Appendix A1	Endangered Species Act
Appendix A2	Clean Water Act
Appendix A3	Coastal Zone Management
Appendix A4	Essential Fish Habitat
Appendix A5	Clean Air Act
Appendix A6	Hazardous, Toxic, and Radioactive Wastes
Appendix A7	Fish and Wildlife Coordination Act
Appendix A8	Environmental Coordination/Correspondence
Appendix A9	Cultural Resources
Appendix A10	Finding of No Significant Impact
Appendix B1	Channel Design
Appendix B2	Geotechnical
Appendix B3	Structural
Appendix B4	Cost Engineering
Appendix C	Economics
Appendix D	Real Estate
Appendix E	Pertinent Correspondence

ACRONYMS

APM	A.P. Moller
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CY	Cubic yard
DDNPCX	Deep Draft Navigation Planning Center of Expertise
E.O.	Executive Order
EPAMT	Elizabeth – Port Authority Marine Terminal
FWS	Fish and Wildlife Service
GCT	Global Container Terminal
HARS	Historic Area Restoration Site
IPCC	Intergovernmental Panel on Climate Change
LERR	Lands, Easements, Rights-of-way and Relocations
MLLW	Mean Lower Low Water
NEPA	National Environmental Policy Act
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NR	National Register
NYNJHDCI	New York New Jersey Harbor Deepening Channel Improvements
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
PJPAMT	Port Jersey – Port Authority Marine Terminal
PPX1	Post Panamax Generation 1 (nominal capacity of 5,000-7,000)
PPX2	Post Panamax Generation 2 (nominal capacity of 7,000-10,000)
PPX3	Post Panamax Generation 3 (nominal capacity of 10,000 – 14,000 twenty-foot equivalent units)
PPX4	Post Panamax Generation 4 (nominal capacity of 14,000 + twenty-foot equivalent units)
TEU	Twenty-foot Equivalent Units
ULCV	Ultra Large Container Vessel
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency

Chapter 1: Introduction

1.1: Integrated Feasibility Report and Environmental Assessment

This New York New Jersey Harbor Deepening Channel Improvements (NYNJHDCI) Draft Integrated Feasibility Report and Environmental Assessment (draft integrated report) documents the U.S. Army Corps of Engineers (USACE) feasibility study planning process for channel improvements of the existing Harbor Deepening Project and documents compliance with the National Environmental Policy Act (NEPA) as integrated into the planning process.

The existing Harbor Deepening Project consists of the main navigation channels in the Port of New York and New Jersey that support the container terminals. The navigation channels extend from the Atlantic Ocean through the Port of New York and New Jersey and to the marine terminals that are called on by commercial deep-draft vessels. The Harbor Deepening Project is authorized by Section 435 of the Water Resources Development Act of 1996 (Pub. L. No. 104-303) to a depth of -50 feet at mean lower low water (MLLW) or greater. The Harbor Deepening Project has been constructed and is maintained at -50 feet MLLW and -53 feet MLLW in Ambrose Channel. The Port of New York and New Jersey is the busiest container port on the East Coast and the second busiest container gateway in the United States. The Port of New York and New Jersey is typically the first port of call for the largest container vessels calling on the U.S. East Coast.

The fleet of container vessels regularly calling on the Port of New York and New Jersey includes vessels that are depth constrained at the existing channel depth and experience maneuverability inefficiencies at the existing channel width. Continued growth in vessel sizes calling the Port of New York and New Jersey has resulted in the Port receiving vessel calls larger than the *Regina Maersk* design vessel of the 1999 study. As a result, the existing Harbor Deepening Project's channel dimensions which are based off the *Regina Maersk* have been superseded. The superseding of the channel dimensions has a significant adverse effect on the economics and engineering design of the existing Harbor Deepening Project. Pursuant to Section 216 of the River and Harbor Act of 1970 the NYNJHDCI study evaluates proposed modifications of the constructed Harbor Deepening Project.

1.2: Study Purpose, Scope and Need for Action*

The purpose of the NYNJHDCI study is to determine if there are technically feasible, economically justifiable, and environmentally acceptable recommendations for federal participation in a navigation improvement project for the New York and New Jersey Harbor.

The existing federal navigation channel was designed for the *Regina Maersk* (1,044 feet long, 140 feet wide, has a static draft of 46 feet, and a capacity to carry 6,400 Twenty-foot Equivalent Units (TEUs)). The vessels routinely calling on the harbor today are longer, wider, and have drafts deeper than the existing channel design vessel. These larger vessels have a greater risk of grounding, collision or marine casualty, and have resulted in limitations to operation within the harbor.

The need for this investigation arises from inefficiencies currently experienced by commercial

vessels in the harbor where a significant share of the current fleet exceeds the capacity of the existing federal navigation channel. These inefficiencies are projected to continue in the future as vessel sizes are expected to increase.

Deep draft navigation is one of the U.S. Army Corps of Engineer's primary mission areas. As stated in 33 U.S.C. 540, "[f]ederal investigations and improvements of rivers, harbors, and other waterways shall be under the jurisdiction of and shall be prosecuted by the Department of the Army…" Making channel improvements will yield national economic development benefits. Contributions to national economic development are increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation.

The USACE determined that the current study will focus its analysis on the existing federal -50-foot MLLW navigation channels in the New York and New Jersey Harbor and immediately adjacent areas. Evaluating additional anchorages are outside the scope of this study and are evaluated in a separate study, the *New York and New Jersey Harbor Anchorages Final General Evaluation Report* (USACE, 2019d). This NYNJHDCI study will determine whether there is a technically feasible, economically justifiable, and environmentally acceptable recommendation for federal participation in a navigation improvement project in the New York and New Jersey Harbor. The period of analysis for this study is 2039 through 2088, representing an estimate of the first 50 years following the completed construction of a navigation improvement project.

1.3: Study Authority

The study authority for the Port of New York-New Jersey Harbor Navigation Study is Section 435 of the Water Resources Development Act of 1996 (Pub. L. No. 104-303), which reads:

> *SEC. 435 PORT OF NEW YORK-NEW JERSEY NAVIGATION STUDY*
>
> *The Secretary shall conduct a comprehensive study of navigation needs at the Port of New York-New Jersey (including the South Brooklyn Marine and Red Hook Container Terminals, Staten Island, and adjacent areas) to address improvements, including deepening of existing channels to depths of 50 feet or greater, that are required to provide economically efficient and environmentally sound navigation to meet current and future requirements.*

The study conducted pursuant to Section 435 above resulted in a USACE Chief's Report dated 2 May 2000, recommending a channel at a depth of -50 feet MLLW in the harbor based on the *Regina Maersk* as the design vessel. The recommended plan was authorized for construction in Section 101(a)(2) of Water Resources Development Act 2000 (Pub. L. No. 106-541). Construction of the resulting 50-foot Harbor Deepening Project was completed in 2016.

In March 2018, an Initial Appraisal Report, Compliance with Section 216 of the River and Harbor Act of 1970 was completed to determine if there is potential federal interest to undertake modifications to the existing 50-foot federal navigation project. The Initial Appraisal Report states that the accelerating expansion of the volume of trade and the resulting fleet transition to larger vessels that has taken place since the 50-foot federal navigation project was authorized has led to the existing project's channel's dimensions being unsuitable for the current needs of the Port of New York and New Jersey. This has occurred sooner than was anticipated by the 1999

Study that had used the specifications from the design vessel of the Regia Maersk. This fact has a material effect on the economics and engineering design of the existing 50-foot federal navigation channels. The Initial Appraisal Report found "a comparison of these facts with the requirements of Section 216 indicates that all of the requirements of Section 216 have been meet." The Initial Appraisal Report made the recommendation to "investigate and determine if there is a Federal interest in continuing the project with the preparation of cost-shared feasibility report for analyzing alternatives to address the identified problems though possible modifications of the project."

The New York New Jersey Harbor Deepening Channel Improvements, Navigation Feasibility Study (NYNJHDCI Study) is a result of the approved Initial Appraisal Report. River and Harbor Act of 1970 Section 216 limits the analysis of the NYNJHDCI Study to the constructed 50-foot Harbor Deepening Project.

1.4: Non-Federal Sponsor

A Feasibility Cost Sharing Agreement was executed on 22 July 2019 with The Port Authority of New York and New Jersey as the non-federal sponsor. The NYNJHDCI Study is cost shared 50% federal and 50% non-federal.

1.5: Existing Harbor Deepening Project

The existing 50-foot federal navigation channels[1] – constructed during the Harbor Deepening Project – resulted from the recommendations made in the New York & New Jersey Harbor Navigation Study of December 1999. The project consists of the federal channels that lead to the container terminals in the Port of New York and New Jersey from the Atlantic Ocean. The federal channels are used by and designed for the deep-draft commercial vessels calling on the facilities within the Port of New York and New Jersey. Container vessels, tankers, car carriers, and other bulk goods carriers make up the majority of the deep-draft commercial vessels using these channels. Among these vessels, container vessels are the most depth-limited and are most constrained by the configuration of the channels.

A map of the constructed project is provided in Figure 1 and Figure 2 and the existing constructed as authorized federal channel dimensions are organized in Table 1. All container traffic enters the New York Harbor north through the Ambrose Channel which is maintained at a federally-authorized depth of -53 feet MLLW. After the Ambrose Channel, vessels continue north and enter the Anchorage Channel which has an authorized depth -50 feet MLLW, and provides access west to the Kill Van Kull, northeast to the Bay Ridge Channel, and west to the Port Jersey, just north of the Kill Van Kull channel. The Kill Van Kull channel has an

[1] The maintained depth and authorized depth of the various channels may differ. The maintained channel depth is designed to permit the safe and efficient transit of a loaded design vessel at any phase of the tide. The determination of the navigation channel depth is based upon the loaded static summer salt water draft of the design vessel, plus allowances for various underkeel clearances such as ship squat, water density, ship response to waves, and safety clearance. The authorized channel depth differs from the maintained channel depth in channels with rock or otherwise hard bottom. In such channels, an additional 2 feet of safety clearance is required at initial construction; the channels are then allowed to fill in to the maintained channel level.

authorized depth of -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material), and provides access to the facilities along Newark Bay and the Arthur Kill channels. From the Kill Van Kull, vessels sail north into the Newark Bay Channel which has an authorized depth of -50 feet MLLW (-52 feet in rock or otherwise hard material) or continue west to the Arthur Kill channel. The Arthur Kill has an authorized depth of -50 feet MLLW (-52 feet in rock or otherwise hard material) to Howland Hook. The Newark Bay Channel provides access west to the Elizabeth and South Elizabeth Channels, from which the vessels reach the port facilities at Port Newark and Port Elizabeth channels.

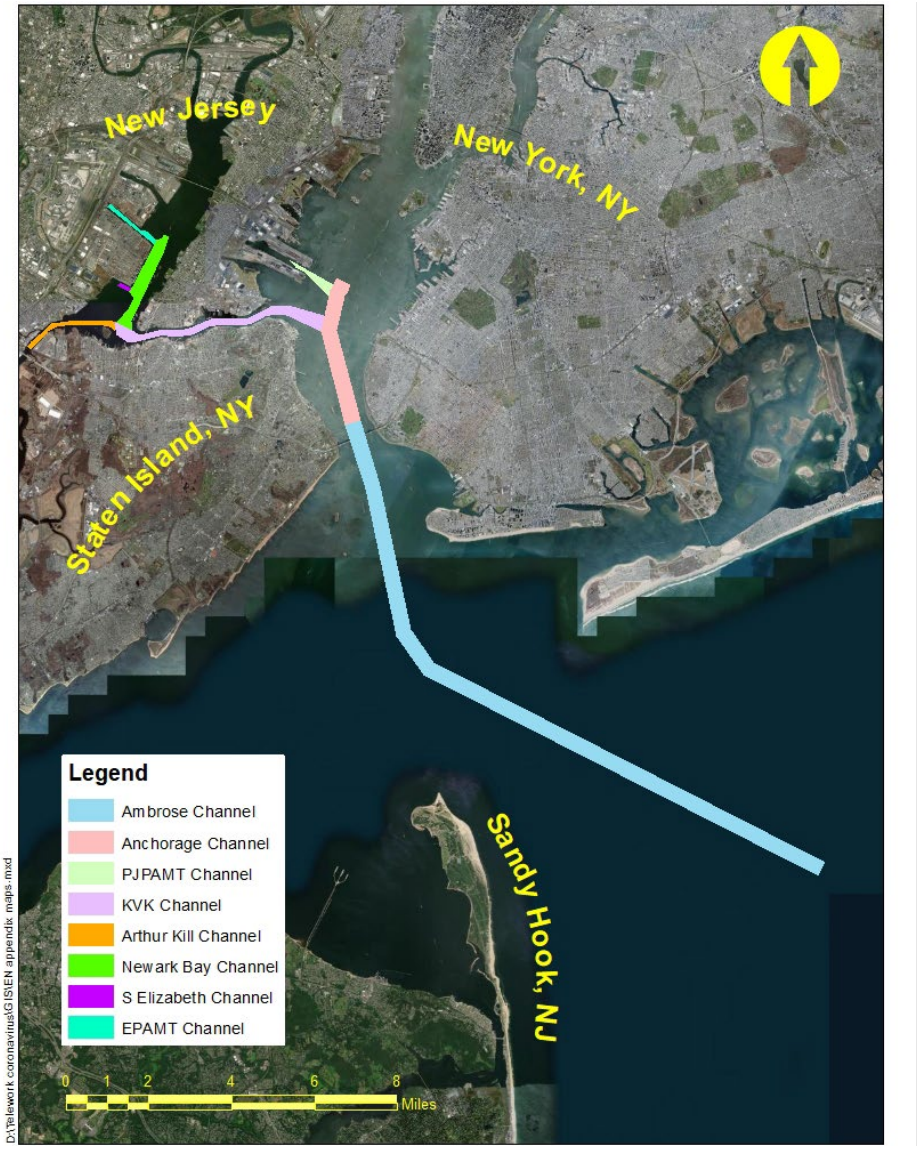


Figure 1: Constructed 50-Foot Harbor Deepening Project

Figure 2: Constructed 50-Foot Harbor Deepening Project, Inner Harbor

Table 1: Existing Authorized and Constructed Harbor Deepening Project Channel Dimensions

	Maintained Channel Depth [a] ft MLLW	Authorized Channel Depth [b] ft MLLW
Ambrose Channel	53	53
Anchorage Channel	50	50
Port Jersey	50	52
Kill Van Kull	50	52
Newark Bay	50	52
South Elizabeth	50	52
Port Elizabeth	50	52
Arthur Kill	50	52

[a]Maintained channel level includes the summer salt water draft, squat, salinity, wave motion, and safety clearance. The channels will be maintained at this depth.

[b]The authorized channel level includes additional safety clearance needed for hard bottom

The existing 50-foot Harbor Deepening Project specifically authorized deepening the following channels: Ambrose Channel, Anchorage Channel, Bay Ridge Channel, the Kill Van Kull, the Newark Bay Channels, Port Jersey Channel, and the Arthur Kill to Howland Hook. The channels were deepened to -50 feet MLLW except in areas of rock or otherwise hard material where they were deepened to -52 feet MLLW, with the exception of the Ambrose Channel, which was deepened to -53 feet MLLW. All channels are maintained at -50 feet MLLW with the exception of Ambrose Channel, which is maintained at -53 feet MLLW, due to the wave action that occurs in the Ambrose Channel. The Bay Ridge Channel deepening was deferred.

1.5.1: Recent Construction History

In this section we give a brief history of the recent prior pertinent authorizations behind construction of the existing federal channels.

Ambrose & Anchorage Channels

- Section 101(a)(2) of the Water Resources Development Act of 2000 authorized deepening of the Ambrose Channel for its entire length to a depth of -53 feet MLLW and deepening the Anchorage Channel to a depth of -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material) from the Narrows to 1,000 feet passed its juncture with Port Jersey Channel.

Kill Van Kull and Arthur Kill to Gulf Port Reach

- Section 301(a)(12) of the Water Resources Development Act of 1996 re-authorized the 45-foot project in the Kill Van Kull and Newark Bay at a higher cost in accordance with Section 902 of Water Resources Development Act of 1986.
- Section 301(b) of the Water Resources Development Act authorized a further deepening of the Arthur Kill to Gulfport not to exceed -45 feet MLLW.
- Section 301(a)(11) Water Resources Development Act of 1999 re-authorized the deepening of Arthur Kill to Howland Hook to -41 feet MLLW and -40 feet MLLW to Gulfport in accordance with the 23 July 1999 report.
- Section 101(a)(2) of the Water Resources Development Act of 2000 authorized the deepening of the Kill Van Kull and the Arthur Kill to a depth of -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material). The Kill Van Kull was authorized to be deepened from its juncture with Anchorage to the Arthur Kill, and the deepening of the Arthur Kill was authorized from its juncture with the Kill Van Kull Channel and Newark Bay to the southernmost berth at the Howland Hook Marine Terminal.

Newark Bay

- Section 301(a)(12) of the Water Resources Development Act of 1996 re-authorized the -45-foot MLLW Kill Van Kull and Newark Bay Channels project at a higher cost in accordance with the Section 902 cap procedures.
- Section 101(a)(2) of the Water Resources Development Act of 2000 authorized deepening the Newark Bay Channel to a depth of -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material from its juncture with the Kill Van Kull to the juncture with the Elizabeth Channel, including deepening the existing Elizabeth, South Elizabeth, and Elizabeth Pierhead Channels to -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material).

Port Jersey Port Authority Marine Terminal

- The Water Resources Development Act of 1999 re-authorized the deepening of the existing channel from -35 to -45 feet MLLW in accordance with the Chief of Engineers report.
- Section 101(a)(2) of the Water Resources Development Act of 2000 authorized the deepening of the Port Jersey Channel to a depth of -50 feet MLLW from its juncture with

Anchorage Channel to the Global Terminal and Military Ocean Terminal at Bayonne Facilities.

Anchorage Areas

- The Chief of Engineers discretionary authority contained in S.D. 17 authorized expanding Red Hook Anchorage by 200 yards by shifting Anchorage Channel 200 yards to the west.

1.6: Prior Studies and Reports

Numerous studies and reports related to the New York and New Jersey Harbor have been conducted. A detailed list of these reports, as well as a historical summary of the federally authorized anchorages in the harbor, can be found in the 2000 New York and New Jersey Harbor Navigation Study Report (USACE, 2000a).

Relevant studies, reports, and authorizations since 2000, are listed below:

- Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in New York New Jersey Harbor (Yozzo et al., 2004)
- Final Environmental Assessment, Elimination of "High Spot C" Obstruction to Navigation within the New York Bight Navigational Precautionary Area – Ambrose Channel (USACE, 2012a)
- New York and New Jersey Harbor Navigation Project, Initial Appraisal Report, Compliance with Section 216 of the River and Harbor Act of 1970 (USACE, 2018a)

1.7: Study Area

The NYNJHDCI study area includes the existing 50-foot federal navigation channel and the immediately surrounding areas. The New York and New Jersey Harbor is located between the southeastern-most point of New York State and the northeastern part of New Jersey. The 50-foot federal navigation channels are adjacent to New York City in New York State and the cities of Bayonne, Elizabeth, and Newark in New Jersey. The harbor is located along the upper-middle portion of the Atlantic Seaboard and is often the first port of call on the East Coast for the largest container vessels. The harbor is approximately 190 miles southwest of Boston, Massachusetts and approximately 75 miles northeast of Philadelphia, Pennsylvania. The harbor is formed by the confluence of, among other smaller tributaries, the Hudson River, East River, Raritan River, Jamaica Bay, and Newark Bay which is itself formed by the confluence of the Hackensack and Passaic Rivers. The network of 50-foot federal navigation channels extends from the Atlantic Ocean into the New York and New Jersey Harbor and the marine terminals of the Port Authority of New York and New Jersey (Figure 1: and Figure 2).

The existing 50-foot Harbor Deepening Project provides access to five terminals:

1. Global Container Terminal Bayonne by way of Port Jersey Channel
2. A.P. Moller Terminal by way of Newark Bay and South Elizabeth Channels
3. Maher Terminal by way of Newark Bay and Elizabeth Channels
4. Port Newark Container Terminal by way of Elizabeth Channel

5. Global Container Terminal New York by way of the Arthur Kill

The planning area is a geographic space with an identified boundary that includes the area identified in the study authorizing document and the locations of alternative plans which are often called project areas. The locations of resources that would be directly, indirectly, or cumulatively affected by alternative plans are often called the affected area.

1.8: National Environmental Policy Act Coordination

The National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality's Guidance Regarding NEPA Regulations, and the USACE's Procedures for Implementing NEPA (Engineering Regulation 200-2-2) are essential to the District's formulation and analysis. Furthermore, this document follows the Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, published in the Federal Register on July 16, 2020, and affects all documents, including this one, published on or after September 14, 2020 (85 FR 43304). An Environmental Assessment is a concise public document prepared by a federal agency to determine whether the proposed action has the potential to cause significant environmental effects (40 Code of Federal Regulations 1508.9(a)). The purposes of an Environmental Assessment are to:

- provide evidence and analysis sufficient to determine whether an Environmental Impact Statement is required;
- aid a federal agency's compliance with NEPA when no Environmental Impact Statement is necessary;
- facilitate preparation of an Environmental Impact Statement when one is necessary; and
- serve as the basis to justify a finding of no significant impact.

The Environmental Assessment must discuss:

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

This integrated report is consistent with the above NEPA statutory requirements. The report reflects an integrated planning process, which avoids, minimizes, and mitigates adverse project effects associated with navigation improvement actions. Sections of the report that satisfy the environmental assessment requirements of the National Environmental Policy Act (NEPA) of 1970 are marked with an asterisk (*) in the headings

The U.S. Coast Guard (USCG), National Marine Fisheries Service (NMFS), and the Environmental Protection Agency (EPA) agreed to be cooperating agencies as part of preparation of this integrated document. The U.S. Fish and Wildlife Service (USFWS) agreed to be a participating agency as part of preparation of this integrated document.

NEPA interagency meetings were held on November 21, 2019 and June 15, 2020. Stakeholder meetings were held with the Harbor Operations Steering Committee (August 7, 2019) and the

Sandy Hook Pilots (February 4 and 20, 2020).

Correspondence under Section 106 of National Historic Preservation Act of 1966 describing the proposed action and inviting consultation was sent to five federally recognized tribes, the New York State Historic Preservation Office, New Jersey State Historic Preservation Office, the Advisory Council on Historic Preservation, and the New York City Landmarks Commission.

Chapter 2: Existing Environmental Conditions*

This chapter describes the existing environmental and socioeconomic conditions found within the action area. This chapter has been prepared in accordance with the NEPA and the Council on Environmental Quality Regulations for implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations 1500-1508) regulations. This section summarizes the existing (baseline) conditions, to provide a sound basis for plan formulation as described in Chapter 4 and the impact analysis that is provided in Chapter 6. The existing conditions are used as the baseline to forecast the changes that would be expected without USACE action to address inefficiencies in the federal navigation system. The topics in this section are structured to mirror the topics presented in Chapter 6, where the future without-project and future with-project alternatives are evaluated and compared.

2.1: Topography and Bathymetry

The project study area is characterized by manmade, landfilled, and/or altered features. The topography of the project study area is level, with an approximate topographic range of 6 to 13 feet above mean sea level. No naturally occurring steep slopes exist along the channels or berthing areas considered under the national economic development plan. The maximum natural grade reported is 1%, as measured from United States Geological Survey maps.

Stability analysis of channel side slopes was performed during the Harbor Deepening Project by USACE on the Ambrose, Anchorage, Bay Ridge, and Port Jersey Channels using the computer program UTEXAS 3. The program considers data such as channel slope profiles, stratigraphy, soil properties, and water properties. The Spencer, Bishop, USACE, and Lowe procedures were used to obtain the lowest factor of safety for the governing cross-section of each slope. The analyses were designed to be conservative: the highest point along each cross-section and the deepest projected dredge depth were selected. The proposed channel slope angles are 1.0V to 3.0H for slopes in soils and 1.0V to 1.0H for slopes in rock. Further stability analysis will be done during pre-construction engineering and design phase.

The Upper Bay has a dynamic hydrology due to the variation in tidal velocity, amount of freshwater flow, and bathymetry among the connecting bays (USACE, 1999). The Kill Van Kull and Newark Bay Channels were deepened from -35 feet MLLW to -40 feet MLLW in the late 1980's through the early 1990's (i.e. Kill Van Kull/Newark Bay-40 Deepening). Most of these same channels (i.e. Kill Van Kull/Newark Bay-45) were further deepened to -45 feet MLLW beginning in 1999 and ending in 2004. Deepening the Port Jersey Channel to -41 feet MLLW (Port Jersey-41), began in 2002. These navigation channel deepening projects were authorized before the Harbor Deepening Project and are referred to collectively as predecessor projects. The predecessor projects were authorized as Section 101, Section 102, and Section 202a of the Water Resources Development Act of 1986, Pub. L. No. 99-662.

2.2: Environmental Justice

Executive Order 12898 directs federal agencies to identify and address disproportionately high

and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Consistent with this mandate, an evaluation of the population in the vicinity of the New York and New Jersey Harbor was conducted to determine the potential for the project to adversely affect minority and low-income populations (see Chapter 6 for an in-depth analysis).

2.3: Geology and Soils

The New York-New Jersey Harbor consists of numerous bays, rivers, and channels of complex shape that are connected to the Hudson River – the main element of the harbor complex. The area is underlain by both bedrock and unconsolidated materials. Coastal plain deposits form a seaward-thickening wedge of poorly consolidated sediments, which dip gently to the east and unconformably overlie older rock units. Surficial deposits in the project area are either glacial or postglacial, being deposited either before or after the close of the most recent glaciation period. No economically significant mineral deposits are mapped in the study area; however, commercial sand mining periodically occurs in the Ambrose Channel (Lower Bay) and other locations in the Harbor.

2.3.1: Kill Van Kull

The bedrock underlying the Kill Van Kull, beginning at the east, consists of: serpentinite in the Constable Hook Reach; sandstone of the Stockton Formation westward to Bergen Point (through the Bergen Point East and Bergen Point West Reaches); diabase from Bergen Point to the eastern part of Newark Bay; and shale of the Lockatong Formation, with the arkosic sandstone member of the Lockatong at Shooters Island at the confluence of the Arthur Kill, Kill Van Kull, and Newark Bay. Based upon past boring data, the Stockton and Lockatong Formations have limited outcroppings in the Kill Van Kull Channel. Throughout the Kill Van Kull (including the Constable Hook Reach, Bergen Point East Reach, and Bergen Point West Reach), previously blasted, fractured, or moderately weathered bedrock underlies the channel. Dense to very dense sand underlies the Kill Van Kull east of the Bayonne Bridge and through the Bergen Point East Reach. (Lewis and Kummel 1950, Lyttle and Epstein 1987, Drake et al. 1996, Stanford 1996).

2.3.2: Newark Bay

Based on borings and laboratory test data published by The Port Authority of New York and New Jersey (1996), USACE-New York District (1997b) and on a boring performed by a consultant for USACE, the stratigraphy at Newark Bay is as follows: (1) black organic silt - this stratum of very soft to soft organic sediments extends from approximately -5 to -18 feet MLLW; (2) sand - a layer of loose to medium sand about 12 feet thick underlies the organic silt, extending from about -18 to -30 feet MLLW; (3) stiff clay and silt - a 45- to 60-foot-thick layer of stiff clay and silt or varied silt and clay underlies the sand, from a depth of about -30 feet MLLW to the top of rock; and (4) bedrock - rock at Newark Bay is red shale.

2.3.3: Port Elizabeth

Based on reports prepared for The Port Authority of New York and New Jersey by Gahagan and Bryant Associates, Inc. (1997) and Moffat & Nichol Engineers (1998), the stratigraphy at

Elizabeth – Port Authority Marine Terminal is as follows (NY/NJHP, 1998): (1) stiff to very stiff clay - a layer of stiff to very stiff clay with silt extends from a depth of about -41 feet MLLW (mudline) to about -70 feet MLLW. At some locations, a 1- to 6-foot-thick layer of soft clay was encountered at the mudline; (2) bedrock – the bedrock elevation varies from a depth of about -45 feet MLLW (west section of the channel) to about -80 feet MLLW. The red shale of the Passaic (Brunswick) Formation underlies the Elizabeth Channel.

2.3.4: Port Jersey Channel

Based on borings constructed as part of a channel-deepening study (USACE 1998) and also on subsurface information prepared by The Port Authority of New York and New Jersey (Moffat & Nichol International 1998), the stratigraphy of the Port Jersey Channel is as follows: (1) Organic silt/clay: along the centerline of the channel, a soft organic clay/silt layer, typically 5 to 10 feet thick, extends from a depth of about -35 feet MLLW (mudline) to about -45 feet MLLW. Near the channel slopes, this layer is generally at a depth between -10 feet MLLW and -20 feet MLLW and is about 4 to 10 feet thick. The organic layer at the bottom of the channel may have been deposited after the channel was dredged to its design depth (NY/NJHP, 1998); (2) Glacial soils: a red-brown, dense sand/silt layer with Standard Penetration Test (SPT) N-values ranging from 9 blows to over 100, but typically about 25; a 5- to 20- feet thick sand layer having N-values mostly above 50, indicative of a dense to very dense material (3) Bedrock: encountered bedrock consisted of gneiss, mica schist, and red shale that were typically slightly weathered, with recoveries ranging from 0% to 40%. A 5-foot-thick layer of decomposed rock was typically present between the glacial till and the bedrock. Based on the bedrock contours provided by USACE (USACE-New York District 1998), bedrock depth varies from -60 feet MLLW and -120 feet MLLW in the northwest to southeast direction within the channel (NYNJHP 1998). Bedrock underlying the Port Jersey Channel is believed to be Member C of the Manhattan Schist (Lyttle and Epstein 1987). Geology of Upper New York Bay, to the east of the Port Jersey Channel, is believed to be in thrust-fault contact with serpentinite associated with the Hartland Formation (Baskerville 1994, Drake et al. 1996).

2.3.5: Ambrose Channel

In the Ambrose Channel, gray to light brown, medium to fine sand, with little or no organic content predominates, with gravel in some places (WCFS, 1998a). During past borings, no bedrock was encountered down to their limiting depth of 20 feet below the mudline (WCFS, 1998a). The Magothy Formation is believed to be the geologic unit underlying the Ambrose Channel (Lyttle and Epstein, 1987).

2.3.6: Soils

Infilling of the project site and portions of the study area began in the late nineteenth century and continued into the 1970s. Over 1,000 acres of wetlands were filled, a 7,000-foot-long channel was created, and the bayshore was bulkheaded. Approximately 1.5 million cubic yards of hydraulically pumped fill from the ship channel were used to fill nearby meadow lands during the construction of Newark Airport. In general, the area reflects human influences on soil development. Soils within the Port Newark/Elizabeth Port Authority Marine Terminal area are classified by the Draft Soil Survey of Union County (Union County Soil Conservation Service,

1991) as Urban Land, Udorthents-waste substratum, and Udorthents-organic substratum. Soils classified as Urban Land are located in areas of which more than 85% of the surface is covered by impervious structures such as pavement and buildings. Portions of these soils that are not covered are so extensively disturbed that natural soil profiles no longer exist. The Udorthents-organic substratum refers to various fill materials overlying tidal marsh deposits; thickness and composition of this fill material varies to a great degree. The marsh soils themselves are high in organic content and are poorly drained, highly compressible, and relatively unstable. The Udorthents-waste substratum refers to deep-to-shallow fill overlying non-earthy wastes.

2.4: Water Resources and Water Quality

The bays, navigation channels, harbor areas, and rivers surrounding the New York and New Jersey Harbor comprise a complicated hydrologic and hydraulic system. Variations in topography, freshwater input, tidal energy, and meteorological forces produce regions of different hydraulic and water quality characteristics. The New York and New Jersey Harbor tidal cycle generally responds to the tide propagating in from the New York Bight, with some amplification and small phase lags between Upper New York Bay and Newark Bay. At subtidal timescales, the wind force, density currents, and variations in freshwater flows become important factors in the harbor circulation, particularly in areas where tidal currents are weak (Oey et al., 1985).

2.4.1: Groundwater

Groundwater occurs in the project area in bedrock, in unconsolidated Cretaceous deposits, and in Pleistocene and Recent deposits. Groundwater in bedrock in the project area generally is stored and transmitted along fractures and joint openings that decrease in size and number with depth. Unfractured rock usually has negligible capacity to store and transmit groundwater. Rock types occurring in the project area include schist, serpentinite, and interbedded conglomerate, sandstone, siltstone, and shale. Schist, diabase, and serpentinite all generally do not produce enough water to be considered potential groundwater sources. The aforementioned are not considered important aquifers in this area.

The Passaic (Brunswick) Formation is an extensive and important aquifer in areas of New Jersey adjacent to the project area (Nemickas, 1976). In the Passaic Formation, the groundwater system consists of a series of alternating tabular aquifers and aquicludes several tens of feet thick and dipping to the northwest at approximately 10 degrees (Carswell, 1976). The water-bearing fractures in each tabular aquifer are fairly continuous, but there is poor hydraulic connection between individual aquifers. The aquifers generally extend downdip for a few hundred feet and are continuous along strike for thousands of feet. Both water-table and artesian conditions exist in the Passaic Formation, with artesian confinement caused by overlying low-permeability silt and clay.

Water quality in the Passaic Formation adjacent to the Kill Van Kull is strongly influenced by Hackensack River and Newark Bay. Water from the Passaic Formation in this area is hard to very hard and highly mineralized. Heavy pumpage has induced recharge of poor quality water that is high in chloride from these sources (Carswell, 1976).

The Stockton Formation has hydrologic properties similar to those of coarse parts of the Passaic Formation. The Lockatong Formation generally yields considerably smaller quantities of water than the finer-grained part of the Brunswick.

2.4.2: Sediment Characteristics

Sediment characteristics vary widely over the project area as a result of the complex flow patterns. Newark Bay sedimentology reflects the deposition of sediments from river input at the northern end, and tidal input at the southern end. Sediments within Newark Bay tend to be a fine-grained combination of silts, clays, and sands, with larger-grained materials present in the southern end of the bay due to materials introduced by tidal activity.

Upper New York Bay has the most complex distribution of sediments. Currents vary substantially, and a high degree of input is biogenic or anthropogenic. Sediments in Upper New York Bay vary from coarse sands and gravels in high-energy areas to fine-grained silts and clays in low-energy areas.

Lower New York Bay sediments in the area just south of the Narrows are characterized by gravelly sands underlying the main channel, with finer-grained sands, clays, and silts to the east and west of the channel. Extensive deposits of sand characterize the northern part of Lower New York Bay.

A variety of contaminants are found in the sediments of the Harbor. Contaminants detected in sediment samples have included: polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyl (PCB) congeners, metals, and dioxin/furans. Similar to sediment type, the quality of sediments varies substantially, depending on what area is sampled. Typically, water bodies adjacent to or downstream from areas that have a history of industrial activity, especially prior to the introduction of environmental regulations in the 1970s, show the greatest potential for contaminated sediments.

2.4.3: Water Quality

New Jersey Department of Environmental Protection (NJDEP) and NYSDEC have established classification systems for the best intended uses of surface waters in the project area (Surface Water Quality Standards, New Jersey Administrative Code 7:9B; Water Quality Regulations, 6 NYCRR parts 700-705). These classifications are based on the extent to which these surface waters will attain the Clean Water Act goals of aquatic life support and swimmability, and the designated uses outlined by the state. Designated uses are generally based on a set of numeric and narrative water quality criteria. The swimmability goal means having all possible surface waters of sufficient quality to allow for primary-contact recreation. The aquatic life support goal means having all possible waters of sufficient quality to support healthy and reproducing aquatic biota.

For Upper New York Bay, the NJDEP and NYSDEC classifications are SE-2 (saline, estuarine waters) and I (fishing), respectively. These waters are suitable for fishing and secondary contact recreation. The Kill Van Kull is classified as SE-3 (NJDEP) and SD (NYSDEC). SE-3 waters are suitable for maintenance and migration of fish populations and secondary contact recreation. Class SD waters are suitable for fish survival. Class SD waters are characterized as waters not

primarily used for recreational purposes, shellfish culture, or the development of fish life, and, due to natural or manmade conditions, cannot meet the requirements of these uses. Newark Bay, under jurisdiction of NJDEP, is also classified as SE-3. The New York waters of Lower New York Bay are classified as I around Gravesend Anchorage and as SB further offshore in the vicinity of Ambrose Channel. SB marine waters are suitable for primary contact recreation (e.g., swimming).

2.5: Vegetation, Wetlands, and Submerged Aquatic Vegetation

2.5.1: Aquatic Habitat

Aquatic habitats within the project area, which include both marine and estuarine habitats, vary in depth from shallow intertidal areas to deep-water channels. Estuarine systems consist of tidal and subtidal habitats and adjacent tidal wetlands that are generally surrounded by land but that have open, partially obstructed, or sporadic access to the open ocean. Ocean and freshwater flows mix in estuarine habitats. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5 ppt. Estuarine habitat traditionally comprises four salinity categories: oligohaline (<8 ppt), mesohaline (8-18 ppt), and polyhaline (18-30 ppt), with some eurohaline water (>30 ppt) from open ocean embayments where high evaporation rates lead to elevated salinity levels. The estuarine environment affected by marine waters has tidally influenced boundaries. These boundaries are generally maintained by seawater that is transported through inlets mixing with freshwater supplied by land runoff. Estuarine habitats in the project area include the open-water and shoreline areas of Upper New York Bay, the Kill Van Kull, and Newark Bay.

Marine habitat consists of open ocean overlying the continental shelf and its associated coastline (Cowardin et al. 1979, Tiner 1985). Parts of the project area that are considered marine include the open-ocean waters of the New York Bight Apex as well as the open-water areas of Lower New York Bay. Marine habitats are exposed to the waves and currents of the open ocean, while water regimes are determined primarily by the ebb and flow of oceanic tides. Salinity generally exceeds 30 ppt with little or no dilution except at the boundaries of estuarine waters. Marine systems extend from the outer edge of the continental shelf shoreward to the seaward limit of the estuarine system.

Habitats within the estuarine and marine portions of the project area vary from shallow subtidal mudflats to deep channels. Deep channels within the project area include maintained navigation channels, interpier berthing areas, and naturally occurring deep-water areas. Although natural water depths in the harbor are for the most part less than -20 feet MLLW, depths in some areas exceed -90 feet MLLW (e.g., the Narrows).

Subtidal deep habitats also include submerged structures (e.g., pile fields, wrecks), and some underpier and interpier areas, which provide habitat for most fish species, including juvenile striped bass (*Morone saxatilis*) and recently settled winter flounder (Able et al. 1995). These pile fields and interpier habitats are found throughout the project area but are most extensive along the developed shorelines of the Kill Van Kull and Newark Bay.

The shallow subtidal zone (-0 to -6 feet MLLW) are important transitional areas between tidally

exposed wetlands and deepwater or pelagic systems. The shallow subtidal zone is a recipient, producer, and converter of nutrients in the aquatic ecosystem. The shallow subtidal zone receives nutrients, typically in the form of plant debris and organic sediments. The nutrients are flushed from the intertidal wetlands daily, and in seasonal pulses when the plant material breaks down at the end of the growing season. Nutrients can also be exported to the shallow subtidal zone by forage fish and invertebrates that feed on plant matter; nutrients exported by silversides (*Menidia menidia*), mummichogs (*Fundulus heteroclitus*), and crustaceans are then immediately available for transfer to higher trophic levels, such as predatory fish and birds. Some predators, such as bluefish (*Pomatomus saltatrix*), Atlantic needlefish (*Strongylura marina*), and cormorants (*Phalacrocorax sp.*) actively feed in the shallow subtidal zone. Nutrients can also be exported to the shallow subtidal zone from sewage treatment plant discharges and stormwater outfalls. Non-point discharges, such as runoff from impervious surfaces, can also contribute nutrients as well as contaminants to the shallow subtidal zone.

2.5.2: Vegetation

The dominant wetland vegetation in the project area is reflective of the wetland type and degree of human disturbance and invasion by common reed (*Phragmites australis*). Observations on wetland vegetation and wildlife were made as part of the Harbor Deepening Project Baseline Biological Reconnaissance Survey in September 1998. The wetlands in the tidally influenced creeks are characterized by an unvegetated mud flat grading to a monoculture of saltmarsh cordgrass (*Spartina alterniflora*), then to a monoculture of common reed. The saltmarsh cordgrass is typically found in the frequently inundated ("IM" wetlands on the NYSDEC maps and "E2EM" wetlands on the NWI maps) portions of the intertidal marsh; common reed is found in the upper portions of the intertidal marsh and in the high marsh. Less commonly observed plants were salt meadow cordgrass (S. *patens),* groundsel bush *(Baccharis halimifolia),* both of which occur in the high marsh, and water hemp *(Amaranthus cannabinus),* which is found in the intertidal marsh. Common reed is an invasive species that often out-competes cordgrass in the upper intertidal area. While common reed has little food value for wildlife, it functions as cover, traps sediments, and absorbs waterborne nutrients. Common reed spreads by seed and rhizomes (specially adapted roots), rapidly colonizing disturbed or cleared areas. The saline waters carried by mosquito control ditches in portions of the intertidal wetlands may prevent or slow the spread of common reed. In the case of common reed, ditching can serve either to facilitate or prevent its spread. When ditching serves to reduce the tidal influence and period of (saline) inundation, common reed may gain a competitive edge over saltmarsh cordgrass. However, tidal ditches of sufficient width and depth will prevent the spread (by rhizomes) of common reed. Ditching facilitates the invasion of common reed from the upland edge of the wetland but can prevent invasion in isolated portions of the wetland.

2.5.3: Submerged Aquatic Vegetation

There is no documented submerged aquatic vegetation within the project area.

2.5.4: Intertidal Wetlands

The intertidal system is defined as the area between MLLW and mean higher high water (MHHW). Saltwater marshes, mudflats, gravel/sand beaches, and rock or riprap shorelines

subject to periodic tidal inundation are all examples of intertidal habitats. There are no intertidal wetlands within the project area.

2.6: Essential Fish Habitat

An essential fish habitat is defined under the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Sustainable Fisheries Act requires that essential fish habitat be identified for those species actively managed under federal fishery management plans. This includes species managed by the eight regional Fishery Management Councils, established under the Magnuson-Stevens Fishery Conservation and Management Act, as well as those managed by the National Marine Fisheries Service (NMFS) under fishery management plans developed by the Secretary of Commerce.

Essential fish habitat designations emphasize the importance of habitat protection to healthy fisheries and serve to protect and conserve the habitat of marine, estuarine, and anadromous finfish; mollusks; and crustaceans. Essential fish habitat embodies both the water column (including its physical, chemical, and biological growth properties) and its underlying substrate (including sediment, hard bottom, and other submerged structures). Under the essential fish habitat definition, necessary habitat is that which is required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Essential fish habitat is designated for a species' complete life cycle, including spawning, feeding, and growth to maturity, and may be specific to each life stage (e.g., eggs, larvae).

Species for which essential fish habitats have been designated in the New York and New Jersey Harbor are butterfish (*Peprilus tricanthus*), Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), black sea bass (*Centropristus striata*), bluefish, red hake (*Urophycis chuss*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), windowpane flounder (*Scophthalmus aquosus*), winter flounder (*Pseudopleuronectes americanus*), little skate (*Leucoraja erinacea*), clearnose skate (*Raja eglanteria*), winter skate (*Leucoraja ocellata*), king mackerel (*Scomberomorus cavalla*), Atlantic Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), sand tiger shark (*Carcharias taurus*), dusky shark (*Carcharhinus obscurus*), and sandbar shark (*Carcharhinus plumbeus*). See Appendix A4 for species-specific assessment.

2.7: Wildlife

The finfish community in the project area, consisting of a variety of estuarine, marine, and anadromous fish species, is typical of large coastal estuaries and inshore waterways along the Mid-Atlantic Bight. Situated in the transition zone between northern cold water (boreal) species and temperate (warm-water) species, New York Bight and the NY/NJ Harbor estuary serve as a spawning ground, migratory pathway, and nursery/foraging area for many fish species.

Many of the species that are seasonally abundant in the project area are transient or migratory, moving through the project area to upstream spawning grounds in the Hudson River or entering

the area on a seasonal basis from nearby ocean waters. These species include estuarine migratory species that use the estuary primarily as a nursery, or as a forage area for juveniles or adults.

Species that migrate from marine waters to spawn in the freshwater reaches of the Hudson River, in freshwater tributaries, or in the upper reaches of the estuary are considered anadromous. This includes several common species of herring (*Clupeidae*) such as blueback herring *(Alosa aestivalis),* alewife (*A. pseudoharengus),* and American shad (*A. sapidissima),* as well as the relatively less common hickory shad (A. *mediocris)* and gizzard shad *(Dorosoma cepedianum)* (U.S. Fish and Wildlife Service, 1997). These species occur in the project area primarily as adults, migrating to spawning areas, and heavily influence the seasonal composition and abundance of the fish community. Other anadromous species occurring in the project area include Atlantic tomcod *(Microgadus tomcod),* Atlantic sturgeon *(Acipenser oxyrhyncus*), rainbow smelt *(Osmerus mordax),* and striped bass.

Deeper, open-water habitats in this region support over 60 migratory and resident fish species including species of commercial or recreational importance such as winter flounder and black sea bass (RPA, 2003; USACE, 2004a). Northwest Staten Island and the islands along the Kill Van Kull were designated as a Special Natural Waterfront Area by New York City due to the diverse landscape of habitats (NYCDCP, 2011). Arlington Marsh and Graniteville Swamp are examples of important habitats within this region.

Large breeding populations of herons, egrets, and ibises have used uninhabited islands in the region as nesting sites, and the nearby marshlands and mudflats as foraging areas. From the late 1970s through the early 1990s, the islands supported the largest heron rookery in New York State. It was estimated that the entire rookery in the study area accounted for almost 25 percent of the wading birds that nested in coastal waters within New York, New Jersey, and Connecticut (U.S. Fish and Wildlife Service, 1997). The three islands near this project are Shooters Island, Hoffman Island, and Swineburne Island. Of these, only Hoffman Island was shown to support active wading bird rookeries during the most recent survey (NYC Audubon, 2019), however all three provide habitat for other bird species and may be recolonized by wading birds in the future. The water of the Upper Bay also supports migratory marine mammals, such as humpback whales (*Megaptera noveangliae*) (NYSDEC, 2019).

Three endangered marine mammals have been identified by NMFS as occurring within the project area. These include the northern right whale (*Eubalaena glacialis*), the humpback whale, and the finback whale (*Balaenoptera physalus*) (NMFS, 1999). These species are migratory, using the harbor in transit to other habitat areas, or have been recorded in the Lower New York Bay area, although some individuals have been documented as far up the Hudson River as the Troy Dam.

2.8: Benthic Fauna

Benthic communities have varied roles in the estuarine ecosystem. New York Harbor once had a vibrant benthic community, but major environmental degradation due to the development of New York City, heavy industry, and all of the associated pollution from both as well as overfishing of local stocks of shellfish affected benthic populations. Supporting evidence is

provided by historical accounts of New York's oyster industry. Before 1900, oysters were found throughout much of the lower estuary and north to Ossining, New York, including Newark Bay, Arthur Kill, Kill Van Kull, Jamaica Bay, Raritan Bay, and the New Jersey shore of the Hudson. By the turn of the century, the shellfish industry was limited to waters south of the Narrows; by 1920 it largely had disappeared from harbor waters (Kirby, 2004; Franz 1982). Filter feeders such as clams, oysters, and sponges clarify and clean the waters of the bay through their biological processes, removing particulate matter and potentially toxic materials, providing for a healthy marine environment. Today's remnant population located primarily on sub-tidal rip-rap and other hard structure rather than natural oyster reefs, which have been eliminated from the region, provides few such ecological services. However, there is an active and growing oyster restoration program to return oysters to New York Bay by constructing new reefs and stocking live oysters (Billion Oyster Project, 2019). Several small restoration reefs are present in the greater region (though none in the project area) at this time, along with remnant oyster populations attached to hard structures, such as rip-rap and concrete pilings. Benthic primary and secondary consumers, as well as detritivores, pass the energy of primary producers (phytoplankton) to higher levels of the food web. Many benthic species are prey for economically important species such as the blue crab (*Callinectes sapidus*), striped bass, winter flounder, bluefish, and summer flounder (Limburg et al., 2006).

The benthic communities of the lower New York Harbor include an array of fauna that play important roles in the food web (USACE, 2006; Cerrato et al. 1989). The lower New York Bay benthic community includes epifauna (organisms that live attached to surfaces on the river bottom) such as oysters (*Crassostrea virginica*) and barnacles, which need hard structure. These benthic communities live along with organisms that can be found on sand bottom such as blue mussels (*Mytilus edulis*), sponges (phylum *Porifera*), sea squirts (class *Ascidiacea*), and sea stars (class *Asteroidea*). Also, these benthic communities include infauna that burrow into bottom sediments and are characterized by worms (primarily polychaetes [typically the most numerous organism in the region (USACE, 2006, 1999b)] and nemotodes), clams (the most numerous in the project region is the dwarf surf clam, [*Mulinia lateralis*]), and other tunneling organisms such as tube worms. The USACE 1989-1999 survey indicated few organisms in the project region besides polychates, but the more recent surveys (USACE 1999, 2006, 2011, 2013, 2017) indicated that significant ecological recovery has taken place since the 1980s, with a much wider variety of species being found today compared to earlier decades. The benthic community in the project region is, in some areas low in biomass and diversity due to sediment contamination and sediment composition (less sand and more clay and/or silt, with no reef or hard bottom habitat), with areas dominated by higher percentage sand sediments holding much greater species numbers, biomass and diversity (USACE, 2006). Due to the nature of this substrate, the biologically active zone (BAZ), where living organisms can be found, is deeper than silt and mud sediment types.

2.9: Special Status Species

The Action Area consists of the areas transited by dredging vessels/equipment and the areas under consideration for additional widening and/or deepening. The Action Area includes the area of potential air and water quality impacts. The geographic extent of water quality impacts is

dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions such as wind and currents (USACE, 2015). The Action Area includes the range of noise impacts as they pertain to special status species.

This section provides a summary of the special status species that are known or have the potential to occur in the Action Area. The following references were consulted for compilation of the special status species that have the potential to occur in the Action Area that is provided in Table 2:

- Information, Planning and Consultation System (IPaC) search conducted within the Action Area (USFWS, 2020);
- National Oceanographic and Atmospheric Administration, National Marine Fisheries Service (NMFS, 2020) Section 7 Mapper, url: https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27
- Large Whale Strike Database (Jensen and Silber, 2003).

Table 2: Special Status species that have potential to occur in Action Area

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	NEW YORK STATE STATUS	NEW JERSEY STATE STATUS	CRITICAL HABITAT IN ACTION AREA (Y/N)
Atlantic Sturgeon	*Acipenser oxyrhynchus*	E	HPS	E	N
Shortnose Sturgeon	*Acipenser brevirostrum*	E	E	E	N
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E	E	N
Loggerhead Sea Turtle	*Caretta caretta*	E	T	E	N
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	E	E	N
Green Sea Turtle	*Chelonia mydas*	E	T	T	N
North Atlantic Right Whale	*Eubalaena glacialis*	E	E	E	N
Fin Whale	*Balaenoptera physalus*	E	E	E	N

E = Endangered; T = Threatened; HPS = High Priority Species of Greatest Conservation Need (Not Currently Endangered, Threatened, or Special Concern)

2.9.1: Federally Threatened and Endangered Species and Designated Critical Habitat

Animals and plants listed as endangered or threatened are protected under the Endangered Species Act of 1973. According to the Endangered Species Act of 1973, an "endangered species" is defined as any plant or animal species in danger of extinction throughout all or a substantial portion of its range. A "threatened species" is any species likely to become an endangered species in the foreseeable future throughout all or a substantial part of its range. "Proposed Species" are animal or plant species proposed in the Federal Register to be listed

under Section 4 of the Endangered Species Act of 1973. "Candidate species" are species for which the FWS and NMFS have sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act of 1973. Critical habitat is designated per 50 Code of Federal Regulations parts 17 or 226 and defines those habitats that are essential for the conservation of a species classified by the federal government as threatened or endangered and that may require special management and protection.

A Biological Assessment for those species under the jurisdiction of NMFS is available in Appendix A1. Coordination is ongoing. There are no candidate species known or with the potential to occur in the project Action Area. The closest critical habitat is for the Atlantic sturgeon, the local distinct population segment, which is a relatively isolated sub-population (New York Bight Distinct Population Segment) (Figure 3), whose critical habitat includes the Hudson River. The critical habitat begins approximately 3 miles upriver of the project Action Area.

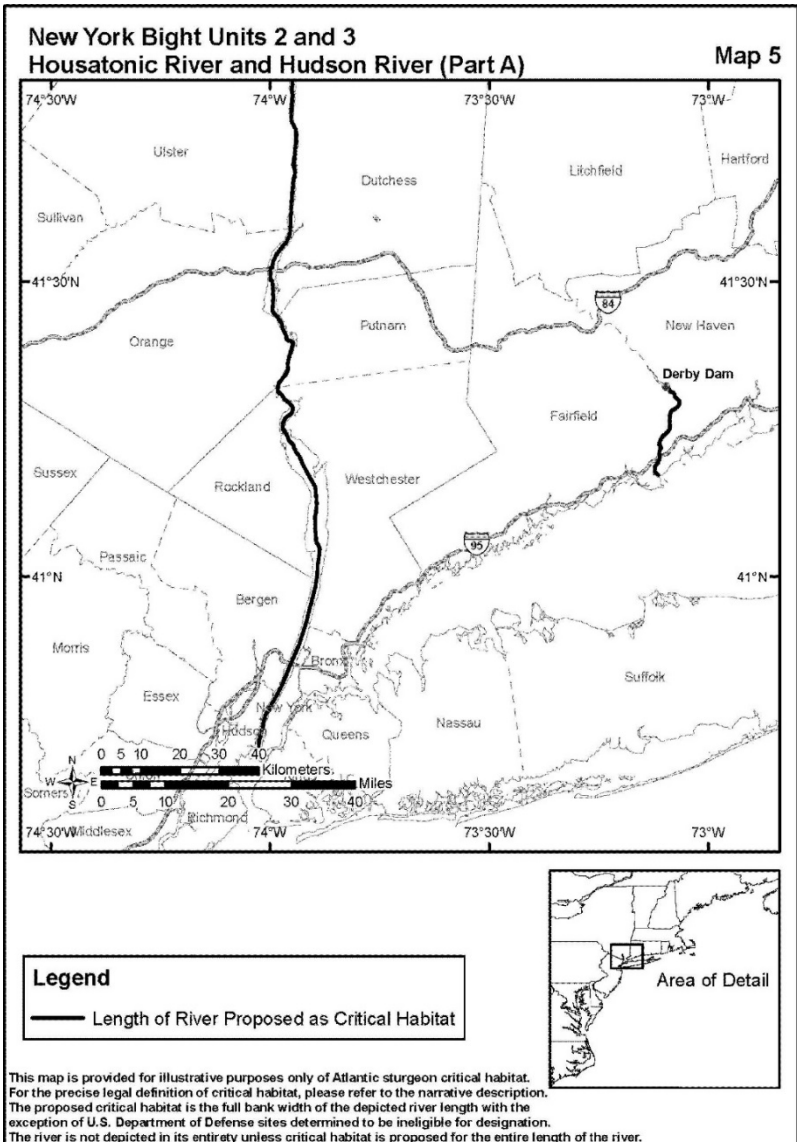


Figure 3: New York Bight Distinct Population Segment

Both the Atlantic and shortnose sturgeon (*Acipenser brevirostrum*) migrate through waters of the Hudson River and New York Bay to reach spawning waters in freshwater reaches of the Hudson River. The Hudson River population of shortnose sturgeon is one of the healthiest remaining populations of this species (Woodland and Secor, 2007). Shortnose sturgeon are, however, transient in upper New York Harbor waters and likely only to be found there during their migrations to spawning grounds and are not known to occur in lower New York Harbor. Atlantic sturgeon do migrate through waters of Lower New York Bay, and adjacent channels and waters. The local juvenile population aggregates in the spring and fall near Breezy Point, known as the Rockaway Aggregation. This population experiences the highest by-catch rate during otter trawling fishery seasons (Dunton, 2014).

Based on review of the survey and National Oceanic and Atmospheric Administration stranding data (Jensen and Silber, 2003), there are two records of finback (fin) whale strikes with mortality in New York Harbor and one from Manhattan.

Green sea turtles feed primarily on sea grass and can be found foraging in sea grass beds on the eastern side of Long Island as well as in open pelagic waters and are highly unlikely to be found in the local project area. Therefore, there would be "no effect" to the green sea turtle and this species is dismissed from further analysis. Leatherback, Kemp's Ridely, and loggerhead sea turtles could potentially be found transiting waters of the Action Area and adjacent waters transited by dredging vessels. A Biological Opinion was issued on sea turtles and sturgeon by NMFS in 2012 relative to the New York Harbor Deepening Project. The Biological Opinion did not include detailed analysis on the shortnose sturgeon or Hawksbill sea turtle due to NMFS's determination of "Not Likely to Adversely Affect," due to the extremely low probability of these two species being found in the area and impacted by the proposed dredging. Only the Ambrose Channel was considered suitable sea turtle habitat.

2.9.2: Marine Mammals

The Marine Mammal Protection Act of 1972, as amended, prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. In reference to the Marine Mammal Protection Act, a marine mammal is a species found in the U.S. that is classified into one of the following four distinct groups: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), sirenians (manatees and dugongs), and marine fissipeds (polar bears and sea otters). Only cetaceans, pinnipeds, and sirenians (a single migratory manatee, named "Ilya" has been spotted several times in recent years) have the potential to occur in the Action Area. All marine mammals in the U.S. are protected under the Marine Mammal Protection Act.

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The term "take" per the Marine Mammal Protection Act is defined as harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal. For most activities "harassment" refers to the act of pursuit, torment, or annoyance which:

- Can injure a marine mammal or a marine mammal stock in the wild which is referred to as Level A Harassment; or
- Has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns that include but are not limited to the following: migration, breathing, nursing, breeding, feeding, or sheltering which is referred to as Level B Harassment.

Table 3 provides a comprehensive listing of marine mammals documented to occur throughout the coastal waters of New York and New Jersey. The humpback whale, West Indies Distinct Population Segment, the only humpback whale population segment that occurs in New York, is no longer federally listed, but is still protected under the Marine Mammal Protection Act and has been recently returning in numbers to New York Harbor waters.

Table 3: Marine mammals documented to occur throughout the coastal waters of New York and New Jersey

TAXONOMIC CATEGORY/ COMMON NAME	SCIENTIFIC NAMES
Baleen Whales	
Blue whale	*Balaanoptera musculus*
Fin whale	*Balanoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Minke whale	*Balaenoptera acutorostrata*
Northern right whale	*Eubalena glacialis*
Sei whale	*Balaenoptera borealis*
Delphinids	
Atlantic white-sided dolphin	*Lagenorhynchus acutus*
Bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinus delphis*
Long-finned pilot whale	*Globicephala melas*
Other toothed whales	
Cuvier's beaked whale	*Ziphius cavirostris*
Harbor porpoise	*Phocoena phocoena*
Sperm whale	*Physeter macrocephalus*
Pinnipeds	
Grey seal	*Halichoerus grypus*
Harbor seal	*Phoca vitulina*

2.9.3: Bald Eagles Protected under the American Bald and Golden Eagle Act of 1972

Previously listed as federally endangered, the bald eagle (*Haliaeetus leucocephalus*) has made a remarkable comeback and is no longer federally listed. The bald eagle is currently protected under the American Bald and Golden Eagle Act, and the Migratory Bird Treaty Act. Bald eagles breed throughout much of Canada and Alaska, in addition to scattered sites across the lower 48 states, from California to the southeastern U.S. coast and Florida. Wintering habitat covers most

of the contiguous U.S., with some year-round distribution in the northwest. Northern birds return to breeding grounds as soon as weather and food availability permit, generally between January and March.

A large raptor, the bald eagle has a wingspread of about seven feet. Adults have a dark brown body and wings, white head and tail, and a yellow beak. Juveniles are mostly brown with white mottling on the body, tail, and undersides of wings. Bald eagles typically breed and winter in forested areas adjacent to large bodies of water. However, such areas must have an adequate food base, perching areas, and nesting sites. Throughout its range, it selects large, super-canopy roost trees that are open and accessible. Nests are constructed from an array of sticks placed in an interwoven pattern. Other materials added as fillers may include grasses, mosses, and even corn stalks. Nests are massive; often exceeding several thousand kilograms in weight.

The FWS National Bald Eagle Management Guidelines (2007) are used to assess potential effects to nesting bald eagles and provides management guidelines to avoid impacts to nesting bald eagles (USFWS, 2007). To avoid disturbing bald eagles, a nest buffer is recommended between the human activity and the nest where applicable. Human impacts are considered detrimental to nesting success within the primary buffer and within the secondary buffer, human impacts are thought to impact the quality of the primary nest buffer. The primary buffer is a distance of 330 feet from the nest and the secondary buffer is a distance of 660 feet from the nest. Human activities that are considered detrimental to breeding activities (e.g. development, logging, use of toxic chemicals, etc.) are to be limited within the primary buffer and those that could impact the integrity of the primary buffer are restricted within a secondary buffer (e.g. developments, roadways, etc.). Per the management guidelines, a nest buffer of 2,640 feet is recommended from the nest for loud, disturbing noises such as those caused by blasting and other loud, intermittent noises.

No bald eagle nests currently exist within the Action Area. The Action Area is not located in a Bald Eagle Concentration Area. The closest known nesting location for bald eagles are in Linden and Kearny (NJDEP, 2019), approximately 4 miles from the study area, and recent sightings indicate there is a nest on Staten Island (Trezza, 2016).

2.9.4: Species Protected under the Migratory Bird Treaty Act and Executive Order 13186

The Migratory Bird Treaty Act and Executive Order 13186 requires agencies to protect and conserve migratory birds and their habitats. Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the FWS.

Migratory birds nest throughout North America, some as far north as the Arctic. In late summer and fall, they migrate south for the winter. Some winter in the southern United States, Mexico, the Caribbean or Central America while others go as far as South America. Each spring they return north to their breeding grounds. Many migratory songbirds, shorebirds, and raptors rest and refuel in the area during their spring and fall migrations (Table 4). Others winter south and return to the watershed each spring to breed.

Migratory birds are defined as those described by the FWS in the 50 Code of Federal Regulations 10.13 and consist of species that that belongs to a family or group of species in the United States as well as Canada, Japan, Mexico, or Russia. Most birds native (naturally occurring in the U.S.)

to the U.S. belong to a protected family and are protected by the Migratory Bird Treaty Act. A species qualifies for protection under the Migratory Bird Treaty Act if it meets one or more of the following four criteria:

(1) It (a) belongs to a family or group of species named in the Canadian convention of 1916, as amended in 1996; (b) specimens, photographs, videotape recordings, or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) the documentation of such records has been recognized by the American Ornithologists Union or other competent scientific authorities.

(2) It (a) belongs to a family of group of species named in the Mexican convention of 1936, as amended in 1972; (b) specimens, photographs, videotape recordings, or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) the documentation of such records has been recognized by the American Ornithologists' Union or other competent scientific authorities.

(3) It is a species listed in the annex to the Japanese convention of 1972.

(4) It is a species listed in the appendix to the Russian convention of 1976.

Table 4: Avian species that may rest and refuel in the area during spring and fall migrations
(Note this table spans two pages)

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
American Oystercatcher	*Haematopus palliates*	Lesser Yellowlegs	*Tringa flavipes*
Bald Eagle	*Haliaeetus leucocephalus*	Long-eared Owl	*Asio otus*
Black Scoter	*Melanitta nigra*	Long-tailed Duck	*Clangula hyemalis*
Black Skimmer	*Rynchops niger*	Nelson's Sparrow	*Ammodramus nelsoni*
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Northern Gannet	*Morus bassanus*
Black-legged Kittiwake	*Rissa tridactyla*	Parasitic Jaeger	*Stercorarius parasiticus*
Bobolink	*Dolichonyx oryzivorus*	Prairie Warbler	*Dendroica discolor*
Bonaparte's Gull	*Chroicocephalus Philadelphia*	Prothonotary Warbler	*Protonotaria citrea*
Bridled Tern	*Onychoprion anaethetus*	Purple Sandpiper	*Calidris maritima*
Brown Pelican	*Pelecanus occidentalis*	Razorbill	*Alca torda*
Buff-breasted Sandpiper	*Calidris subruficollis*	Red Knot	*Calidris canutus*
Canada Warbler	*Cardellina Canadensis*	Red Phalarope	*Phalaropus fulicarius*
Cerulean Warbler	*Dendroica cerulean*	Red-breasted Merganser	*Mergus serrator*
Clapper Rail	*Rallus crepitans*	Red-headed Woodpecker	*Melanerpes erythrocephalus*
Common Eider	*Somateria mollissima*	Red-necked Phalarope	*Phalaropus lobatus*
Common Loon	*gavia immer*	Red-throated Loon	*Gavia stellata*
Common Tern	*Sterna hirundo*	Ring-billed Gull	*Larus delawarensis*
Cory's Shearwater	*Calonectris diomedea*	Roseate Tern	*Sterna dougallii*

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Double-crested Cormorant	*phalacrocorax auritus*	Royal Tern	*Thalasseus maximus*
Dovekie	*Alle*	Ruddy Turnstone	*Arenaria interpres morinella*
Dunlin Calidris	*alpina arcticola*	Rusty Blackbird	*Euphagus carolinus*
Eastern Whip-poor-will	*Antrostomus vociferous*	Saltmarsh Sparrow	*Ammodramus caudacutus*
Evening Grosbeak	*Coccothraustes vespertinus*	Seaside Sparrow	*Ammodramus maritimus*
Golden Eagle	*Aquila chrysaetos*	Semipalmated Sandpiper	*Calidris pusilla*
Golden-winged Warbler	*Vermivora chrysoptera*	Short-billed Dowitcher	*Limnodromus griseus*
Great Black-backed Gull	*Larus marinus*	Snowy Owl	*Bubo scandiacus*
Great Shearwater	*Puffinus gravis*	Surf Scoter	*Melanitta perspicillata*
Herring Gull	*Larus argentatus*	Thick-billed Murre	*Uria lomvia*
Hudsonian Godwit	*Limosa haemastica*	Whimbrel	*Numenius phaeopus*
Kentucky Warbler	*Oporornis formosus*	White-winged Scoter	*Melanitta fusca*
King Rail	*Rallus elegans*	Willet	*Tringa semipalmata*
Leach's Storm-petrel	*Oceanodroma leucorhoa*	Wilson's Storm-petrel	*Oceanites oceanicus*
Least Tern	*Sterna antillarum*	Wood Thrush	*Hylocichla mustelina*

2.10: Floodplains

Through Executive Order 11988, federal agencies are required to evaluate all proposed actions within the one percent annual exceedance (100-year) floodplain. Actions include any federal activity involving 1) acquiring, managing, and disposing of federal land and facilities, 2) providing federally undertaken, financed, or assisted construction and improvements, and 3) conducting federal activities and programs affecting land use, including, but not limited to, water and related land resources planning, and licensing activities. In addition, the 0.2 percent annual exceedance (500-year) floodplain should be evaluated for critical actions or facilities, such as storage of hazardous materials or construction of a hospital. The Executive Order provides an eight-step process to evaluate activities in the floodplain that generally includes 1) determine if the proposed action is in the floodplain, 2) provide public review, 3) identify and evaluate practicable alternatives to locating in the one percent annual exceedance floodplain, 4) identify the impacts of the proposed action, 5) minimize threats to life and property and to natural and beneficial floodplain values and restore and preserve natural and beneficial floodplain values, 6) reevaluate alternatives, 7) issue findings and a public explanation, and 8) implement the action. Proposed actions may have limited impacts such that the eight-step process may vary or be reduced in application, which is the case for this project.

The proposed action, widening and deepening within and adjacent to the navigation channels of New York and New Jersey Harbor, is not in the floodplain, and should not impact floodplains under the criteria listed under Executive Order 11988. Any dredged material should be placed

either in the offshore Historic Area Remediation Site (HARS) site or appropriately permitted upland disposal sites able to handle and properly store non-HARS suitable dredged materials, should any be within the dredging footprint. The proposed action will not influence the chance of flooding in the local floodplain. No effect on local floodplains due to project implementation is expected, and impacts to floodplains, as defined in EO 11988, are dismissed from further consideration.

2.11: Cultural Resources

As a federal agency, the Corps has certain responsibilities for the identification, protection and preservation of cultural resources that may be located within the Area of Potential Effect associated with the proposed project. Present statutes and regulations governing the identification, protection and preservation of these resources include the National Historic Preservation Act of 1966, as amended; the National Environmental Policy Act of 1969; Executive Order 11593; and the regulations implementing Section 106 of the National Historic Preservation Act of 1966 (36 Code of Federal Regulations Part 800, Protection of Historic Properties, August 2004). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places. This work is done in coordination with the State Historic Preservation Offices of New Jersey and New York, federally recognized Tribes, and interested parties. The district carried out a review of existing surveys and historical documentation to identify previously recorded historic properties and properties with the potential to be eligible for the National Register of Historic Places and areas of archaeological sensitivity within the Area of Potential Effect.

The Area of Potential Effect represents the physical extent of the undertaking within which direct and/or indirect effects of the construction, operation, and maintenance of the project could be caused to the character or use of a historic property. For this project, the Area of Potential Effect includes the construction limits of all widened or deepened channels, a 500-foot buffer around any blasting that will take place for vibrations (Figure 4), and any additional locations that will be required to be used as environmental mitigation sites (to be identified in the future). No staging areas have been identified, but if used, staging areas would be part of the Area of Potential Effect as well. For this project, the term construction limits refers to the areas that will actually be deepened or widened, whereas Areas of Potential Effect include all of these areas, in addition to mitigation sites, staging areas, and the 500-foot buffer around known bedrock in the construction limits for potential vibration impacts.

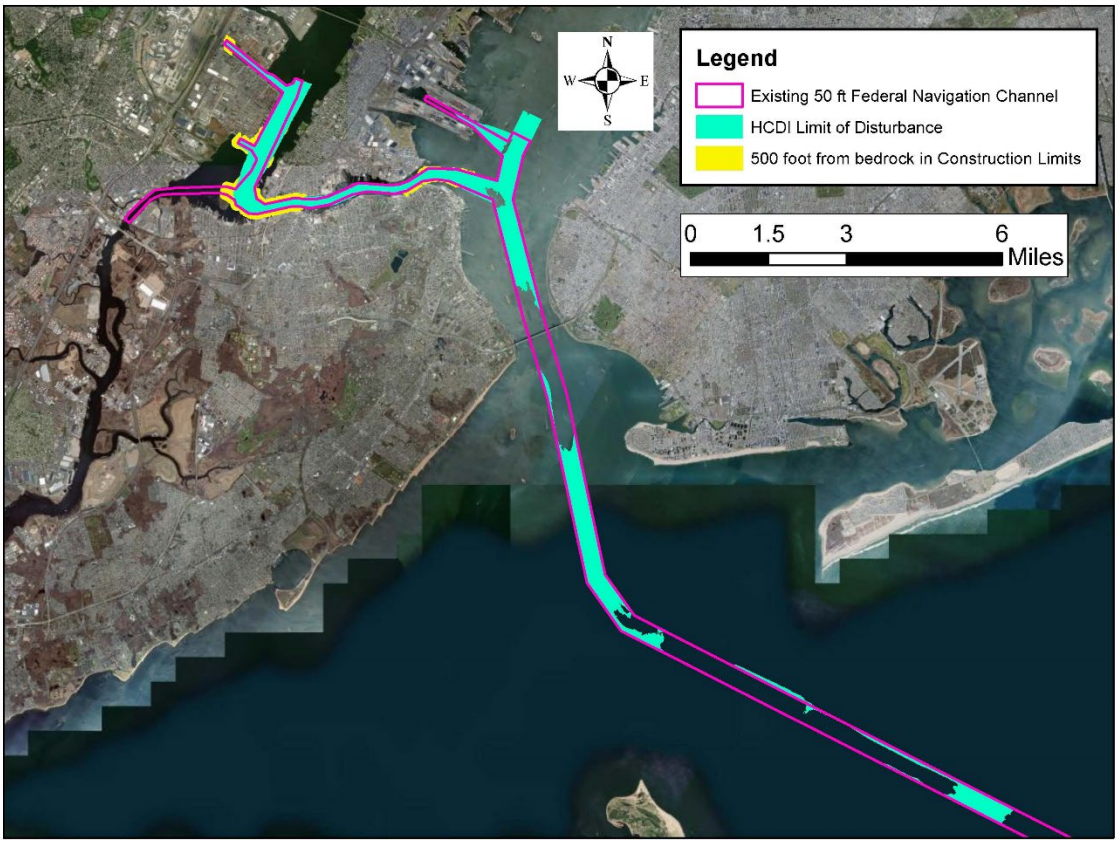


Figure 4: Area of Potential Effect for Cultural Resources of the NYNJHDCI Project

There are many cultural resources within one mile of the Area of Potential Effect. In New York there are 52 archaeological sites within one mile of the Area of Potential Effect (this is 1 mile from the 500-foot vibration buffer). Of these, 14 resources are National Register (NR) eligible, 27 are not eligible, and 11 are undetermined. There are also 19 New York State Museum sites within one mile of the Area of Potential Effect. Also, in New York, there are 912 building sites within one mile of the Area of Potential Effect. 75 are listed on the NR, 113 are eligible, 187 are not eligible, and 537 are unevaluated. In New Jersey, there are five archaeological sites within one mile of the Area of Potential Effect. This is according to spatial data the district received from the NJ State Historic Preservation Office in November 2012 for the Hudson Raritan Estuary Project. Once the NY State Historic Preservation Office reopens, this data will be updated. In New Jersey there are 26 NR historic resources and districts within one mile of the Area of Potential Effect. Four resources are listed on the NR, while the other 22 are eligible for the NR. See Appendix A9 for the complete listing of cultural resources within one mile of the Area of Potential Effect.

2.12: Recreation

Although opportunities for recreation are present within the Action Area, the major use of the

navigation channels and associated anchorages within the Action Area is for marine vessel navigation to and from marine terminals and shipyards via the New York and New Jersey Harbor channels.

Recreational boaters as well as charter fishing boats and cruise liners also use the lower New York Bay for access to attractions, which includes non-commercial fishing as well as land-based sites and tourist attractions, depending on the activity, as well as for access from points upstream in the Hudson River to pursue similar activities.

Recreational fishing in the region, the main recreational activity other than passing cruise liners, occurs mostly from boats and includes estuarine and marine fish species (e.g., porgy, weakfish, striped bass, summer flounder, and bluefish) as well as blue crab, the latter of which is also harvested commercially at a limited scale in New York Bay and the Hudson River. The project Action Area is generally closed to shellfish harvest, though areas outside of it along cleaner oceanic waters are, in some cases, open to such harvest (https://www.dec.ny.gov/outdoor/103483.html). Overall, recreational opportunities are limited to boat-based activity due to the offshore, deep water nature of the navigation channels in the immediate area of proposed construction.

2.13: Aesthetics and Scenic Resources

The Action Area for visual resources are the industrial, commercial, urban, residential, recreational, and tourist sites as well as transportation routes which include bridges and various highways, with views of the New York-New Jersey Harbor. The visual experience is dependent upon the pattern of the land (i.e., the topography), the pattern of water bodies, vegetation, and manmade development at any location. Views along the harbor include a waterfront with a mix of industrial, commercial, naval, marine, and urban shoreline uses. Within the vicinity of the proposed project, the topography is relatively flat.

Because much of the Action Area is low elevation with very slight relief, viewers can generally see long distances from locations that are only slightly higher than the surrounding area. From the ground level, these locations are only near the river bank. Due to the highly urbanized nature of the Greater New York City Metropolitan Area, with numerous tall buildings throughout the Area, the view of the water is quickly lost as you move inland. However, both multi-story commercial and residential buildings can provide attractive waterfront views. Depending on the height of the individual building, these views can be had from significant distance inland from the harbor. There are four bridges from which the Action Area can be viewed:

- The Verrazzano-Narrows Bridge between Brooklyn, NY and Staten Island, NY;
- The Bayonne Bridge between Staten Island, NY and Bayonne, NJ;
- The Goethals Bridge between Staten Island, NY and Elizabeth, NJ, and;
- The Newark Bay Bridge (officially the Vincent R. Casciano Memorial Bridge) between Bayonne, NJ and Newark, NJ.

Two golf clubs with extensive recreational acreage, the Liberty National and Bayonne, lie immediately north and south, respectively, of the Military Ocean Terminal at Bayonne (MOTBY) on the Port Jersey Peninsula. Throughout the industrial portion of the Action Area

viewshed, there are numerous towering cranes and related land-side infrastructure used for loading and unloading ships along the waterfront. Navigation within the Action Area includes large commercial deep draft navigation vessels, smaller tugs and service vessels, as well as large and small recreational vessels. Large recreational vessels include national and international passenger ships (cruise liners), which can dock at the Manhattan Cruise Terminal at piers 88 and 90 along the Hudson River.

2.14: Coastal Zone Management

Aquatic habitats within the project area often overlap with wetland habitat types, particularly in shallow-water and intertidal areas. These shallow habitats and their locations are often defined by state and federal agencies as part of the coastal zone and are managed under the states' Coastal Zone Management Act and wetland protection programs. Coastal and aquatic habitats in New Jersey are defined under the Coastal Zone Management Location, Use and Resource Rules (New Jersey Administrative Code 7:7E). New Jersey's location rules classify all coastal land and water locations into general areas or one or more special areas. Special areas (including water areas, water's edge areas, land areas, and coast-wide areas) are those considered naturally valuable or sensitive to impact and require focused attention during project planning. Special water areas in estuarine and marine environments extend landward to the spring high water line. New Jersey special water areas occurring in the project area include shellfish habitat, prime fishing areas, finfish migratory pathways, navigation channels, ports, submerged infrastructure routes, and intertidal and subtidal shallows.

Coastal and aquatic habitats in New York State are defined in regulations promulgated under the Tidal Wetlands Act (Land Use Regulations, NYCRR 661) and delineated as tidal wetlands on state inventory maps. These aquatic/wetland habitats are classified as: coastal fresh marsh; intertidal marsh; coastal shoals, bars, and mud flats; littoral zone; high marsh or salt meadow; and formerly connected tidal wetlands.

2.15: Hazardous, Toxic, and Radioactive Wastes

Hazardous, toxic and radioactive waste is defined by Engineering Regulation 1165-2-132 as:

> "Except for dredged material and sediments beneath navigable waters proposed for dredging… hazardous, toxic and radioactive waste includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA)… Dredged material and sediments beneath navigable waters proposed for dredging qualify as hazardous, toxic and radioactive waste only if they are within the boundaries of a site designated by the USEPA or a state for a response action (either a removal action or a remedial action) under CERCLA, or if they are part of a National Priority List site under CERCLA."

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980.CERCLA provides the U.S. Environmental Protection Agency the funds and authority to remediate

contaminated sites where there is no identifiable responsible party. CERCLA was enacted to provide the necessary funds to protect human health and the environment, identify responsible parties to pay for remediation of sites, involve communities in the process, and return contaminated sites to productive uses (USEPA, 2020a).

The National Priorities List is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. There are six federally listed National Priority List Superfund sites located upgradient of the project and several New York State and New Jersey State listed known contaminated sites within the vicinity of the project. The majority of these sites are located on land, outside of the NYNJHDCI project area except for a portion of a National Priority List Superfund/State Listed (New Jersey) site, identified as an operable unit of the Diamond Alkali Superfund Site (Diamond Alkali).

The main plant of Diamond Alkali was added to the National Priority List in 1984 and was located at 80 Lister Avenue in Newark, New Jersey approximately five miles upgradient from Newark Bay along the western shore of the Passaic River. The Diamond Alkali plant is historically known for the manufacturing of agricultural chemicals and herbicides used in the production of "Agent Orange". Agent Orange was primarily used in the 1950s and 1960s during the Vietnam War. Bi-products of Agent Orange manufacturing polluted the surface and subsurface of the plant grounds in addition to the Passaic River which drains south into Newark Bay. Although production of Agent Orange ceased in the 1970s, adverse effects of manufacturing processes are still present to this day. Due to the known pollution concerns, the New Jersey Department of Environmental Protection (NJDEP) prohibits the consumption of fish or shellfish from the Lower Passaic River and Newark Bay (USEPA 2020b).

The Newark Bay Study Area was added as an Operable Unit of the Diamond Alkali in 2004, including Newark Bay, Arthur Kill and Kill van Kull channels and portions of the Hackensack River. In 2007, a remedial investigation work plan for the Newark Bay Study Area was prepared and included investigation goals to determine the horizontal and vertical extent of Diamond Alkali contamination by sampling for several contaminants including, but not limited to, polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, pesticides and metals. Currently, remedial investigation is still in progress under the oversight of the USEPA, estimated for completion with a record of decision by November 2022, according to the schedule posted on the USEPA website (USEPA 2020b). Additional Diamond Alkali study information and plans are located on the Newark Bay Study website: www.ournewarkbay.org.

Following the previous 50-foot Harbor Deepening Project, studied under an Environmental Impact Statement and subsequent Environmental Assessment, the project documentation was contested in 2005 to further assess the actions of the 50-foot Harbor Deepening Project (United States District Court, 2005). In June 2007, the district prepared an additional Environmental Assessment to assess the effects of the Harbor Deepening Project on the Newark Bay Study Area, which resulted in a finding of no significant impact (USACE, 2007). In October 2007, the lawsuit was settled by the parties with an agreement stipulating that USACE will work closely with the USEPA and NJDEP on the advancement of the 50-foot Harbor Deepening Project with the ongoing investigation efforts of the Diamond Alkali site planned in the Newark Bay and to

perform construction under best management practices, so as not to interfere with ongoing investigation and remediation efforts occurring in the Newark Bay (United States District Court, 2007). The Newark Bay Operable Unit is co-located within the NYNJHDCI project area. No other federal or state listed contaminated sites were identified within the project area (Appendix A6).

Currently, remedial investigation and reporting of the Newark Bay Operable Unit is still in progress. In 2007, Tierra Solutions, Inc. prepared a Phase II Remedial Investigation Work Plan for the Newark Bay Study Area, which detailed sampling goals to determine the horizontal and vertical extent and concentration levels of Diamond Alkali contaminants of concern, including, but not limited to, polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, polychlorinated biphenyls, polyaromatic hydrocarbons, pesticides and metals (Tierra 2007). In 2017 a Phase III Sediment Investigation Field Report was prepared to document the sediment sampling activities performed at 231 sampling locations in Newark Bay. Phase III data will be forthcoming in a Remedial Investigation Report. Additional Diamond Alkali study information and plans are located on the Newark Bay Study website: www.ournewarkbay.org (NBSW 2020).

In January 2020 the Final Natural Resource Damage Assessment Plan for the Diamond Alkali was released by the USFWS and the National Oceanic and Atmospheric Administration (NOAA), detailing the assessment of accumulated damages caused by the Diamond Alkali on the natural resources located within the Passaic River and Newark Bay, including the Arthur Kill, Kill Van Kull, and portions of the Hackensack River. The purpose of the Natural Resource Damage Assessment Plan is to document the exposure of natural resources to hazardous substance releases and identifies the anticipated procedures for evaluating the injuries caused by exposure. This report details the hazardous substance exposure to natural resources (i.e. fish, shellfish, birds) and outlines recommendations and a proposed pathway forward (USFWS et al 2020).

As of September 2020, the USEPA's cleanup schedule for the Diamond Alkali, Newark Bay Operable Unit estimates that the combined remedial investigation/feasibility study for the Newark Bay Operable Unit will be completed in approximately September – November 2022, with a Record of Decision completed also in 2022 (USEPA 2020c).

Table 5: Diamond Alkali Cleanup

MILESTONE	START DATE	COMPLETION DATE
OU 03 - NEWARK BAY		
Administrative Order of Consent (EPA Performed)		2/13/2004
Combined Remedial Investigation/Feasibility Study (PRP Performed, EPA Oversight)	2/13/2004	Estimated Sep - Nov 2022
Record of Decision		Estimated Sep - Nov 2022

Source: USEPA 2020c

The study area is heavily urban and has many contaminated sites located in the vicinity, both in New Jersey and New York. These sites are primarily located on land and outside of the NYNJHDCI project boundary except for a portion of one Federal and State (New Jersey) listed Superfund site identified as the Diamond Alkali, Newark Bay Operable Unit located in New Jersey. The District will continue to coordinate with the USEPA and NJDEP in order to not

interfere with ongoing investigation and remediation efforts occurring in the Newark Bay Study Area. It is not anticipated that any other federal or state listed contaminated site will affect or be affected by the project.

The current schedule for the NYNJHDCI project estimates completion of the Final FR/EA by January 2022 with a signed Chief's Report by May 2022, following State and Agency review. The Preconstruction Engineering and Design phase is not anticipated to begin until after the signing of the Chief's Report with construction estimated to begin in approximately 2025. The remedial investigation activities for the Diamond Alkali, Newark Bay Operable Unit listed on the USEPA website are currently estimated to be completed, with a record of decision, by November 2022. Schedules are subject to change based on a variety of field and project advancement conditions and therefore, information regarding any future remedial action plans for the responsible parties to remediate the Diamond Alkali Newark Bay Operable Unit will be coordinated with the USEPA and NJDEP as well as further future coordination with the USEPA and NJDEP to ensure complimentary actions commence with the improvement of the Port navigation channels without interfering with remedial action activities.

A Confined Disposal Facility is located in Newark Bay between Port Elizabeth channel and Port Newark channel. Now closed and capped, the Confined Disposal Facility was designed to store contaminated dredge materials and to prevent pollution of the estuary. The Confined Disposal Facility is located outside the proposed dredging areas of the existing navigation channels and will be avoided to ensure no impact to the Confined Disposal Facility.

In accordance with Engineering Regulation 1165-2-132, dredged materials will be tested under dredged material placement criteria for their suitability for beneficial use in accordance with the appropriate guidelines and criteria including, but not limited to, Section 404 of the Clean Water Act and/or Section 103 of the Marine Protection Research and Sanctuaries Act and supplemented by the Corps of Engineers Management Strategy for Disposal of Dredge Material: Containment Testing and Controls.

2.16: Air Quality

The project area is located in the New York and New Jersey Harbor System, encompassing parts of the New Jersey counties of Essex, Hudson Middlesex, Monmouth, and Union, and the New York counties of Kings, New York, and Richmond. These counties are part of the New York, Northern New Jersey, Long Island, and Connecticut ozone nonattainment areas. These counties have been designated with the following attainment statuses with respect to the National Ambient Air Quality Standards for criteria pollutants: 'serious' nonattainment area for the 2008 8-hour ozone standard, 'moderate' nonattainment for the 2015 8-hour ozone standard, and 'maintenance' for the 2006 particulate matter less than 2.5 microns standard. Essex, Hudson, and Union Counties, all in New Jersey, are part of a 'maintenance' area for the 1971 carbon monoxide standard (40 Code of Federal Regulations Section 81.331). The ozone nonattainment counties are part of a larger Ozone Transport Region. Ozone is controlled through the regulation of its precursor emissions, which include oxides of nitrogen and volatile organic compounds. Sulfur dioxide is a precursor for particulate matter less than 2.5 microns. The counties in which the project will take place are in attainment of the National Ambient Air Quality Standards for all other criteria pollutants.

Emissions from the project will be associated with non-road equipment and marine vessels operating in the New York and New Jersey Harbor System. Emissions will primarily be generated from the diesel engines on board the vessels, and will include oxides of nitrogen, volatile organic compounds, sulfur dioxide, carbon monoxide, and particulate matter less than 2.5 microns. Emissions from federal actions, such as the proposed project, are regulated under 40 Code of Federal Regulations Section 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.

2.17: Noise and Vibration

Noise and vibration is often defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or diminishes the quality of the environment. Response to noise varies by the type and characteristics of the noise source; distance from the source; receptor sensitivity; and time of day. Noise can be intermittent or continuous, steady or impulsive, and it may be generated by either mobile or stationary sources, and changes in noise are typically measured and reported using a weighted sound intensity (or level), which represents sound heard by the human ear and is measured in units called decibels (dBA). The Action Area includes the navigation channels dredged, the improvement measures, dredged material placement/disposal areas, and the transit of dredging vessels through the project area. The geographic extent of noise impacts is dependent upon factors such as the type of dredging equipment, length of time spent dredging, and environmental conditions such as wind speed and direction. Noise can carry for considerable distance underwater and overland. Underwater noise from blasting as well as other dredged related noise as part of the New York Harbor Channel Deepening and Kill Van Kull were examined in detail (USACE, 2004b, 2012) and impacts to underwater life were determined to be minor from blasting as well as various dredging equipment types, relative to the background noise already present in lower New York Harbor.

The dredges used in the New York and New Jersey Harbor for maintenance dredging are mechanical or hydraulic dredges. Sound production is largely influenced by sediment properties – to excavate hard, cohesive and consolidated soils, the dredger must apply greater force to dislodge the material (Robinson et al., 2011) Sound from dredges can be variable, depending on the phase of operation, and the type of dredge used, but typically occur at low frequencies (<500) (Reine et al., 2014).

2.17.1: Ambient Noise in New York and New Jersey Harbor Action Area

Ambient noise is the all-encompassing sound associated with a given environment at a specified time. Humans hear sound from 0-140 dB, and sound above this threshold is associated with pain. There are several sources of ambient noise within the Action Area which can be attributed to both natural (wind waves, fish, tidal currents, mammals) and anthropogenic (general city noise, commercial and recreational ships/vessels, dredging, pile driving, etc.) inputs. While some anthropogenic underwater noise is produced intentionally (e.g., naval sonar, echosounders), most noise sources are an incidental by-product of human activity (e.g., shipping,

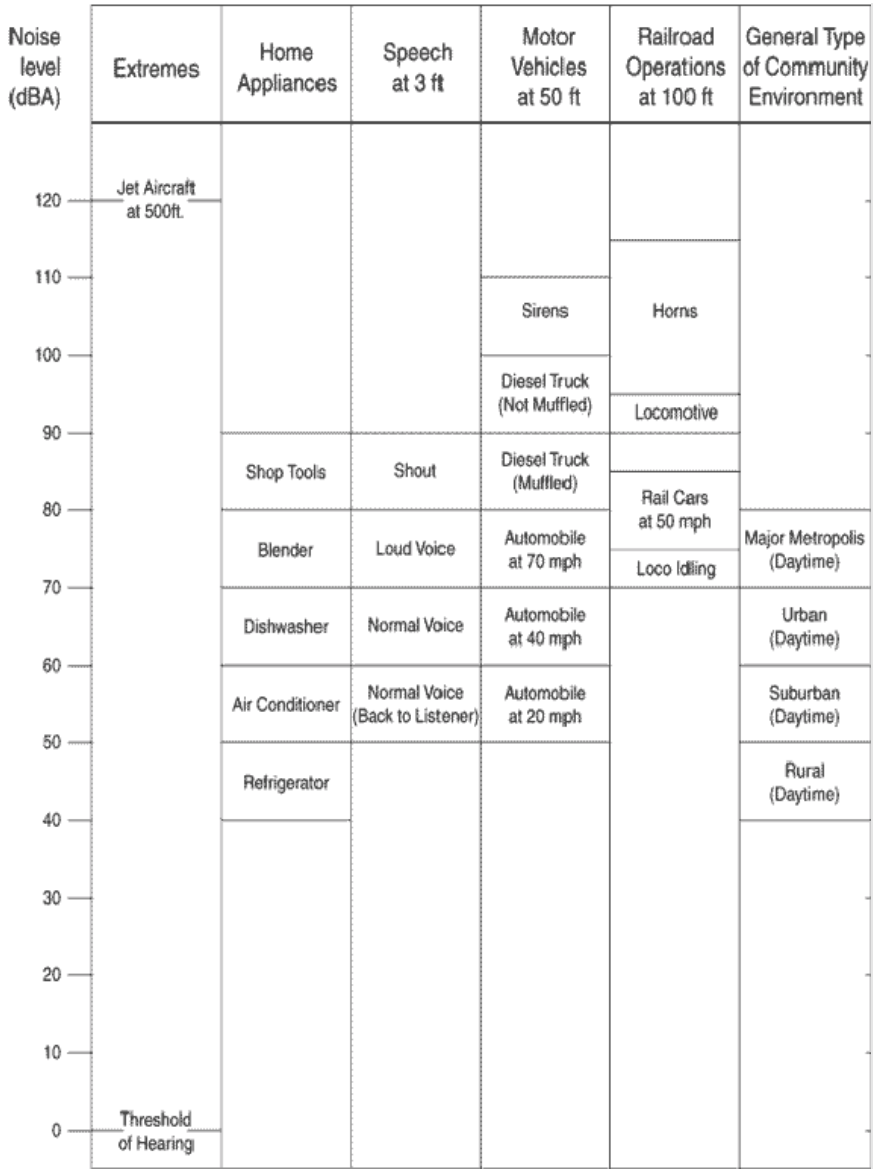
construction) (Farcas et al. 2016). For underwater environments, ambient noise includes tides, currents, and waves, as well as noise produced by marine mammals, fish, invertebrates, and by humans. Low frequency noise levels such as these, as well as noise produced by human activities, tend to carry long distances in the water but are attenuated the farther away one is from the source.

The Action Area is a working waterway with adjacent land use characterized largely by industrial, commercial, and residential uses along with significant roadways and associated truck and car noise. In 2017, 2,011 container vessels carrying 3,396,469 TEU utilized the port, following a decreasing trend in number of calls/year while at the same time the volume has been increasing (3,214,338 TEU and 2,251 vessel calls at the port in 2015). Fewer, larger ships call at the port, a common trend world-wide as container vessels increase in size. Noise sources for vessels include cranes, whistles, and various motors for propulsion, while adjacent dockside noise sources include cranes, trucks, cars, and loading and unloading equipment. One unique feature of the port is the express rail network, which was built to support movement of containers via rail, which reduces the need to transport cargo to its destination by truck, though most cargo is still transported by truck. Ship traffic, including ships transiting the study area can generate sounds ranging from 10 to 1,000 Hz, with most produced at low frequencies (20-500 Hz) with a noise level as high as 188dB at 1 m for a 54,000 gross ton container ship traveling at 21.7 knots, though the dB decreases rapidly with distance though shipping traffic can elevate noise in a wide area (by 15-20 dB at frequencies below 300 Hz) (McKenna et al., 2013).

Cruise ports in the local area carried 730,617 passengers in 2017, such vessels typically dock at the Cape Liberty Cruise Port in Bayonne or the Brooklyn Cruise Terminal, and may also use the New York and New Jersey navigation channels and anchorages as they make their way to and from their docking facilities. A major source of noise in the project Action Area is the network of roads servicing the area, with major highways having noise levels as high as 70-75db within and adjacent to the road during periods of high traffic (Department of Transportation, 2018).

In addition to noise and vibrational inputs attributed to this being a bustling commercial, industrial, and military center, the potential areas affected by noise and vibration include expanses of parks, open spaces, and greenways, as well as residential areas. These areas are sensitive noise receptors, or areas where human activity may be adversely affected by excess noise inputs. These receptors include, but are not limited to schools, churches, cemeteries, homes, golf courses, and parks/playgrounds. Sensitive noise receptors are in areas that generally have lower ambient noise levels, which can range anywhere from 40 dBA (quiet suburban area at night) to 70 dBA (Table 5).

Table 6: Common Ambient Noise Levels



Chapter 3: Existing and Future Economic and Navigation Conditions

The existing condition and future without-project condition of the project area is described herein. The existing and future conditions will later be compared, as they relate to navigation and influence of such on the local and national economies. This comparison is integral to the selection of the Tentatively Selected Plan.

3.1: Existing Condition

3.1.1: Navigation Features

Authorized in 2001, construction for the existing project commenced in 2004 and was completed in 2016. This project includes a system of channels with a maintained depth of -50 to -53 feet MLLW throughout the Port of New York and New Jersey. The network of federal navigation channels and connected marine terminals are shown in the map in Figure 2.

The New York and New Jersey Harbor is located between the southeastern-most point of New York State and the northeastern part of New Jersey. The existing 50-foot federal navigation channels are adjacent to New York City in New York State and the cities of Bayonne, Elizabeth, and Newark in New Jersey. The network of 50-foot federal navigation channels extends from the Atlantic Ocean into the New York and New Jersey Harbor and the marine terminals of the Port Authority of New York and New Jersey. The harbor's container terminals serve a vast hinterland that can be defined by the 31 immediately surrounding counties within which the most populous metropolitan area in the United States is found (USACE, 2000a; U.S. Census Bureau, 2018).

Ambrose and Anchorage Channels

The Ambrose Channel, which leads from the Atlantic Ocean and outer harbor into the Port of New York and New Jersey, was authorized by Section 101(a)(2) of the Water Resources Development Act of 2000 in accordance with the Report of the Chief of Engineers dated May 2, 2000 for deepening for its entire length to a depth of -53 feet MLLW and deepening the Anchorage Channel to a depth of -50 feet MLLW (-52 feet MLLW in rock or otherwise hard material) from the Narrows to 1,000 feet passed its juncture with Port Jersey Channel. The Ambrose Channel is 63,600 feet in length, from the Atlantic Ocean to the Narrows, and is 2,000 feet wide at its base. The Anchorage Channel is 19,000 feet long from the Narrows to the point 1,000 feet north of the junction with the Port Jersey Channel and is also 2,000 feet wide at its base.

Kill Van Kull and Arthur Kill to Gulf Port Reach

The Kill Van Kull and Arthur Kill channels were authorized by Section 101(a)(2) of the Water Resources Development Act of 2000 in accordance with the Report of the Chief of Engineers dated May 2, 2000 for deepening their entire length to a depth of -50 feet MLLW, and -52 feet MLLW in rock or other hard material. The Kill Van Kull federal channel begins at its junction with the Anchorage Channel adjacent to Constable Hook, and leads west into the Arthur Kill at

Bergen Point. The -50-foot MLLW existing project continues west through the Arthur Kill, wrapping around Staten Island heading south and ending at the Gulf Port Reach. The Kill Van Kull is 31,800 feet long and is 800 feet wide at its base. The Arthur Kill is 14,400 feet long and is also 800 feet wide at its base. The slide slopes for the Arthur Kill and Kill Van Kull vary from 3H:1V to 1H:1V as the channels pass through changing strata.

Newark Bay

Newark Bay, Elizabeth, South Elizabeth, and Elizabeth Pierhead Channels were authorized by Section 101(a)(2) of the Water Resources Development Act of 2000 in accordance with the Report of the Chief of Engineers dated May 2, 2000 to be deepened to a depth of -50 feet MLLW, and -52 feet MLLW in rock or other hard material . Newark Bay Main Channel as authorized is 14,000 feet in length and extends from its juncture with the Kill Van Kull to a point located 1,500 feet north of the Elizabeth Channel. Newark Bay Channel varies in width from 2,200 feet near Bergen Point to 800 feet at the channel's most northern point. The access channels Elizabeth, South Elizabeth, and Elizabeth Pierhead serve Port Newark/Elizabeth on the west shore of Newark Bay. Elizabeth Channel is 8,800 feet long and varies in width from 500 to 800 feet. South Elizabeth Channel is 2,700 feet long and is 500 feet wide. The slide slopes for these channels also vary from 3H:1V to 1H:1V as the channels pass through changing strata.

Port Jersey Channel

Port Jersey Channel was authorized to be deepened to -50 feet MLLW, and -52 feet MLLW in rock or other hard material, by Section 101(a)(2) of the Water Resources Development Act of 2000 in accordance with the Report of the Chief of Engineers dated May 2, 2000 for a length of 10,000 feet from its juncture with the Anchorage Channel west through the berthing areas at Global Marine Terminal – New York. Port Jersey Channel is 500 feet wide at its base and the slide slopes are 3H:1V.

Anchorage Areas

There are two main anchorage areas in the Port of New York and New Jersey: Red Hook Flats and Gravesend Bay. The current configuration of the Red Hook Flats and Gravesend Bay anchorages was authorized by The River and Harbor Act of 27 October 1965. The Red Hook Flats contains three separate anchorages, a southern, middle, and north area. The southern area is authorized to a depth of -45 feet MLLW, the middle area is authorized to a depth of -40 feet MLLW, and the northern area is authorized to a depth of -35 feet MLLW. Each of these areas are approximately 3,335 feet in length. Gravesend Bay is authorized to a depth of -47 feet MLLW and is approximately 2,225 feet in length.

3.1.2: Navigation Operational Behaviors

This section focuses on the existing conditions that describe navigation from sea to terminal. Specifically, the focus is on the behavior of the vessel operators as it relates to the channel bottom. By study pathway we describe port operations with respect to the current vessel fleet and potential changes that could accommodate the future fleet of container vessels. We located and scaled the existing delays, and we identified the associated risks experienced by the existing vessel fleet as it relates to the current channel depths and widths.

The operating restrictions that we describe relate to ultra large container vessels (ULCV). These restrictions pertain to vessels that have a length overall of 1,160 feet, a beam greater than 159 feet, and generally have a capacity of 14,000 TEUs or greater. ULCVs are currently calling on the Port of New York and New Jersey. Examples of such vessels include the CMA CGM Theodore Roosevelt, which has a capacity of 14,400 TEUs, measures 1,200 feet in length overall and has a beam that is 158 feet wide.

Prior to entering the Port of New York and New Jersey, a suitable berth of destination for a ULCV must be confirmed clear and an anchorage spot should be confirmed available for bailout purposes. Suitable berths have sufficient depth and large enough cranes to unload the vessel. Global Terminal Bayonne (Port Jersey - Port Authority Marine Terminal) has one such berth. ULCVs transiting to Global Terminal Bayonne (Port Jersey - Port Authority Marine Terminal) may draft up to 49 feet. Vessels that draft more than 47 feet must arrive and depart between 1 and 2 hours after high water as measured at the Battery. There cannot be a cruise ship at Bayonne Cruise Terminal and a ULCV at Port Jersey – Port Authority Marine Terminal at the same time. The approach to Port Jersey - Port Authority Marine Terminal must be made as wide as possible, pushing the north-end of the channel limits. The current width of the Port Jersey Channel is a key factor in the difficulty of maneuvering a ULCV in and out of Port Jersey - Port Authority Marine Terminal. The cross-current of the inbound lane results in substantial difficulty in stopping a ULCV. Vessels are not permitted to back into Global Terminal Bayonne, meaning that they must depart by backing out into Anchorage Channel. The current depth of the Anchorage Channel north of the Port Jersey Channel is not deep enough to facilitate backing out a ULCV in an efficient manner. The efficiency constraint is the result of the extra time spent on completing a complicated maneuver.

Generally, ULCVs may not navigate beyond the Narrows when the maximum sustained winds are greater than 20 knots or maximum gusts are 25 knots or greater. This restriction is critical for the safe navigation of tight spaces such as the Kill Van Kull. Vessels must transit the Kill Van Kull to reach either Elizabeth - Port Authority Marine Terminal/Port Newark or Howland Hook. There are several restrictions specific to the Kill Van Kull. ULCVs are required to transit the Kill Van Kull at slow speeds, posing maneuverability challenges with respect to the wind. Vessels should not transit Bergen Point in sustained winds of 30 knots or greater or gusts greater than 34 knots as measured at Mariners Harbor. The vessels are required to transit the Kill Van Kull within 1 hour on either side of high water or low water as measured at the battery, and the maximum draft is 49 feet. Vessels no larger than 500 feet in length overall are permitted to meet or overtake ULCVs in the Kill Van Kull. This restriction imposes extensive delays on the majority of container, tanker, and other large-vessel traffic transiting to Howland Hook and Elizabeth. ULCV operators would not typically need to wait for the Kill Van Kull to be clear of smaller vessels such as barges. However, no bunker barges are allowed alongside a vessel berthed along the Kill Van Kull while a ULCV passes, and traffic is restricted to one-way from Constable Hook to the Ambrose Channel.

There are additional restrictions on vessels transiting to Global Terminal New York (Howland Hook), and this is largely due to the configuration of the federal channel. A key restriction is the tight turn from the North of Shooter's Island Reach into the Port Elizabeth Reach in the Arthur Kill. The vessels that have a destination of Howland Hook must not have an overall length

greater than 1,100 feet, a draft greater than 47 feet (high water or low water). The wind restrictions applied to ULCVs navigating beyond the narrows apply to all large container vessels transiting to Howland Hook. The tight turn, the width of the channel, the length of the vessel, and the wind conditions result in a difficult and perilous navigation conditions. Additionally, the largest beam a vessel may have and be safely berthed at Howland Hook is 150 feet. Vessels with beams any larger will violate the channel limits, threatening the safety of passing traffic. Vessels departing Howland Hook must back up out of the terminal and the full length of North of Shooters Island Reach, then execute a k-turn between the South Reach of Newark Bay and Bergen Point. During this operation, traffic is stopped until the k-turn is complete, imposing significant delays to other vessels in the Harbor.

ULCVs are restricted to a maximum of two channel transits per tide window, which generally means a maximum of four transits per day. Many ULCV calls are located at Elizabeth - Port Authority Marine Terminal, which has several berths and cranes that are suited to accommodate a ULCV. ULCVs have berthed on the face of Elizabeth - Port Authority Marine Terminal and are now more commonly berthed on the Elizabeth Channel side. The width of the South Elizabeth channel is not sufficient to accommodate a ULCV. The maximum draft a vessel may have and transit to Elizabeth - Port Authority Marine Terminal is 49 feet. ULCVs are currently transiting the federal channel light-loaded and still reach the 49-foot draft restriction. Transit to and from Elizabeth - Port Authority Marine Terminal through the Newark Bay Channel is restricted to one-way, imposing significant delay on the interacting traffic. ULCVs enter Elizabeth Channel bow-in, which means that the vessels must back out into the Newark Bay Channel in the direction of the Middle Reach (North). This maneuver has been the cause of difficulties and near-misses, especially in cases where pilots are facing wind out of the northwest.

3.1.3: Terminal Facilities

For this study, The Port Authority of New York and New Jersey marine facilities consist of six container terminals. The terminals are the first port of call for approximately 85 percent of vessels calling on the East Coast. They have processed up to 7.2 million TEUs per year and over $200 billion worth of cargo. The terminals serve 23 ocean carriers including all the major global alliances as well as 11 independent carriers. Figure 5 shows a map of the port with the container terminals highlighted in yellow. The container terminals include Red Hook Container Terminal, Global Container Terminal Bayonne, Global Container Terminal New York, A.P. Moller Terminal, Maher Terminal, and Port Newark Container Terminal. The containerized cargo is handled at marine facilities leased by the Port Authority to individual terminal operators.

Figure 5: Map of Container Terminals

APM: A.P. Moller
GCT: Global Container Terminal

Port Newark Container Terminal

Port Newark Container Terminal is a 272-acre facility at Port Newark in New Jersey. Port Newark Container Terminal has 13 Post-Panamax Class ship-to-shore cranes of which seven accommodate the Super Post-Panamax vessels with an outreach of up to 225 feet and six accommodate the Post-Panamax vessels with an outreach of up to 200 feet. Port Newark Container Terminal has a total berthing area of 4,400 linear feet.

At its current configuration, Port Newark Container Terminal has a throughput capacity of 1.3 million TEUs. Port Newark Container Terminal leads the Port of New York and New Jersey by moving 25% of its vessel container volume via rail. Additional improvements are planned for the terminal, including opening a new gate complex, increasing the terminal capacity, and increasing the peak crane handling. Moreover, Port Newark Container Terminal plans to expand by developing 50 additional acres, deepening the berthing area, and upgrading the container handling equipment, including the addition of super post-Panamax ship-to-shore cranes. Port Newark Container Terminal has a long-term lease agreement with The Port Authority of New York and New Jersey through the year 2050.

Maher Container Terminal

Maher Container Terminal is a 450-acre facility located at Elizabeth – Port Authority Marine Terminal in Elizabeth, New Jersey. Maher Container Terminal has 24 ship-to-shore Post-Panamax cranes, including 8 Super Post-Panamax cranes with an outreach of up to 225 feet and 16 Post-Panamax cranes with an outreach of up to 200 feet. In addition, the terminal has a total berthing length of 10,128 feet. Maher Container Terminal is immediately adjacent to the ExpressRail Elizabeth which has 18 working tracks totaling 43,000 linear feet.

A.P. Moller Terminals

A.P. Moller Terminal is a 350-acre facility located at the Elizabeth – Port Authority Marine Terminal in Elizabeth, New Jersey. A.P. Moller Terminal has 15 ship-to-shore Post-Panamax cranes; 4 Super Post-Panamax cranes with an outreach of 206 feet and 11 Post-Panamax cranes with an outreach of up to 140 feet. The terminal has a berthing length of 6,001 feet. Like the Maher Terminal, A.P. Moller Terminal is also adjacent to the ExpressRail Elizabeth.

Global Container Terminal New York

Global Container Terminal New York is a 187-acre facility located at Howland Hook Marine Terminal, near Goethals Bridge, in Staten Island, New York. Global Container Terminal New York has 6 ship-to-shore post-Panamax cranes, with an outreach of up to 135 feet. Global Container Terminal New York has a berthing length of 3,012 feet. This terminal is uniquely equipped with an expanded on-dock rail transfer service, by ExpressRail Staten Island, which has 5 tracks totaling 6,000 linear feet.

Red Hook Container Terminal

Red Hook Container Terminal is a 65.6-acre facility located in Brooklyn, New York. This terminal has five cranes with an outreach of up to 150 feet. The length of the ship berth is 2,080 feet at -42 feet MLLW. Red Hook Terminal connects to Express Rail Elizabeth via barge service. The channel segment leading to Red Hook Container Terminal was not included in the 50-foot deepening project. This terminal was screened from further consideration and analysis since the scope of this study is limited to the currently constructed 50-foot channel.

3.1.4: Port Operations and Economic Considerations

The existing port operations consist of container storage capacity, cargo composition, fleet composition, container services, and route groups.

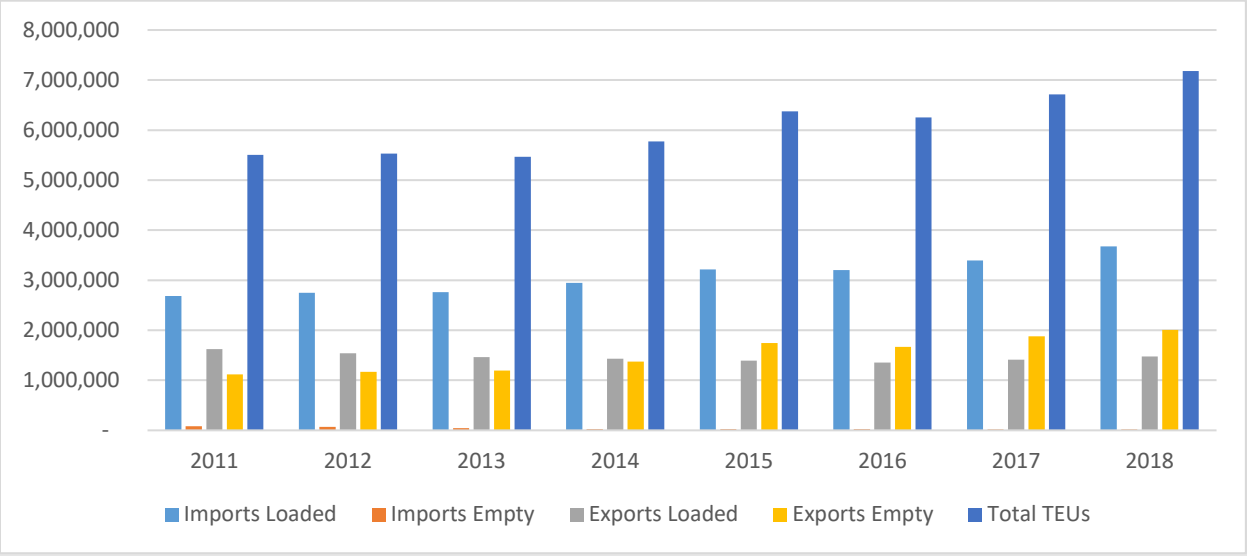
Distribution Centers

Approximately 1 billion square feet of warehousing and distribution space is located within 50 miles of the port.

Cargo Profile

The Port of New York and New Jersey handled approximately 7.2 million TEUs in 2018 and ranks second in the United States in terms of total containerized volume exported and imported, counting LA/Long Beach as a one port. The TEUs traded at the port over 2011 – 2018 have been plotted in Figure 6. The largest containerized import volumes are for furniture followed by machinery & appliances, plastic and beverages. The largest containerized export volumes are wood pulp followed by vehicle parts, plastic and wood. The lead trading partner is China followed by India for both imports and exports. Germany is third in terms of volume traded for imports and Spain for exports.

Figure 6: TEUs – Port of New York and New Jersey

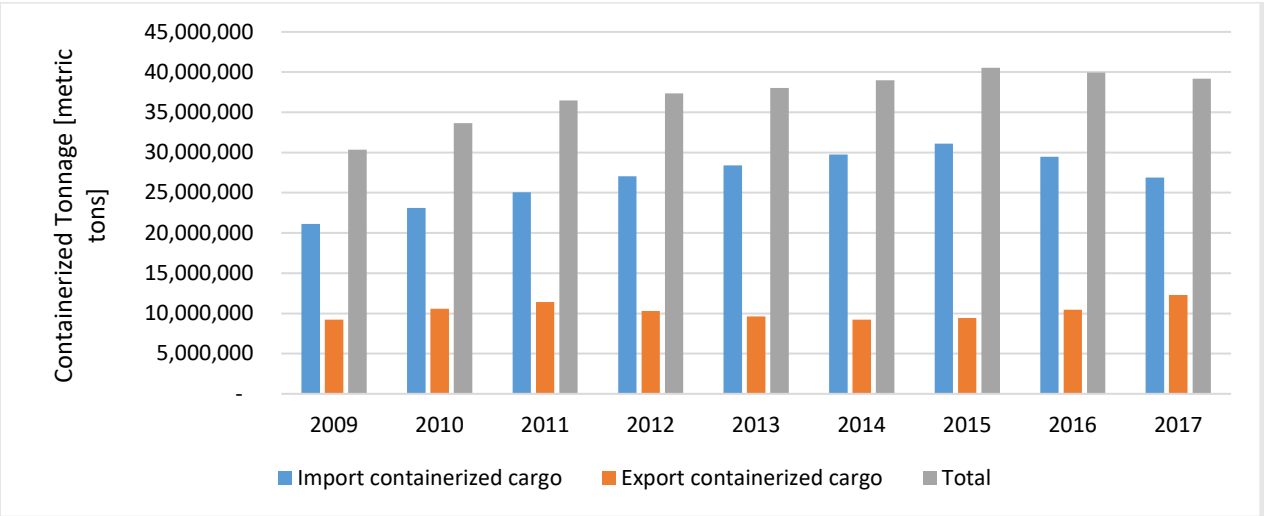


Historical Commerce

The Port of New York and New Jersey captures 53.5 percent of the North Atlantic market share, 32.8 percent of the East Coast market share and 15.9 percent of the U.S. market share. The Port imports more cargo than it exports based on metric tons. The Port is the first port of call for approximately 75% of all carrier services on the East Coast (Port Authority of New York and New Jersey, 2020). The Port is located in the heart of the New York metropolitan region and provides access to 27 million local consumers. In addition, the Port's rail connections allow shippers to reach another 98 million consumers in destinations as far away as the Ohio Valley, Midwest and Canada.

Historical containerized metric tonnage moving through the Port of New York and New Jersey has been plotted in Figure 7. Based on data for years 2009 to 2017, foreign shipments averaged approximately 37 million metric tons. Of this total, imports accounted for approximately 27 million metric tons, or 72 percent, while exports accounted for 10.3 million tons or 28 percent.

Figure 7: Containerized Tonnage – Port of New York and New Jersey



Fleet Composition

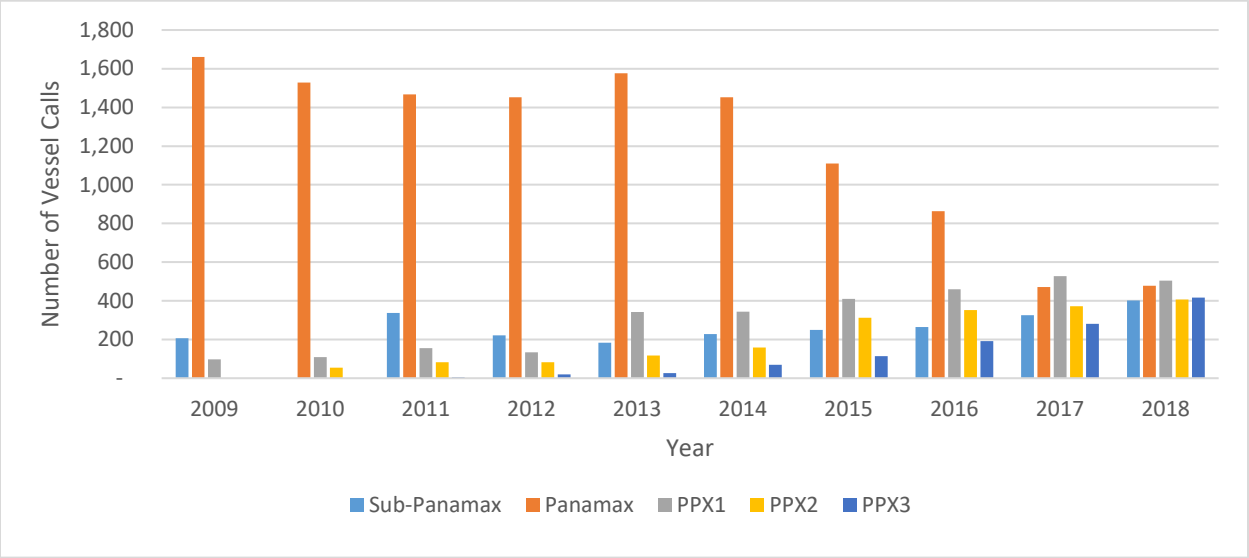
Data for the container fleet was obtained from Waterborne Commerce Statistics Center, the National Navigation Operation & Management Performance Evaluation Assessment System and the Port Authority of New York and New Jersey to determine vessel characteristics of the fleet calling the port. The ships are classified as sub-Panamax (SPX), Panamax (PX), post-Panamax Generation I (PPX1), post-Panamax Generation II (PPX 2), post-Panamax Generation III (PPX 3) and post-Panamax Generation IV (PPX 4). The vessels are distinguished based on physical and operation characteristics, including lengths overall, design draft, beam, speed and TEU capacity. Containership classes overlap in all facets of dimensions, such as length, beam, depth and TEU capacity. For purposes of this document, Table 6 shows the breakdown of the containership class sizes. For the purposes of this analysis, beam width was the characteristic that separated the classes. The Port and industry tend to use the terms "very large container vessel (VLCV)" to describe vessels with TEU capacity between 11,000 and 15,000 TEU and "ultra large container vessel (ULCV)" to describe vessels with TEU capacity of 18,000 to 21,000 TEU. These industry classes roughly correspond with PPX3 and PPX4 vessel class, respectively.

Table 7: Containership Classes

CLASS	DEADWEIGHT TONNAGE (METRIC TONS)	LENGTH OVERALL (FEET)	BEAM (FEET)	DESIGN DRAFT (FEET)
Subpanamax (SPX)	6,500 – 40,000	390 - 730	65 - 103	20 - 40
Panamax (PX)	24,000 – 69,000	558 - 930	105 - 107	27 - 45
Post-Panamax Generation 1 (PPX1)	71,200 – 80,900	930 – 1,000	108 - 133	45 - 47
Post-Panamax Generation 2 (PPX2)	80,901 – 110,000	1,026 – 1,100	134 - 145	46 - 49
Post-Panamax Generation 3 (PPX3)	117,500 – 144,500	1,100 – 1,200	149 - 177	49 - 51
Post-Panamax Generation 4 (PPX4)	150,000 – 194,600	1,201 – 1,308	178 - 194	51 – 52.5

Figure 8 shows historical trends in containership vessel sizes and fleet composition for the Port of New York and New Jersey. As shown, sub-Panamax vessels are continuing to be used at relatively the same rate. The number of Panamax calls has dropped dramatically as larger post-Panamax vessel transition to services calling The Port of New York and New Jersey.

Figure 8: Containership Vessel Trends



Container Services

The Port of New York and New Jersey has 40 weekly port of call ocean carrier services and 54 total services. Table 7 shows the service division by region as of 2018.

Table 8: Container Services

WORLD REGION	SERVICES
Asia	11
Indian Subcontinent & Southeast Asia	10
Europe and Mediterranean Region	16
South America and Caribbean	17

Route Groups

Numerous container services call on the Port of New York and New Jersey which are operated by many carriers and have trade routes that originate in various parts of the world. Therefore, carrier services were grouped by the world region they serve. For example, there are a number of carrier services that call on various ports in the Far East, transit the Panama Canal, proceed to ports along the east coast United States the then return to the Far East. As of 2019, 54 unique ocean carrier services used the terminals at the Port of New York and New Jersey. Container cargo were aggregated into route groups for forecasting, modeling and presentation purposes based on world regions and vessel composition. Vessel service information was provided by the port authority. That data along with National Navigation Operation & Management Performance Evaluation Assessment System data was used to determine route groups. Table 8 shows the regions, route groups and the distance of each route.

Each route group has unique characteristics such as cargo volume, cargo weight, ports of call, vessel types, mix of vessels, etc. and therefore are evaluated separately before being combined as part of the NED analysis.

Table 9: Route Group Information

ROUTE GROUP REGIONS	DISTANCE DISTRIBUTION		
	MINIMUM	MOST LIKELY	MAXIMUM
Africa – South America – Caribbean – Gulf of Mexico - East Coast United States	1,450	7,300	16,100
Europe – Mediterranean – East Coast United States	6,300	7,500	11,500
Far East – Panama Canal – East Coast United States, including pendulum routes	19,400	29,800	31,900
Far East – Indian Subcontinent – Southeast Asia – Suez Canal – East Coast United States	16,900	25,300	31,400

3.2: Future Without-Project Conditions

3.2.1: Navigation Features

The Port of New York and New Jersey federal channels are deepened periodically to maintain the authorized channel dimensions. Under without-project conditions, maintenance dredging is projected to continue on a regularly scheduled basis to maintain the existing condition dimensions presented in Section 2.2.1.

Anchorage Areas

The future without-project conditions include the recommended plan of the New York and New Jersey Harbor Anchorages Final General Reevaluation Report (USACE, 2019d). The future-without-project conditions therefore revise the existing conditions with respect to the anchorages such that Gravesend Bay Anchorage will be maintained at -50 feet MLLW, 3,000 feet wide with a maximum swing area of 3,600 feet. The future without-project conditions of the Red Hook Flats are unchanged from the existing condition.

3.2.2: Navigation Operational Behaviors

This section focuses on the future without-project conditions that describe navigation from sea to terminal; specifically on the behavior of the vessel operators as it relates to the channel bottom. In what follows, by study pathway, we describe what port operations looks like in the future without-project condition with respect to the future expected vessel fleet. We have characterized the kind of maneuvering tactics that will be required if no project is built in Section 3.1.2. The resulting scale of the expected delays and associated risks are exacerbated by the changing vessel fleet as it they relate to the current channel depths and widths.

Generally, it is expected that the fleet of vessels that call on the Port of New York and New Jersey will continue to include larger and larger vessels. In the future without-project condition, this future fleet is expected to contain ships such as the *Maersk Triple E Ultra Large Container Vessel Class* (*Triple E*). The historical record is clear: vessel size has grown extensively, persistently redefining the limits of engineering feasibility and further exploiting economies of scale. There is no reason to believe that this trend will not continue. Indeed, a contract has been awarded by DNV GL to Hudong Zhonghua Shipbuilding (group) Co. Ltd. for the design of 25-

26,000 TEU vessel powered by liquefied natural gas[1]. In a separate study, the New York Harbor and Tributaries Focus Area Feasibility Study, it was found that ULCVs at the 21,000 TEU class are among the largest size vessel to be calling on the Port of New York and New Jersey in the near to mid-term. However, the current channel configuration in the future without-project condition inhibits the ability to realize all potential economies of scale. A *Triple E* vessel would have to transit the channel in the future without-project condition light-loaded so as to not exceed the 49-foot draft limit. Further, such a vessel will be pushed to the horizontal limits of the channel in difficult maneuvers, risking allisions. For example, as discussed in Section 3.1.2, ULCVs enter Elizabeth Channel bow-in and back out into the Newark Bay Channel in the direction of the Middle Reach (North). A Maritime Institute of Technology and Graduate Studies simulation of a Maersk Triple E vessel backing out of Elizabeth Channel in the current channel configurations found that the vessel is likely to allide with the channel bottom to the north and west of Elizabeth Channel limits, experiencing rudder damage. Reduction in transaction cost globally in the use of a vessel the size of a *Triple E* vessel to transport commerce to the Port of New York and New Jersey may out-weigh the relatively higher risk in transiting the channel. However, this future without-project condition dynamic presents an opportunity to reduce navigation hazards and enable relatively more reliable, safer, and more economically efficient waterborne transportation systems for the movement of commerce throughout the Port of New York and New Jersey.

3.2.3: Terminal Facilities

The Port Authority of New York and New Jersey published the *Port Master Plan 2050* outlining "options for maximizing [existing] investments and identifies the next generation of potential planning studies, land use, and infrastructure development projects." The *Port Master Plan 2050* is a flexible, holistic framework for the near and long term, but is not definitive nor final. Implementation will require design, permits, outreach, and authorization. The plan consists of two phases. Phase I entails a plan for maximizing recent investments over the next 10 to 15 years. Phase II consists of a longer-term plans for future growth over the next 10/15 to 30 years.

Phase I: Years 0 to 10/15

The priority of Phase I is expanding container capacity west of the Kill Van Kull through road and rail improvements. Phase I also includes a strategic expansion at Port Jersey - Port Authority Marine Terminal and hardening marine infrastructure through the Berth and Wharf Replacement Program. The Port Authority of New York and New Jersey is also implementing technology to minimize the port facilities' impact on the environment.

At Port Newark and Elizabeth – Port Authority Marine Terminal, The Port Authority of New York and New Jersey plans to continue implementing roadside improvement projects. These plans include the Port Street realignment project, data capture using E-ZPass or GPS reader technology, and chassis and empty container storage depot location study, while progressively implementing projects to improve connectivity with I-95 and I-78. The Howland Hook Marine Terminal will be progressively built out to support enhanced container-handling capability.

[1] source: https://www.maritimebulletin.net/2020/01/15/is-the-26000-teu-container-vessel-coming-now/?fbclid=IwAR2ejVNpPeBwzH2MsCNPF3HpePV88sZ-dyUcZQYQo7OUx_bYgfJ7X_Zn0j8

Improvements to road-side connectivity and land-side traffic movements around the Port Jersey – Port Authority Marine Terminal are the focus of Phase I at this site. This work includes building on the recent completion of the New Jersey Turnpike's Interchange 14A and promoting enhanced separation of port and public vehicles.

Phase II: Years 10/15 – 30

Phase II involves accommodating increased volumes of containerized cargo, a principle occupant of The Port Authority of New York and New Jersey's land assets. Phase II also involves streamlining operations and enhancing collaboration within each cargo sector and the other cargo sectors expand. There are plans to incrementally enhance intermodal rail operations, and potentially expand the footprint of the terminal facilities as Port Newark, Brooklyn, and Port Jersey – Port Authority Marine Terminal. Adoption of new technologies are also part of the Phase II plans, including using semi-automated guided vehicles, data-driven operations, and electric vehicles.

Together, the Phase I and Phase II plans support the conclusion that future with- and without-project condition landside facilities are sufficient to accommodate the volume of forecast commerce growth over the period of analysis[1].

3.2.4: Port Operations and Economic Considerations

The future without-project port operations consist of container storage capacity, cargo composition, fleet composition, container services, and route groups.

Commodity Forecast

Estimates of the future commerce directly connected to the Port of New York and New Jersey over the period of analysis are linked to the port's hinterland and the extent to which the port shares commodity flows with other ports. Under future with- and without-project conditions, the volume of cargo moving through the Port of New York and New Jersey is assumed to be the same. The share of the commodity projections also remains the same as existing condition. However, channel deepening will allow shippers to load vessels more efficiently and take advantage of larger vessels. This efficiency translates to transportation cost savings and is the main driver of the national economic development benefits. Cargo projections ultimately drive vessel fleet projections in terms of the quantities and sizes of vessels in the with- and without-project conditions.

The top import commodities for the Port of New York and New Jersey are furniture, machinery and appliances, plastic and beverages. Top export commodities in terms of volume are wood pulp, vehicle parts, plastic, and wood and articles of wood. As of 2018, the major import growth commodities are apparel, iron and steel, and vehicle parts. The major export growth commodities are food waste, oil seeds and miscellaneous grains, and iron and steel.

The method used to determine the forecast of import and export tonnage consists of three steps. First, the baseline of import and export tonnage was established using an average of historical

[1] Details regarding terminal operators' plans for the future without-project condition were provided to USACE to inform the plan formulation and economic analysis of this study. These details are confidential and therefore are not reported here.

data. Second, the import and export growth rates for each route group were established. Third, the forecast growth rates were applied to the baseline to determine the total import and export trade volumes for the Port of New York and New Jersey.

To minimize the impact of potential variances in the trade volumes on the long-term forecast, five years of data was used to establish the baseline for the commodity forecast. Empirical data from 2013 to 2017 was used to develop a baseline, allowing the forecast to capture the full range of economic growth that occurred during that timeframe. Three years were used to estimate the percent tonnage by trade route. The baseline tonnage represents the starting point from which commerce was forecasted. The historical containerized imports that moved through the port from 2013 to 2017 has been organized in Table 9.

During this time period, imports mostly increased with a slight decrease in 2016, but recovered in 2017. Trade with Asia leads the Port of New York and New Jersey market for the Pathway to Elizabeth – Port Authority Marine Terminal accounting for nearly 58% of import tonnage.

Table 10: Pathway to Elizabeth – Port Authority Marine Terminal Historical Containerized Baseline Metric Tons

	2013	2014	2015	2016	2017	BASELINE TONNAGE	ROUTE GROUP	ROUTE GROUP PERCENT	BASELINE TONNAGE BY ROUTE GROUP
IMPORT CONTAINER-IZED CARGO	16,987,000	18,311,000	18,431,000	18,025,000	21,404,000	18,631,600	Africa/South & Central America/US East Coast	6%	1,060,000
	Rate of Change by Year						EU-MED-ECUS	37%	6,894,000
		8%	1%	-2%	19%		East Asia to US East Coast (via Panama Canal)	17%	3,167,000
							East Asia to US East Coast (via Suez)	41%	7,639,000
	2013	2014	2015	2016	2017	BASELINE TONNAGE	ROUTE GROUP	ROUTE GROUP PERCENT	BASELINE TONNAGE BY ROUTE GROUP
EXPORT CONTAINER-IZED CARGO	9,801,600	9,434,700	9,197,200	9,736,300	9,826,200	9,599,200	Africa/South & Central America/US East Coast	5%	513,000
	Rate of Change by Year						EU-MED-ECUS	26%	2,516,300
		-4%	-3%	6%	1%		East Asia to US East Coast (via Panama Canal)	20%	1,965,000
							East Asia to US East Coast (via Suez)	48%	4,605,000

The Pathway to Port Jersey – Port Authority Marine Terminal includes the channel segments to Global Container Terminal Bayonne which include the Ambrose Channel and the Anchorage Channel. GCT Bayonne handles approximately 10 percent of the port's container volumes. The

historical volumes of metric tonnage moving through the terminal have been organized in Table 10.

Table 11: Pathway to Port Jersey – Port Authority Marine Terminal Historical Containerized Baseline Metric Tons

	2013	2014	2015	2016	2017	BASELINE TONNAGE	ROUTE GROUP	ROUTE GROUP PERCENT	BASELINE TONNAGE BY ROUTE GROUP
IMPORT CONTAINERIZED CARGO	2,989,900	3,670,100	3,816,900	4,014,300	3,694,100	3,637,000	Africa/South & Central America/US East Coast	7%	272,000
	Rate of Change by Year						Europe to US East Coast	10%	346,000
		23%	4%	5%	-8%		East Asia to US East Coast (via Panama Canal)	40%	1,451,000
							East Asia to US East Coast (via Suez)	43%	1,569,000
	2013	2014	2015	2016	2017	BASELINE TONNAGE	ROUTE GROUP	ROUTE GROUP PERCENT	BASELINE TONNAGE BY ROUTE GROUP
EXPORT CONTAINERIZED CARGO	1,238,000	1,494,000	1,311,000	1,333,000	1,349,000	1,345,000	Africa/South & Central America/US East Coast	4%	47,500
	Rate of Change by Year						EU-MED-ECUS	5%	67,200
		21%	-12%	2%	1%		East Asia to US East Coast (via Panama Canal)	47%	632,300
							East Asia to US East Coast (via Suez)	44%	598,100

Data was combined from three sources to develop the long-term trade forecast for the Port of New York and New Jersey. The three sources include The Port Authority of New York and New Jersey, previous USACE East Coast analyses and a national forecast obtained by the Institute for Water Resources that was developed by IHS Global Insight. The task of estimating commodity growth rates has been completed for several USACE deep draft navigation studies along the East Coast in the past decade. Those analyses along with information from the National IHS forecast were used to develop growth rates for application to this study.

IHS is a research firm that develops trade forecasts and provides economic and financial coverage of countries, regions and industries. The company provides data collection of regional, national, and global economic statistics; financial markets and securities; and international trade. When making global trade forecasts, IHS employs sophisticated macroeconomic models that contain all commodities which have physical volume. The trade forecasts are produced using a system of linked world trade commodity models that are collectively called the World Trade Model. The commodities forecasted are grouped into IHS' own categories derived from the International Standard Classification and covers 156 International Standard Classification

categories. For all trade partners in the world, the WTM has 103 major countries and regions according to their geographic location.

The most recent containerized tonnage forecast was obtained from the Institute for Water Resources in 2017. The information from this forecast provided tonnage through year 2025. Since this was the most recent forecast acquired, forecasting using IHS sources end at year 2025. From 2025 through 2040, port information was used for forecasting. The Port Authority of New York and New Jersey staff provided their growth rates for containerized imports and exports through 2037. The Port Authority of New York and New Jersey staff developed a long-range port master plan that includes a market analysis to determine the market potential for the maritime industry. To complete the market analysis, the maritime industry trends were analyzed, the market area was identified and a comparison of port facilities with competing ports was completed. Based on this assessment, projected regional growth in cargo was estimated. These growth rates were used for years 2026 through 2040.

Using the sources described above, growth rates were estimated from the baseline year of 2018 to the base year 2030 through 2040 where the forecast was held constant through the end of the period of analysis, 2074. The average growth rates for imports and exports for each period have been organized in Table 11.

Table 12: Containerized Cargo Growth Rates

IMPORT CONTAINER ANNUAL GROWTH RATES				
	2019-2025	**2026-2030**	**2031-2035**	**2036-2040**
East Asia to US East Cost (via Suez)	4.9%	2.8%	2.5%	2.5%
East Asia to US East Cost (via Panama Canal)	5.1%	2.8%	2.5%	2.5%
Europe to US East Coast	3.1%	2.8%	2.5%	2.5%
Africa to South & Central America to US East Coast	3.8%	2.8%	2.5%	2.5%
EXPORT CONTAINER ANNUAL GROWTH RATES				
	2019-2025	**2026-2030**	**2031-2035**	**2036-2040**
East Asia to US East Cost (via Suez)	5.2%	2.8%	2.5%	2.5%
East Asia to US East Cost (via Panama Canal)	5.7%	2.8%	2.5%	2.5%
Europe to US East Coast	4.2%	2.8%	2.5%	2.5%
Africa to South & Central America to US East Coast	4.2%	2.8%	2.5%	2.5%

Using the baseline estimated commerce volumes, the estimated growth rates were applied to the forecast import and export tonnage for the Port of New York and New Jersey by route group over the period of analysis. For purposes of this analysis, the forecast is assumed constant after 2050.

Since the pathways are being analyzed separately, individual commodity forecasts were conducted. Although the tonnage is different based on route group volumes, the growth rates

remain the same. The import and export commodity forecast tonnage for the Pathway to Elizabeth – Port Authority Marine Terminal has been organized in Table 12 and Table 13. The import and export commodity forecast tonnage for the Pathway to Port Jersey – Port Authority Marine Terminal has been organized in Table 14 and Table 15.

Table 13: Pathway to Elizabeth – Port Authority Marine Terminal Import Containerized Metric Tons Forecast

IMPORT FORECAST	2018 - BASELINE	2025	2030	2035	2040 - 2079
East Asia to US East Cost (via Suez)	7,639,000	10,186,000	12,242,000	13,878,000	15,702,000
East Asia to US East Cost (via Panama Canal)	3,110,000	4,409,000	5,053,000	5,729,000	6,481,000
Europe to US East Coast	6,823,000	8,451,000	9,685,000	10,980,000	12,422,000
Africa to South & Central America to US East Coast	1,060,000	1,376,000	1,576,000	1,787,000	2,022,000

Table 14: Pathway to Elizabeth – Port Authority Marine Terminal Export Containerized Metric Tons Forecast

EXPORT FORECAST	2018 - BASELINE	2025	2030	2035	2040 - 2079
East Asia to US East Cost (via Suez)	4,605,000	6,042,000	6,924,000	7,850,000	8,881,000
East Asia to US East Cost (via Panama Canal)	1,965,000	2,854,000	3,271,000	3,708,000	4,196,000
Europe to US East Coast	2,516,000	3,266,000	3,743,000	4,244,000	4,801,000
Africa to South & Central America to US East Coast	513,000	673,000	771,000	875,000	989,000

Table 15: Pathway to Port Jersey - Port Authority Marine Terminal Import Containerized Metric Tons

IMPORT FORECAST	2018 - BASELINE	2025	2030	2035	2040 - 2079
East Asia to US East Cost (via Suez)	1,569,000	2,092,000	2,514,000	2,850,000	3,225,000
East Asia to US East Cost (via Panama Canal)	1,451,000	2,057,000	2,358,000	2,673,000	3,024,000
Europe to US East Coast	346,000	429,000	491,000	557,000	630,000
Africa to South & Central America to US East Coast	272,000	353,000	405,000	459,000	519,000

Table 16: Pathway to Port Jersey - Port Authority Marine Terminal Export Containerized Metric Tons

EXPORT FORECAST	2018 - BASELINE	2025	2030	2035	2040 - 2079
East Asia to US East Cost (via Suez)	598,000	804,000	921,000	1,044,000	1,182,000
East Asia to US East Cost (via Panama Canal)	632,000	918,000	1,053,000	1,193,000	1,350,000
Europe to US East Coast	67,000	87,000	100,000	113,000	128,000
Africa to South & Central America to US East Coast	48,000	62,000	71,000	81,000	92,000

Fleet Forecast

In addition to a commodity forecast, a forecast of the future vessel fleet is required when evaluating navigation projects. To develop the future fleet at The Port of New York and New Jersey, the study simulates loading of the forecasted throughput tonnage distribution by vessel class (Appendix C, Section 4.3).

The forecasted fleet distribution at New York and Jersey relies on assumptions of worldwide fleet transition. Currently, most PPX3 and PPX4 vessels operate on the longest, most efficient trade lanes (i.e., Asia-Europe services). However, as shipbuilders put new PPX3 and PPX4 vessels into service, carriers transition older PPX3 and PXP4 vessels to slightly less efficient routes (e.g. Transpacific then Transatlantic services). PPX1 and PPX2 vessels already on services calling The Port of New York and New Jersey will likely transition to shorter, less efficient routes as newer PPX3 and PPX4 vessels are deployed on The Port of New York and New Jersey services. This process tends to accelerate as carriers face excess vessel capacity on Asia-Europe services, which puts downward pressure on freight rates.

This study assumes that between 2020 and base year 2039, the world fleet of PPX3 and PPX4 vessel will nearly double. This will add significant capacity to Asia-Europe services, and pressure carriers to transition a portion of the PPX3 and PPX4 fleet to slightly less efficient routes (e.g. Transpacific then Transatlantic routes). It is estimated that NYNY's share of PPX3 and PPX4 vessels calling weekly by base year 2039 will represent approximately 14 percent and 1 percent of the world fleet of PPX3 and PPX4 vessels, respectively.

Over the study period, it is anticipated that vessels with 10,000 to 14,000 TEU will become the most used vessel class on Transatlantic routes calling NYNJ. Table 16 presents the initial forecast of containerized vessel calls through 2050. The analysis holds the fleet distribution constant after 2035. Changes in overall vessel calls is based on the increasing commodity forecast. The study uses the fleet forecast as an input to the Corps-certified planning model, HarborSym to estimate benefits for each alternative. Appendix C, Section 4 describes the fleet forecast methodology and future fleet forecast.

Table 17: Vessel Forecast: Calls by Class

Vessel Class	FWOP	52FT	54FT	55FT	57FT
2030					
Panamax Containership	155	155	155	155	155
PPX Gen1 Containership	361	246	166	163	163
PPX Gen2 Containership	713	708	697	697	697
PPX Gen3 Containership	765	765	765	765	765
PPX Gen4 Containership	52	52	52	52	52
Total	**2,046**	**1,926**	**1,835**	**1,832**	**1,832**
2040					
Panamax Containership	130	130	130	130	130
PPX Gen1 Containership	353	242	159	153	153
PPX Gen2 Containership	755	700	657	655	655
PPX Gen3 Containership	1,132	1,132	1,132	1,132	1,132
PPX Gen4 Containership	104	104	104	104	104
Total	**2,474**	**2,308**	**2,182**	**2,174**	**2,174**
2050					
Panamax Containership	95	95	95	95	95
PPX Gen1 Containership	417	284	182	180	180
PPX Gen2 Containership	909	860	799	792	792
PPX Gen3 Containership	1,464	1,464	1,464	1,464	1,464
PPX Gen4 Containership	156	156	156	156	156
Total	**3,041**	**2,859**	**2,696**	**2,687**	**2,687**

Chapter 4: Plan Formulation*

Plan formulation for the NYNJHDCI Study is being conducted in accordance with the six-step planning process described in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (U.S. Water Resources Council, 1983) and the *Planning Guidance Notebook* (USACE, 2000b).

To formulate alternative plans, the project delivery team identifies problems and opportunities (Section 4.2), establishes the planning goals and objectives (Section 4.3), identifies the planning constraints and key uncertainties (Section 4.4), and then identifies measures which are developed into an array of alternatives that can be evaluated and compared. This evaluation and comparison ultimately leads to a tentative selection of an alternative, which is reviewed by the public, resource agencies, stakeholders, and agency technical reviewers. Once input obtained through review is addressed and incorporated, the recommended plan can be finalized.

For the analysis, the harbor was organized into three pathways (Figure 9):

- Pathway from sea to Port Jersey – Port Authority Marine Terminal. This includes the Ambrose Channel, Anchorage Channel, and Port Jersey Channel. This pathway reaches Global Container Terminal Bayonne.
- Pathway from sea to Elizabeth – Port Authority Marine Terminal. This includes the Ambrose Channel, part of Anchorage Channel, Kill Van Kull, Newark Bay Channel, South Elizabeth Channel, and Elizabeth Channel. This pathway reaches Maher, A.P. Moller, and Port Newark.
- Pathway from sea to Howland Hook Marine Terminal. This includes the Ambrose Channel, part of Anchorage Channel, Kill Van Kull, and part of Arthur Kill Channel. This pathway reaches Global Container Terminal New York.

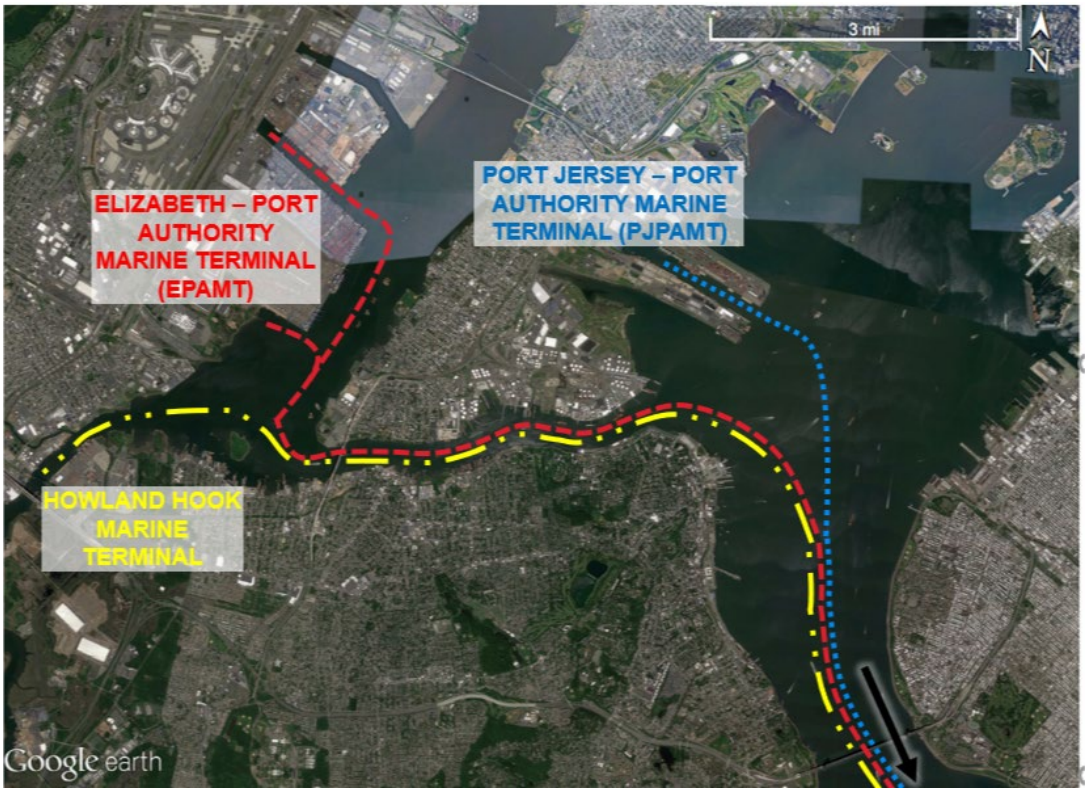


Figure 9: Pathways Used for Analysis

A synopsis of the strategy that the project delivery team used to develop the array of alternatives and the rationale behind this strategy is presented below.

1. Identify and screen management measures for addressing the planning goals and objectives
2. Screen pathways based on existing problems and projected future conditions
3. Incrementally evaluate each navigation pathway for deepening
   - Phase I: Calculate the costs and benefits for dredging from the sea to each destination within the harbor (container terminals), foot by foot of depth dredged. The pathway from the sea to container terminal with the highest net benefits will be selected as the first increment of construction.
   - Phase II: Assuming the pathway selected in Phase I is constructed, calculate the incremental net benefits for deepening, foot by foot, to the remaining container terminal(s). Select the pathway with the highest net benefits as the second added increment.
   - Phase III: Assuming the pathways selected in Phases I and II are constructed, incrementally evaluate additional navigability efficiency components (e.g. bend easing).
4. Compare alternatives, identify the national economic development plan, and select Tentatively Selected Plan.

Per the 1983 Principles and Guidelines by the U. S. Water Resources Council, the federal objective of water and related land resources project planning is to "contribute to national economic development consistent with protecting the Nations' environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements"

(U.S. Water Resources Council, 1983). The 1983 Principles and Guidelines recommends that plans are formulated in consideration of four criteria and four accounts.

The 1983 Principles and Guidelines' four criteria:

- 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.
- Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
- 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.
- 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 1983 Principles and Guidelines' four accounts:

- National Economic Development: changes in the economic value of the National output of goods and services.
- Regional Economic Development: the impact of project spending, either directly or indirectly, on the local economy.
- Environmental Quality: the non-monetary beneficial effects on significant natural and cultural resources.
- Other Social Effects: include the effects that are not covered in the other three accounts, such as community impacts, health and safety, and displacement.

The four criteria and four accounts are used iteratively in the plan formulation process as the alternatives are developed, and as they are evaluated and screened, to assist in the selection of an alternative for recommendation.

The period of analysis for this study is 50 years, from 2039 – the estimated end of a project's construction – to 2088. The characteristics of the design vessel will be used to inform the channel dimensions and alignment needs for the study's period of analysis. Further refinement of the dimensions and alignment of the channels is expected through application of ship simulations during the Preconstruction Engineering and Design Phase. The Deep Draft Navigation Planning Center of Expertise identified the *Maersk Triple E ULCV Class* (*Triple E* or design vessel) as the design vessel. This vessel is consistent with a vessel used for the Maritime Institute of Technology and Graduate Studies simulations (Maritime Institute of Technology and graduate Studies, 2016). The design of each navigation pathway will be based off the design vessel's length and beam dimensions for the design vessel to navigate the pathways. The specifications of the design vessel are:

- 1,308.0 feet in length overall
- 193.5-foot beam
- 52.5-foot design draft

- 18,000 TEU capacity

The identification and evaluation of measures and components, further described below, were informed by discussions with the Sandy Hook pilots, Maritime Association, U.S. Coast Guard, and National Oceanic and Atmospheric Administration at a Steering Committee meeting and throughout the process.

4.1: Problem Identification and Opportunities

The existing federal navigation channel was designed for the *Regina Maersk*; this vessel is 1,044 feet long, 140 feet wide, has a static draft of 46 feet, and a capacity to carry 6,400 TEUs. The vessels routinely calling on the harbor today are over 160 feet longer, 17 feet wider, and up to 4 feet deeper (when fully loaded) with twice as much sail area/freeboard than the design vessel. Theses larger vessel have a greater risk of grounding, collision or marine casualty, and have resulted in operation limitations within the harbor. Overall, the problems experienced in the New York and New Jersey Harbor are:

- Inefficiencies due to depth limitations
- Inefficiencies due to width limitations

Discussions with the vessel pilots revealed the following problems specific to certain areas (Figure 10):

1. Ultra Large Container Vessels are required to back out of Elizabeth - Port Authority Marine Terminal. The narrow width of the Newark Bay Channel makes this maneuver difficult for such a large vessel, increasing the risk of grounding in Newark Bay thereby increasing the transportation cost in risk.
2. The current width of the Newark Bay Channel restricts traffic to one-way. This restriction increases the transportation cost in time for all interacting agents in the harbor and at the port.
3. The South Elizabeth and Newark Bay Channels are too narrow to facilitate backing an Ultra Large Container Vessel out into the Newark Bay Channel. The width of the channels increases the risk of grounding in the South Elizabeth Flats.
4. The bend at Bergen Point into Newark Bay Channel is very narrow and the turn very tight. The difficulty of this maneuver requires restrictive speed heightening the transportation cost in time for all interacting agents in the harbor and at the port.
5. The width of the channel from Constable Hook to Ambrose Channel restricts traffic to one-way, increasing the transportation cost in time for all interacting agents in the harbor and at the port.
6. The bend at the entrance of the Constable Hook Reach is very narrow. The width of this bend imposes restrictive speeds for two-way traffic and incurs higher risk of collisions and allisions. Transportation costs are higher due to the cost of the risk of accidents and due to the cost in time, for all interacting agents in the harbor and at the port.
7. There is no space in Newark Bay or in Constable Hook to allow for convoy assembly and maximize throughput of one-way traffic on the Kill Van Kull. The lack of this space in the federal channel increases the transportation cost in time for all interacting agents in the harbor and at the port.

8. The entrance into Port Jersey Channel is too narrow and the depth of the Anchorage channel beyond the Port Jersey Channel is too shallow to facilitate backing out an Ultra Large Container Vessel. This will increase transportation costs and the costs associated with the risk of ships grounding.
9. There is no place in the Kill Van Kull to allow an Ultra Large Container Vessel to bunker or pull over and facilitate meeting or passing. Should an Ultra Large Container Vessel need to shut down in an emergency situation within the Kill Van Kull, traffic through the Kill Van Kull would be halted. These two factors impose additional transportation costs in time for all interacting agents in the harbor and at the port.

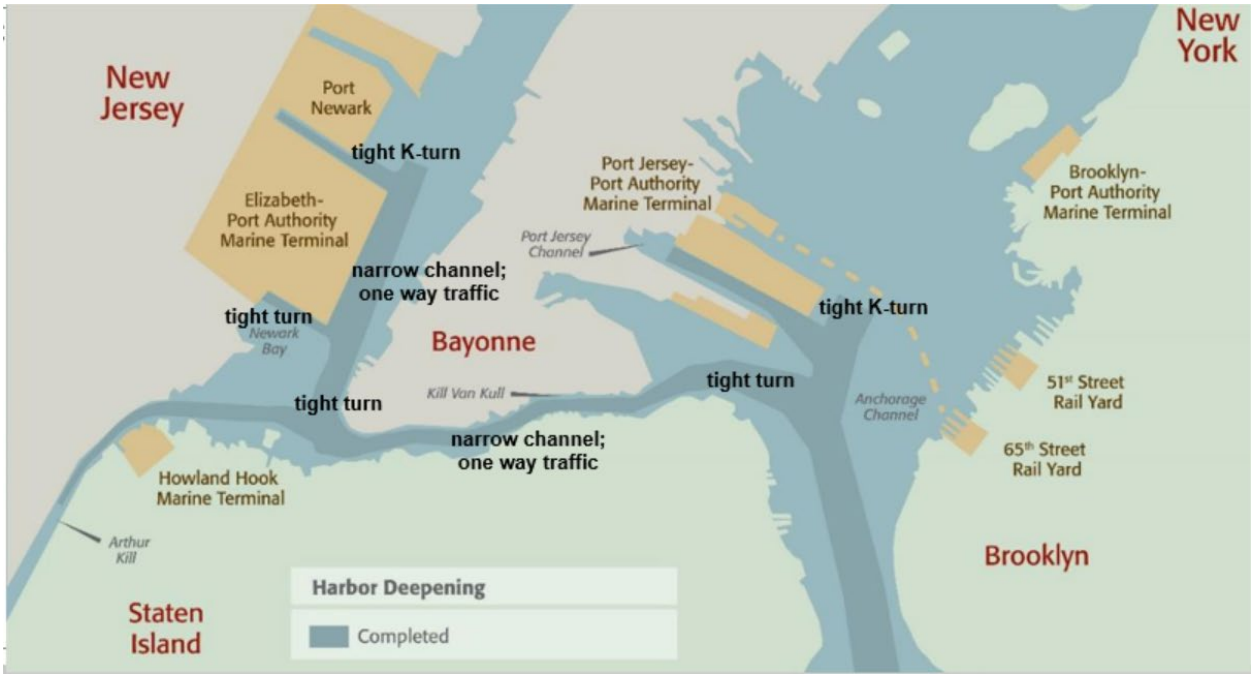


Figure 10: Current and future-anticipated areas of concern for full fleet

Additionally, the restrictions listed above relating to the Kill Van Kill have been described in The Port Authority of New York and New Jersey Port Master Plan:

> "In response to navigational and safety challenges faced by today's largest container vessels, the Port's Harbor Safety, Operations, and Navigation Committee published a Deep Draft Advisory in May 2017. That bulletin restricts large vessels transiting the Kill Van Kull to favorable sailing conditions; the largest vessels are restricted from passing and meeting in the Kill Van Kull, and may only transit the Kill Van Kull during slack water" (Port Authority of New York and New Jersey, 2019).

There are opportunities to improve navigational efficiencies related to the depth and width limitations of the existing federal navigation channel. There is also an opportunity to beneficially use the dredged material and improve safety.

4.2: Planning Goal and Objectives

The team developed a planning goal based on problems and opportunities to help create and evaluate alternative plans. It is the overarching intent of the project to improve navigation in the New York and New Jersey Harbor. Plans are formulated to achieve planning objectives during the 50-year period of analysis from 2039 – the estimated end of a project's construction – to 2088. A planning objective states the intended purposes of the planning process and is 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:

1. Improve the efficiency of operations of containerships in the New York and New Jersey Harbor
   Measurement: decreased transportation costs from in-harbor time savings
2. Allow more efficient use of containerships transiting the New York and New Jersey Harbor
   Measurement: decreased transportation costs by loading existing vessels heavier or switching to larger vessels

4.3: Planning Constraints

Constraints are restrictions that limit the extent of the planning process. They can be divided into universal constraints and study-specific constraints. For brevity, only project-specific constraints are included here. The study's constraint is that we cannot impact or modify the piers of the Bayonne Bridge. The bridge was raised in 2019 and the study will not be considering further modifying the bridge; this limits the alternatives that can be considered in the Kill Van Kull.

- Impacts to the piers of the Bayonne Bridge

Considerations are issues or matters that should be taken into account during the planning process, but do not necessarily limit the extent of the process as do constraints. The following considerations are taken into account:

- Impacts to structures/ bulkheading/ on-land facilities
- Impacts to environmental and cultural/historic resources
- Impacts to existing utilities
- Impacts to the other navigation traffic in the harbor

4.4: Key Uncertainties and Planning Decisions

During the formulation process, there are planning decisions and uncertainties that must be considered and documented. This study uses many sources of existing data for the analysis. For example, the study team assumed existing bathymetric and geotechnical data are sufficient to distinguish between the alternatives considered. Collecting new data was deferred to the next phase, Preconstruction Engineering and Design. The New York and New Jersey Harbor has been studied extensively. The availability of existing data enables the study team to work more efficiently however, existing data may not be tailored exactly to the study team's needs, and assumptions or interpolations may be made to cover any gaps in existing data. The decision to use existing bathymetric and geotechnical data from maintenance dredging data and previous

studies may result in less accurate dredging quantity and cost estimates, nevertheless this was determined to be an acceptable risk.

Hydrologic, salinity, and ecological modeling was also deferred to the Preconstruction Engineering and Design phase because the study team was able to evaluate potential impacts and estimate mitigation costs using existing information and local proxies. The decision to use existing information may result in inaccurate environmental impacts and mitigation costs which would later be revised based on new information; this was determined to be an acceptable risk.

The commodity and fleet forecast developed for the study is an additional source of uncertainty. The long-term trade forecast assumes compound average annual growth of 3.5 percent through 2050. While the study assumes that long-term positive economic growth will drive continued increases in containerized trade, future trade volumes are difficult to predict with certainty. Commodity flows are subject to the ups and downs of the business cycle, individual commodity markets, and political influence.

The fleet forecast assumes that Post Panamax Generation 3 vessels (nominal capacity of 10,000 – 14,000 TEUs) will comprise a larger percentage of calls and carry a larger share of total cargo over the study period. This assumption is based on analysis of containerized vessel order books and firms' preference for the economies of scale and lower unit transportation costs realized by larger, more efficient vessels. However, vessel scrap rates and deployment are firm-level decisions based on operating costs, fleet availability, trade volume, landside infrastructure constraints, scheduling, and other exogenous factors. As a result, forecasting the fleet distribution over the study period involves significant uncertainty. More importantly, the share of cargo carried on Post Panamax Generation 3 and Post Panamax Generation 4 vessels (nominal capacity of 14,000+ TEUs), the benefitting classes of containerships for this project, is subject to change.

Analysis will develop alternative scenarios to test the sensitivity of the recommended plan prior to the release of the Final Report. Analysis will primarily focus on low-growth scenarios as these are most likely to impact plan selection and project justification. The study will test the impact of both slower fleet transition and lower than expected commodity growth. These results will be compared to the baseline scenario to determine the level of confidence in the results of the analysis.

There is also uncertainty with the model used to calculate benefits, HarborSym. Port and individual operations are subject to change based on various conditions including weather, congestion, labor availability, schedule, pilot practices, and other factors leading to variability. The HarborSym model included variations or ranges for many of the variables involved in the vessel costs, loading, distances, speeds, etc. For this study, in-port transportation costs account for only approximately 7 percent of total transportation costs. As a result, assumptions based on the commodity forecast, fleet forecast, and vessel loading assumptions have greater impact on total transportation costs and the difference between plans.

Another uncertainty is sea level rise. The design and implementation of navigation projects requires consideration of the effects of climate change, including global sea level rise. The foundation for coordinated action on climate change preparedness and resilience across the Federal government was established by Executive Order 13514 of October 5, 2009, and the

Interagency Climate Change Adaptation Task Force led by the Council on Environmental Quality (CEQ). In October 2011, the Task Force developed a National Action Plan that provided an overview of the challenges a changing climate presents for the management of the nation's freshwater resources. Climate preparedness and resilience actions have also been established by the USACE, as demonstrated by the annual release of the Climate Change Adaptation Plan, prepared under the direction of the USACE Committee on Climate Preparedness and Resilience (CCPR) (USACE, 2015a). USACE established an overarching USACE Climate Change Adaptation Policy Statement and a governance structure to support mainstreaming adaptation in 2011, following the release of the Executive Order (USACE, 2015a). Per Engineering Regulation 1100-2-8162, Incorporating Sea Level Change in Civil Works Program, released in December 2013, followed by Engineer Pamphlet 1100-2-1 (USACE, 2019a), Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation in July 2014, USACE plans and incorporates climate change into Civil Works projects.

Climate change and global warming have been observed during the 20th and 21st centuries and have resulted in changes in localized sea levels. The 2014 Intergovernmental Panel on Climate Change (IPCC) report states that over the period of 1901 to 2010, the global mean sea level rose by 0.62 feet (IPCC 2014). The U.S. National Climate Assessment (2012) has established a range of global sea level rise predictions for the year 2100 that all predict sea level rise and range in the predicted value from 0.7 feet on the low end to 6.6 feet as a high prediction with intermediate values between the extremes (U.S. National Climate Assessment 2012).

The IPCC also predicts local sea level rise, addressing the localized factors of subsidence and oceanic currents at any location. Changes to relative sea level can result from a number of factors including isostatic rebound (a process by which the earth's crust, having been compressed beneath the weight of glaciers, bounces back), faulting and consolidation of sediments in fill structures, and sediment compression caused by groundwater withdrawals (Boon 2010).

Oceanic currents influence local sea level rise on the Atlantic Coast due to temperature and salinity changes in the Atlantic Ocean, which cause pressure gradients between the Gulf Stream and coastal waters to decrease, which then cause coastal waters to rise (Sallenger et al. 2012). As a result of these factors, local, relative sea level rise (RSLR) on the mid-Atlantic Coast of the United States from North Carolina northward is occurring at approximately twice the global mean rate, and the rate of sea level rise is accelerating both globally and locally. USACE engineering documents require that planning studies and engineering designs evaluate the entire range of possible future rates of sea-level change, represented by three scenarios of "low", "intermediate", and "high" sea-level change (USACE 2013; USACE 2014).

The use of sea level change scenarios as opposed to individual scenario probabilities underscores the uncertainty in how local relative sea levels will play out into the future. At any location, changes in local relative sea level reflect the integrated effects of global mean sea level change plus local or regional changes in geologic, oceanographic, or atmospheric origin.

The Sea Level Change Curve Calculator is designed to help with the application of the guidance found in Engineering Regulation 1100-2-8162 and EP 1100-2-1. The tools use equations in the regulation to produce tables and graphs for the following three sea level rise scenarios:

- Baseline (or "low") estimate, which is based on historic sea level rise and represents the

minimum expected sea level change
- Intermediate estimate
- High estimate, representing the maximum expected sea level rise

The calculator accepts user input – including project start date, selection of an appropriate NOAA long-term tide gauge, and project life span – to calculate projected sea level change for the respective project. The start date used by the calculator is 1992, which corresponds to the midpoint of the current National Tidal Datum Epoch of 1983-2001.

The Newark Bay Main, Port Elizabeth, South Elizabeth, Kill Van Kull, Arthur Kill, Port Jersey, and Anchorage channels were analyzed using data from NOAA station The Battery, NY (#8518750) tide gauge. The Ambrose channel was analyzed using data from the NOAA Station Sandy Hook, NJ (#8531680) tide gauge. Estimated relative sea level change projections from 2020 to 2127 for each gauge were used in this study, calculated with the USACE Sea Level Change Curve Calculator are illustrated on Figures 12 and 13. Each figure notes the projected construction start dates for each site and the combined period of analysis for each possible deepening (2037 –2086 and 2039-2088 for deepening by 4 or 5 feet, respectively). There were no relevant sea level change thresholds identified for the NYNJHDCI study. Regardless of the sea level change scenario, the Port of New York and New Jersey has plans to implement resilience measures to be operable in the future. This is consistent with The Port Authority of New York and New Jersey's Port Master Plan.

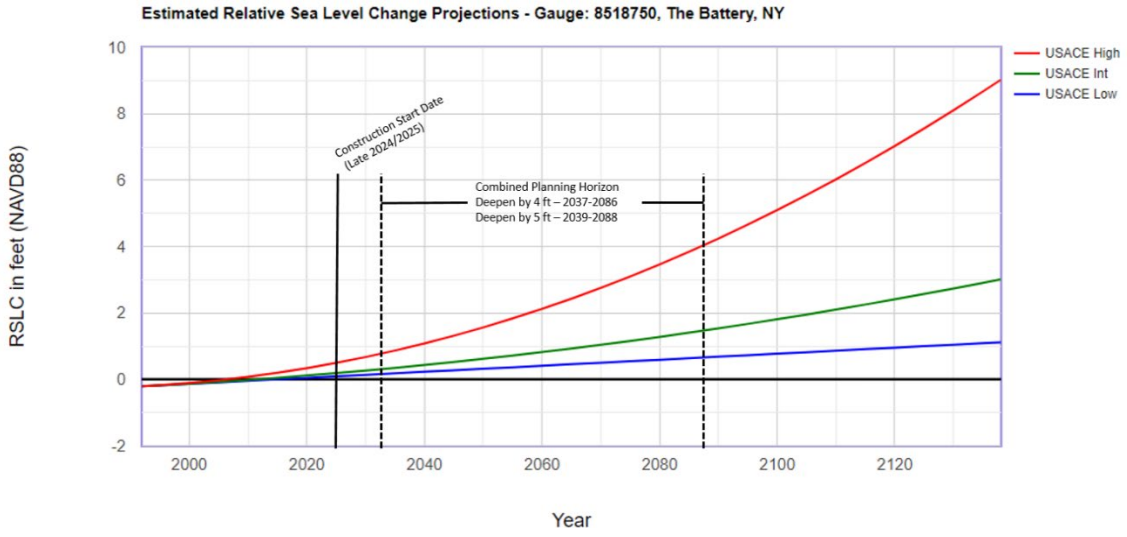


Figure 11: NOAA Gauge: The Battery, NY (#8518750) Relative Sea Level Change Projections, 1992-2138, with Construction Start Date and Planning Horizon.

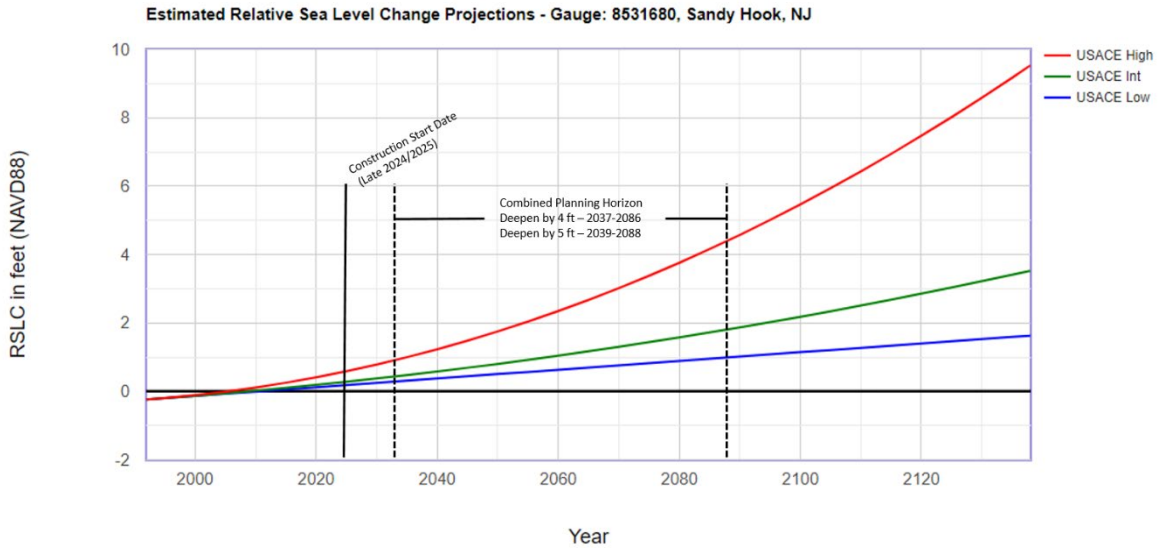


Figure 12: NOAA Gauge: Sandy Hook, NJ (#8531680) Relative Sea Level Change Projections, 1992-2138, with Construction Start Date and Planning Horizon.

The sea level change curve calculator data tables, with annual intervals, for each of these gauges are provided in Appendix B1, Attachment 6.

4.5: Management Measures and Components

In general, measures are types of actions that accomplish the objectives when implemented. A variety of structural/ physical modification and nonstructural/ operational measures were considered to satisfy the study objectives and constraints in consultation with The Port Authority of New York and New Jersey staff. Consideration of the various measures was conducted consistent with federal water resources policies and practices. Measures were evaluated for compatibility with local conditions and relative effectiveness in meeting planning objectives.

Measures removed from further considerations include:

- Nonstructural/ operational changes
  - Improve vessel scheduling and timing of transits (Vessel Traffic System)
  - Relocate aids to navigation to take advantage of naturally deep areas
  - Use lightering
  - Reduce vessel speed in the channel
  - Increase the use of tugboat assistance to improve vessel maneuverability
  - Alternative sites of commerce delivery
- Stepped channel
- Improve existing anchorages and/or create new anchorages

Measures kept for further considerations include:

- Channel deepening
- Improve existing turning areas and/or create new turning areas
- Channel widening

Nonstructural/Operational Measures: The implementation of nonstructural/ operational measures have the potential to improve navigation within the New York and New Jersey Harbor without the physical modification of the channels. The nonstructural measures considered are listed below. Several measures that allow for greater vessel loading economies are currently in use in the port currently and are discussed in the "Port Operations" section. Since many of these nonstructural measures are already being implemented within the harbor, only limited further benefits could be realized. These measures were therefore not carried forward.

- Alternative sites for, or means of, commerce delivery: This non-structural measure generally refers to an alternative site either within or outside the port. Existing sites within the port are usually being used for other types of cargo transportation (e.g., bulk cargo). Sites outside the port would require transportation back to the region by other means. The scope of this study considers all container terminal sites in the port, including existing, expanded, and planned terminals. Moreover, the non-federal partners have not identified any other alternative terminal sites. Therefore, no additional port terminal sites have been identified or proposed for cargo routing or handling. The delivery of goods to an alternative site outside the port (i.e., another East Coast port) with cargo transported back to the region via road or rail is inherently more costly to the carrier. Accordingly, this measure has not been included for further analysis.
- Reduce vessel speed in the channel: Reducing vessel speed while transiting the channel will reduce the amount of squat affecting the vessel. Reducing vessel squat would allow the vessel to ride higher in the water, thereby reducing the vessel's draft while transiting the channel. Implementation of vessel speed reduction is constrained by the need to maintain sufficient speed for maneuverability and the need to reduce crab angle when transiting the channel under windy conditions. The amount of squat reduction potentially gained by slowing to a minimum safe speed would be inconsequential because vessels typically operate at or very near this speed under existing conditions. Therefore, reducing vessel speed in the channel does not meet the planning objectives, and is not carried forward.
- Increase tugboat assistance: Tugboats are used to improve the maneuverability of vessels that have slowed during channel transits, to turn vessels, and to dock vessels. The standard operating practices for tug assistance are sufficient for vessels currently using the channel. Additional tug assistance would not improve the efficiency of vessels transiting the channel because additional use of tugs would not improve vessel loading, increase the size of vessels using the channel, or appreciably increase vessel speed. Additional use of tugs is not carried forward.
- Improve vessel scheduling and timing of transits: Improving the vessel scheduling and timing of transits could potentially reduce the need for restrictions on vessels meeting in the channel. The most effective system currently in use for optimizing vessel scheduling and timing of transits is the Vessel Traffic System, which is under the direction of the Coast Guard. The Vessel Traffic System is currently in use in the New York Harbor. Therefore, significant improvements in the restrictions on vessels meeting in the channel are unlikely to take place by pursuing further improvements in vessel scheduling and timing of transits. Therefore, this measure does not meet the planning objectives and is not carried forward.
- Relocate aids to navigation: There are some spots adjacent to Ambrose Channel that are

naturally deeper than federally maintained channel depths. However, there are not sufficient areas of existing deep water where simply moving the aids to navigation would meet the planning objectives. Therefore, this measure is not carried forward. However, existing deep-water areas may be incorporated into channel widening in some areas.

- Use lightering: During a lightering operation, a vessel is loaded or unloaded to an operable draft in order to transit the channel. Container ships are not capable of lightering. The scope of this study is constrained to container vessel traffic; therefore, this measure is not carried forward.

Structural Measures: Structural measures are those measure that modify the physical attributes of the navigation channels. Since the vessels currently calling at the port are constrained by the dimensions of the channel, a few of these structural measures were carried forward.

- Channel deepening: Deepening the existing channel could potentially allow for deeper and more efficient loading of the existing fleet and allow for the efficient use of larger vessels. The evaluation of deepening needs to include the deepening of berthing areas and consider the use of tidal advantage. Tidal advantage is the use of high tide to provide additional underkeel clearance, which allows vessels with deep drafts to transit the channel. This is a common practice within the study area that is projected to continue. This measure was carried forward.
- Stepped channel: In a stepped channel configuration, the inbound lane would be dredged more deeply than the outbound lane. The inbound lane would be designed to accommodate deeply laden inbound traffic. The outbound lane would be shallower than the inbound lane under the presumption that outbound traffic would have less cargo and thus be operating at shallower drafts. This configuration has not been used in New York Harbor. The stepped channel configuration would be insufficient for existing and projected future conditions in New York Harbor because outbound container traffic currently is loaded nearly as deeply as inbound traffic. Outbound container traffic can be expected to be loaded even more deeply as deepening projects at other U.S. east coast container ports completed and considering New York Harbor is often the first port of call for the largest container vessels. Therefore, a stepped channel configuration was not carried forward.
- Channel widening: Channel widening consists of bend easing and widening channels for improved navigation when turning. Widening the navigation channel would allow for more efficient operation of the vessels within the harbor. Increasing the area in the federal channel available for the largest container vessels to complete turns in and out of the harbor would allow for safer, faster transit. Information collected from the harbor and docking pilots identified several areas where the area available for completing a turn is perilous. The information collected from the pilots is consistent with the Maritime Institute of Technology and Graduate Studies simulations. During the simulations, incidents or near incidents occurred while completing turns. Channel widening would be needed to meet USACE's design specifications for the design vessel and to improve efficiency and safety. Channel widening was considered independently and as a necessary addition to deepening for slope stability and design criteria purposes. This measure was carried forward. However, widening specific areas was removed from further consideration. Widening the Kill Van Kull for two-way traffic was considered but eliminated from further consideration because the space between the piers of the

Bayonne Bridge does not allow for two-way traffic. Widening the channel and impacting Combined Disposal Facility outside of the Port Jersey Channel was also eliminated from further consideration due to environmental considerations and the anticipated costs as compared to benefits.

4.6: Screen Pathways

The USACE met with the operators of the major marine terminals in the Port of New York and New Jersey and the pilot associations responsible for navigating deep draft container vessel traffic into the harbor.

USACE meet with the following marine terminal operators:

- A.P. Moller (Elizabeth - Port Authority Marine Terminal) on March 23, 2020
- Global Container Terminals of Bayonne (Port Jersey - Port Authority Marine Terminal) and New York (Howland Hook) on March 31, 2020
- Port Newark Container Terminal (Elizabeth - Port Authority Marine Terminal) on April 2, 2020
- Maher (Elizabeth - Port Authority Marine Terminal) April 16, 2020

USACE met with the Sandy Hook Pilots Association, Metro Pilots Association, and Moran Towing Corporation:

- August 7, 2019
- February 4, 2020

USACE collected data during these meetings that informed the future without-project conditions. Based on this information, USACE carried out a preliminary evaluation of implementing a several different measures in the Arthur Kill channel/pathway to Howland Hook Marine Terminal. It was determined that the existing configuration of the Arthur Kill channel/pathway sufficiently accommodates Howland Hook Marine Terminal's anticipated future fleet, which includes vessels with a capacity of up to 10,000 TEUs, to navigate to the terminal without channel modification. Efficiency deepening was considered and is not recommended for further consideration because the existing channel depth is not being used to its fullest potential and can accommodate deeper drafting vessels, including the 10,000 TEU vessel. The Arthur Kill channel/pathway to Howland Hook Marine Terminal is not being considered for efficiency widening because a preliminary evaluation indicates low quantifiable benefits and high costs. Therefore, the Arthur Kill channel/pathway has been screened from further analysis. This decision has been fully coordinated with The Port Authority of New York and New Jersey staff and they are in concurrence. If conditions change and significantly larger vessels begin to call Howland Hook Marine Terminal, a limited reevaluation of the pathway to Arthur Kill may be warranted.

Figure 13: Pathways Moving Forward

4.7: Alternative Plan Formulation

The plan formulation strategy for this study is conducted in three phases, as described below. The formulation cost assumptions made during the analysis include the following:

1. The least cost dredged material placement option was assumed for all pathways and alternatives, consistent with the federal standard. Dredged material will be beneficially used and placed either upland, at the Historic Area Remediation Site (HARS), or on a reef.
2. The anticipated volume of maintenance dredging for each channel is calculated based on the estimated rate of sedimentation observed from past operation and maintenance of the harbor applied to any portions of the channel to be widened as part of this project. Consistent with current New York District practice, the Port Jersey channel is anticipated to be maintained by dredging every 10 years, the Anchorage channel reaches to be maintained every seven years and all other channels are assumed to be maintained together in a single contract every three years.
3. 60% (50%) of the total template area can be cleared to 54 (55) feet without the need for blasting. Those reaches with multiple categories of rock hardness are assumed to be blasted at production rates with the hardest applicable category.
4. Cultural mitigation, environmental mitigation, structural demolitions, and utility relocations are not incorporated into the cost estimates.

5. Where production blasting is assumed, drilling and blasting lateral spacing is assumed to be 12 feet for moderately hard tock, 10 feet for hard rock, and 8 feet for hardest rock.
6. Current list of structures exposed to blasting vibrations and deepening/widening is assumed correct.
7. The quantities requiring pre-treatment increase with depth according to the geometry of the cone-shaped influence of blasting.
8. On average, between 2 and 3 plants are assumed to be working at any given time over the duration of the deepening.

The benefits for each pathway were also calculated at the same depths as costs. The benefit assumptions made during the analysis include the following:

1. Vessels continue to load up to a 49-foot sailing draft with a -50-foot MLLW channel; sailing draft becomes 0.7 feet deeper with each additional foot of available channel depth.
2. The future vessel fleet will include Post-Panamax Generation III and Post-Panamax Generation IV vessels with maximum sailing drafts up to the maximum design standards within these classes.
3. Vessel utilization for the Post-Panamax Generation III and Post-Panamax Generation IV vessels reflect the utilization rates of the Post-Panamax Generation II and Post-Panamax Generation I-sized vessels.
4. Vessels can transit the channel in the HarborSym model if they do not violate the underkeel clearance requirements (~+3 feet inner channel).

The cost and benefit assumptions will be revisited as benefit estimates are refined. For more information see Section 5.4: Uncertainty and Additional Analyses, Appendix B4: Cost Engineering, and Appendix C: Economics.

4.7.1: Phase I: Determine First Added Increment

Phase I of the plan formulation strategy is to calculate the costs and benefits for deepening each pathway from sea to container terminal, foot by foot, and select the pathway with the highest net benefits as the first increment.

The team calculated the costs for deepening each pathway – the pathway from sea to Port Jersey – Port Authority Marine Terminal and the pathway from sea to Elizabeth – Port Authority Marine Terminal – by 2 to 7 feet to a maintained depth[1] between -52 feet MLLW and -57 feet MLLW, respectively.

[1] The maintained depth, authorized channel level, and total (dredged) depth of the various channels may differ. The authorized channel level is used herein as it is defined in Engineering Regulation 1110-2-1613, and reflects the loaded summer saltwater draft of the design vessel together with gross underkeel clearance (including allowances for squat, salinity, wave motion, and safety clearance). Maintained depth is understood in relation to the authorized channel level. The maintained depth only differs from the authorized channel level in areas in which the channel bottom is composed of rock or otherwise hard material. In rock-bottomed or hard-bottomed areas, an additional 2 feet of safety clearance is required. The total (dredged) depth of the channel is the sum of the authorized channel level and the dredging tolerance (paid overdepth).

Table 17 contains the inputs and results of the benefit-cost analysis conducted in Phase I. The total formulation costs for deepening in Phase I range from $406.3 million, for deepening the pathways from sea to Port Jersey - Port Authority Marine Terminal by 2 feet, to $5,660.4 million ($5.6 billion) for deepening the pathway from sea to Elizabeth - Port Authority Marine Terminal by 7 feet, or $15.1 million to $36.9 million annually, respectively. Of the alternatives considered in Phase I, deepening the pathway from sea to Elizabeth - Port Authority Marine Terminal by 4 feet maximizes net benefits. With an average annual equivalent cost of $159.6 million and an average annual equivalent benefit of $237.6 million, deepening the pathway from sea to Elizabeth - Port Authority Marine Terminal by 4 feet is estimated to yield net benefits of $78.0 million and have a benefit-to-cost ratio of 1.5. Therefore, deepening the pathway from sea to Elizabeth - Port Authority Marine Terminal by 4 feet to a maintained depth of -54 feet MLLW is selected as the first added increment.

Table 18: Phase I Alternative Costs and Benefits

ALTERNATIVE		FORMULATION COST		BENEFITS		BENEFIT-COST RATIO
		TOTAL INVESTMENT1	ANNUALIZED2	ANNUALIZED	NET	
PATHWAY FROM SEA TO PORT JERSEY-PORT AUTHORITY MARINE TERMINAL						
Alt 1a	No Action	--	--	--	--	--
Alt 1b	Deepen by 2 feet	$406.3 million	$15.1 million	$34.2 million	$19.0 million	2.3
Alt 1c	Deepen by 3 feet	$485.5 million	$18.0 million	$49.6 million	$31.5 million	2.8
Alt 1d	Deepen by 4 feet	$571.6 million	$21.2 million	$65.1 million	$43.8 million	3.1
Alt 1e	Deepen by 5 feet	$657.0 million	$24.3 million	$66.9 million	$42.4 million	2.7
Alt 1f	Deepen by 6 feet	$819.2 million	$30.3 million	$66.9 million	$36.4 million	2.2
Alt 1g	Deepen by 7 feet	$997.3 million	$36.9 million	$66.9 million	$29.8 million	1.8
PATHWAY FROM SEA TO ELIZABETH-PORT AUTHORITY MARINE TERMINAL						
Alt 2a	No Action	--	--	--	--	--
Alt 2b	Deepen by 2 feet	$3,351.5 million	$128.3 million	$130.5 million	$2.2 million	1.0
Alt 2c	Deepen by 3 feet	$3,749.9 million	$143.0 million	$184.0 million	$41.0 million	1.3
Alt 2d	**Deepen by 4 feet**	**$4,195.8 million**	**$159.6 million**	**$237.6 million**	**$78.0 million**	**1.5**
Alt 2e	Deepen by 5 feet	$4,656.9 million	$176.6 million	$243.9 million	$67.3 million	1.4
Alt 2f	Deepen by 6 feet	$5,206.6 million	$197.0 million	$243.9 million	$46.9 million	1.2
Alt 2g	Deepen by 7 feet	$5,660.4 million	$213.8 million	$243.9 million	$30.1 million	1.1

Fiscal Year 2020 price level and 2.75% discount rate

[1]Total investment costs include the cost of mobilization, demobilization, the berth deepening associated cost, and the first cost contingency.

2The annualized costs includes the annual cost of operation and maintenance ($136 thousand for the Pathway to Port Jersey alternatives; $4.1 million for Pathway to Port Elizabeth alternatives)

4.7.2: Phase II: Determine Second Added Increment

Phase II of the plan formulation strategy is to assume the pathway selected in Phase I – sea to Elizabeth - Port Authority Marine Terminal – is constructed and to calculate the incremental costs and benefits for deepening the remaining pathway – sea to Port Jersey - Port Authority Marine Terminal – foot by foot. The team selects the depth that results in the highest net benefits as the second added increment.

The difference between Phase I and Phase II is that Phase II assumes that the pathway from sea to Elizabeth – Port Authority Marine Terminal has already been deepened by 4 feet to maintained depth of -54 feet MLLW. Therefore, when calculating the costs to deepen the pathway from sea to Port Jersey – Port Authority Marine Terminal by 2 to 4 feet in Phase II, the costs only include the cost to deepen from mid-Anchorage Channel to Port Jersey - Port Authority Marine Terminal. It is assumed the costs to deepen the pathway from sea to Elizabeth – Port Authority Marine Terminal, which includes Ambrose Channel, part of Anchorage Channel, the Kill Van Kull, and Newark Bay Channel, by 4 feet are sunk as this pathway was already constructed. The Phase II alternatives that involve deepening from sea to Port Jersey – Port Authority Marine Terminal beyond 4 feet therefore include the costs to deepen from sea to mid-Anchorage Channel by the incremental depth; for example, the Phase II alternative pathway from sea to Port Jersey – Port Authority Marine Terminal being deepened by 6 feet includes the cost of deepening the from sea to mid-Anchorage Channel by 2 feet and deepening from mid-Anchorage Channel to Port Jersey – Port Authority Marine Terminal by 6 feet.

Table 19 contains the inputs and results of the benefit cost analysis conducted in Phase II. The incremental total formulation costs for deepening the pathway from sea to Elizabeth – Port Authority Marine Terminal range from $245.6 million for deepening by 2 feet to $558.8 million for deepening by 7 feet, or $9.2 million to $20.8 million annually, respectively.

Of the alternatives considered in Phase II, deepening the pathway from sea to Port Jersey – Port Authority Marine Terminal by 4 feet maximizes incremental net benefits. With an annual cost of $10.7 million and an annual benefit of $65.1 million, deepening the pathway from sea to Port Jersey - Port Authority Marine Terminal by 4 feet is estimated to yield net benefits of $54.4 million and have a benefit-to-cost ratio of 6.1. Therefore, deepening the pathway from sea to Port Jersey - Port Authority Marine Terminal by 4 feet is selected as the second added increment.

Table 19: Phase II Incremental Alternative Costs and Benefits

ALTERNATIVE		FORMULATION COST		BENEFITS		BENEFIT-COST RATIO
		TOTAL INVESTMENT[1]	ANNUALIZED[2]	ANNUALIZED	NET	
PATHWAY FROM SEA TO PORT JERSEY-PORT AUTHORITY MARINE TERMINAL						
Alt 2a	No Action	--	--	--	--	--
Alt 2b	Deepen by 2 feet	$245.6 million	$9.2 million	$34.2 million	$24.9 million	3.7
Alt 2c	Deepen by 3 feet	$265.7 million	$10.0 million	$49.6 million	$39.7 million	5.0
Alt 2d	**Deepen by 4 feet**	**$286.3 million**	**$10.7 million**	**$65.1 million**	**$54.4 million**	**6.1**
Alt 2e	Deepen by 5 feet	$342.3 million	$12.8 million	$66.9 million	$54.0 million	5.2
Alt 2f	Deepen by 6 feet	$436.5 million	$16.3 million	$66.9 million	$50.5 million	4.1
Alt 2g	Deepen by 7 feet	$558.8 million	$20.8 million	$66.9 million	$46.0 million	3.2

Fiscal Year 2020 price level and 2.75% discount rate

[1] Total investment costs include the cost of mobilization, demobilization, the berth deepening associated cost, and the first cost contingency.

[2] The annualized costs includes the annual cost of operation and maintenance ($136 thousand for the Pathway to Port Jersey alternatives; $4.1 million for Pathway to Port Elizabeth alternatives)

4.7.3: Phase III: Add Additional Efficiency Components

Originally, three efficiency components were considered. After coordinate with local pilots and further analyses, it was determined that two of the efficiency components are actually necessary general navigation features. Thereafter, one efficiency component was evaluated at the eastern entrance of the Kill Van Kull. This component is a widening that would allow vessels to meet and pass other vessels and would allow for vessels to be closer to the Kill Van Kull as they wait for other vessels to transit the channel. This component is indicated by an orange polygon in Figure 14.

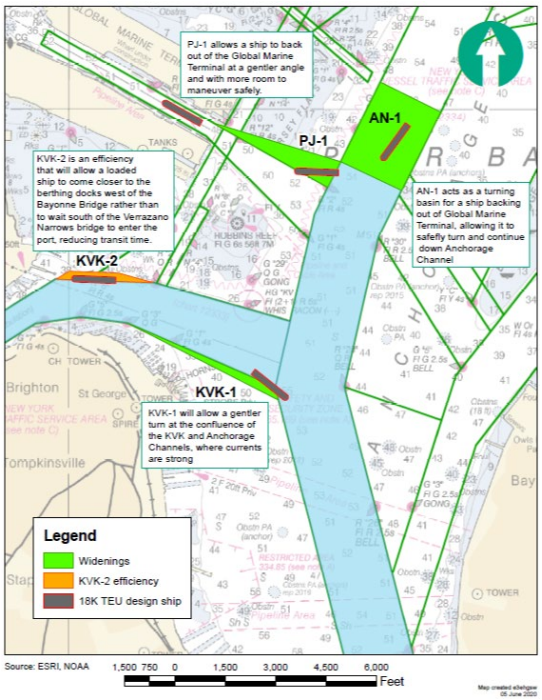


Figure 14: Efficiency Component (orange) at Eastern End of Kill Van Kull

Table 20 contains the inputs and results of the benefit-cost analysis conducted in Phase III. The efficiency component is not economically justified with a cost a benefit-to-cost ratio of 0.34.

Table 20: Phase III Costs and Benefits

ALTERNATIVE	FORMULATION COST		BENEFITS		BENEFIT-COST RATIO
	TOTAL *	ANNUALIZED	ANNUALIZED	NET	
Kill Van Kull Meeting and Passing Zone	$28.9 million	$1.1 million	$367.0 thousand	-$707.0 thousand	0.34

The final step of the plan formulation process is determining the most economically efficient alternative combination with most net benefits (the national economic development plan) and selecting the plan for recommendation (Tentatively Selected Plan). Evaluating the focused array of alternatives and determining the Tentatively Selected Plan is described in the following section.

4.8: Evaluation and Comparison of the Focused Array of Alternative Plans

The focused array of alternatives was developed with economically justified components that are estimated to provide the most net benefits from the incremental analysis presented above. The components that are shown to be producing the most net benefits are deepening the pathway to Elizabeth – Port Authority Marine Terminal by 4 feet, deepening the pathway to Elizabeth – Port Authority Marine Terminal by 5 feet, deepening the pathway to Port Jersey – Port Authority Marine Terminal by 4 feet, and deepening the pathway to Port Jersey – Port Authority Marine Terminal by 5 feet. Various combinations of these components make up the focused array of alternatives (Table 21).

The below Principles and Guidelines Criteria and Accounts were used to evaluate and compare the array of alternative plans.

Principles and Guidelines Criteria

- Completeness
- Effectiveness
- Efficiency
- Acceptability

Principles and Guidelines Accounts

- National Economic Development
- Regional Economic Development
- Other Social Effects
- Environmental Quality

Table 21: Summary Economics of Focused Array of Alternatives

	ALTERNATIVE	TOTAL INVESTMENT COST[1]	TOTAL ANNUALIZED COST[2]	ANNUAL BENEFITS	NET BENEFITS	BENEFIT-COST RATIO
A	No Action	$0	$0	$0	$0	--
B	Deepen Pathway to EPAMT 4’	$4.2 billion	$159.6 million	$237.6 million	$78.0 million	1.5
C	Deepen Pathway to PJPAMT by 4’	$571.6 million	$21.2 million	$65.1 million	$43.8 million	3.1
D	Deepen Pathway to EPAMT by 4’ and PJPAMT by 4’	$4.48 billion	$170.3 million	$302.7 million	$132.4 million	1.8
E	Deepen Pathway to EPAMT by 4’ and PJPAMT by 5’	$4.54 billion	$172.4 million	$304.4 million	$132.1 million	2.2
F	Deepen Pathway to EPAMT by 5’ and PJPAMT by 5’	$5.0 billion	$189.3 million	$310.8 million	$121.5 million	1.6

Fiscal Year 2020 price level and 2.75% discount rate
EPAMT = Elizabeth Port Authority Marine Terminal, PJPAMT = Port Jersey - Port Authority Marine Terminal
[1]Total investment costs include the cost of mobilization, demobilization, the berth deepening associated cost, and the first cost contingency.
[2]The annualized costs includes the annual cost of operation and maintenance ($136 thousand for the Pathway to Port Jersey alternatives; $4.1 million for Pathway to Port Elizabeth alternatives)

The Federal Objective

Per the 1983 Principles and Guidelines by the U. S. Water Resources Council, the federal objective of water and related land resources project planning is to “contribute to national

economic development consistent with protecting the Nations' environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements" (U.S. Water Resources Council, 1983).

The 1983 Principles and Guidelines require that plans are formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. For ease of comparison, the average annual equivalent costs and benefits for the focused array of alternatives are presented in Table 26. The study team carefully analyzed and compared all of the alternatives for completeness, their effectiveness at alleviating navigation inefficiencies, their benefits and costs, and their legality (Table 27).

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. All the alternatives in the focused array were evaluated with consideration of necessary investments and other actions. The plans were looked at for environmental, vessel traffic, and cultural resource impacts, as well as the costs associated with mitigating those impacts and acquiring the required real estate for implementation. Therefore, all actionable alternatives considered as part of the focused array are complete.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. All the actionable alternatives in the final array alleviate the problem of inefficiencies due to depth and width limitations and achieve the study objectives to improve navigational efficiencies related to depth and width limitations in the existing federal navigation channel. Therefore, all actionable alternatives considered as part of the focused array are effective.

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 benefit cost ratios, improved navigation efficiencies, and benefits from the project. This preliminary analysis indicated that all alternatives in the focused array are economically justified and efficient, but Alternative D produces the most net benefits.

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. All alternatives considered as part of the focused array are acceptable.

Table 22: Summary Principles and Guidelines Criteria on the Focused Array of Alternatives

	ALTERNATIVE	COMPLETE	EFFECTIVE	EFFICIENT	ACCEPTABLE
A	No Action	N	N	N	Y
B	Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 4'	Y	Y	Y	Y
C	Deepen Pathway to Port Jersey – Port Authority Marine Terminal by 4'	Y	Y	Y	Y
D	Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 4' and Port Jersey – Port Authority Marine Terminal by 4'	Y	Y	Y	Y
E	Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 4' and Port Jersey – Port Authority Marine Terminal by 5'	Y	Y	Y	Y
F	Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 5' and Port Jersey – Port Authority Marine Terminal by 5'	Y	Y	Y	Y

Economic, Environmental, and Other Social Effects

The 1983 Principles and Guidelines also requires that study alternatives be evaluated under the following accounts:

National Economic Development (NED): National economic development effects are changes in the economic value of the National output of goods and services. Alternative A, No Action does not contribute to national economic development. All of the other alternatives contribute to national economic development in various amounts, with Alternative D marginally contributing the most.

Regional Economic Development (RED): Regional economic development effects are the impact of project spending, either directly or indirectly, on the local economy. Besides Alternative A, implementation of the any of these alternatives could induce regional economic development benefits in the area as residents and business owners are dependent on the port for jobs, and for importing and exporting goods and products. The Port of New York and New Jersey is a crucial driver for the availability of jobs in the region and a high standard of living afforded by these jobs. A study by the North Jersey Transportation Planning Authority reported that the Port of New York and New Jersey directly supports 229,000 workers and indirectly supports 171,000 jobs associated with the port (Cushman & Wakefield Research 2018). The port is responsible for $25.7 billion in personal income and $64.8 billion in business income in the region. Alternatives B through F support the continued economic vitality in the availability of jobs and the high standard of living that is derived from this robust facet of industry. However, Alternatives D, E, and F support the continued economic vitality more than the others because more terminals are benefiting from the plans.

Environmental Quality (EQ): Environmental quality is the non-monetary beneficial effects on significant natural and cultural resources. The categories that make up environmental quality are considered for each alternative in Table 24 and Table 25 using the definitions in Table 23.

Table 23: Defining Criteria for Scale of Impacts

IMPACT SCALE	CRITERIA
No Effect	The resource area would not be affected and there would be no impact.
Negligible	Changes would either be non-detectable or, if detected, would have effects that would be slight and local. Impacts would be well below regulatory standards, as applicable.
Minor	Changes to the resource would be measurable, but the changes would be small and localized. Impacts would be within or below regulatory standards, as applicable. Mitigation measures would reduce any potential adverse effects.
Moderate	Changes to the resource would be measurable and could have either localized or regional scale impacts. Impacts would be within or below regulatory standards, but historical conditions would be altered on a short-term basis. Mitigation measures would be necessary, and the measures would reduce any potential adverse effects.
Major	Changes to the resource would be readily measurable and would have substantial consequences on regional levels. Impacts would exceed regulatory standards. Mitigation measures to offset the adverse effects would be required to reduce impacts, though long-term changes to the resource would be expected.

Table 24: Scale of Final Array's Impacts to Environmental Quality/Resources
(Note this table spans two pages)

	ALTERNATIVES					
	A- No Action	B- Deepen Pathway to EPAMT by 4'	C- Deepen Pathway to PJPAMT by 4'	D- Deepen Pathway to EPAMT by 4' and PJPAMT by 4'	E- Deepen Pathway to EPAMT by 4' and PJPAMT by 5'	F- Deepen Pathway to EPAMT by 5' and PJPAMT by 5'
Water resources & quality	Temporary, Negligible to Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor
Vegetation	Temporary, Negligible to Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor
Essential Fish Habitat	Temporary, Negligible to Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor
Wildlife	Temporary, Negligible to Minor	Temporary to Permanent, Minor	Temporary to Permanent, Minor	Temporary to Permanent, Minor	Temporary to Permanent, Minor	Temporary to Permanent, Minor
Cultural resources	No Effect	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor

	ALTERNATIVES					
	A- No Action	B- Deepen Pathway to EPAMT by 4'	C- Deepen Pathway to PJPAMT by 4'	D- Deepen Pathway to EPAMT by 4' and PJPAMT by 4'	E- Deepen Pathway to EPAMT by 4' and PJPAMT by 5'	F- Deepen Pathway to EPAMT by 5' and PJPAMT by 5'
Air quality	No Effect	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor
Topography / Bathymetry	Permanent, Negligible to Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor	Permanent, Minor
HTRW	No Effect	Temporary, Negligible	Temporary, Negligible	Temporary, Negligible	Temporary, Negligible	Temporary, Negligible

EPAMT = Elizabeth – Port Authority Marine Terminal
PJPAMT= Port Jersey – Port Authority Marine Terminal

Table 25: Scale of Final Array's Impacts to Socioeconomic Resources

	ALTERNATIVES					
	A- No Action	B- Deepen Pathway to EPAMT by 4'	C- Deepen Pathway to PJPAMT by 4'	D- Deepen Pathway to EPAMT by 4' and PJPAMT by 4'	E- Deepen Pathway to EPAMT by 4' and PJPAMT by 5'	F- Deepen Pathway to EPAMT by 5' and PJPAMT by 5'
Recreation	Temporary, Negligible	Temporary, Negligible to Minor	Temporary, Negligible to Minor	Temporary, Negligible to Minor	Temporary, Negligible to Minor	Temporary, Negligible to Minor
Aesthetics	Permanent, Negligible	Permanent, Negligible to Minor	Permanent, Negligible to Minor	Permanent, Negligible to Minor	Permanent, Negligible to Minor	Permanent, Negligible to Minor
Environmental Justice	No Effect	No Effect	No Effect	No Effect	No Effect	No Effect
Noise and Vibration	No Effect	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor	Temporary, Minor

EPAMT = Elizabeth – Port Authority Marine Terminal
PJPAMT= Port Jersey – Port Authority Marine Terminal

Other Social Effects (OSE): Other social effects include the effects that are not covered in the NED, RED, and EQ. This account includes things such as community impacts, health and safety, and displacement. In the future with-project condition, the Port of New York – New Jersey maintains its place amongst the lower cost and highest volume routes. The least cost access for import and export activities is a decision factor for businesses currently residing in the port's hinterlands and for businesses considering relocation to the port's hinterlands. For firms operating on thin margins such as light industry, transportation (transaction) cost plays an important role in the long-term decisions of a firm. Survey evidence suggests that stability of transportation costs and shipping time/customer proximity are two important factors in the decisions of firms considering relocating to the United States (Tate, Ellram, Schoenherr, &

Petersen, 2014). Alternatives B through E support the region's ability to retain and attract business; however, Alternatives D, E, and F provide better support than the others because more terminals would benefit from the plans.

4.8.2: Trade-off Analysis

The implementation of any of the three focused array alternatives with the highest net benefits, Alternative D – Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 4 feet and Port Jersey – Port Authority Marine Terminal by 4 feet, Alternative E – Deepen Pathway to Elizabeth – Port Authority Marine Terminal by 4 feet and Port Jersey – Port Authority Marine Terminal by 5 feet, and Alternative F – Deepen Pathway to Elizabeth - Port Authority Marine Terminal by 5 feet and Port Jersey – Port Authority Marine Terminal by 5 feet, would have tradeoffs. Alternative E and F are estimated to produce more benefits than Alternative D because they would allow vessels to draft deeper; Alternative E would allow vessels heading to and from Port Jersey - Port Authority Marine Terminal to draft deeper than Alternative D, while Alternative F would allow vessels heading to and from both Port Jersey – Port Authority Marine Terminal and Elizabeth – Port Authority Marine Terminal to draft deeper than Alternative D. However, because these alternatives are larger, they cost more than Alternative D and are estimated to produce fewer net benefits than Alterative D. Additionally, Alternatives E and F would have more of an environmental impact than Alternative D in the short term. In the long term, deeper channels will allow for vessels to load more efficiently and may result in a decrease in vessel calls, improving air quality.

Chapter 5: Tentatively Selected Plan*

The preliminary analysis presented in Chapter 4 identified Alternative D – deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey - Port Authority Marine Terminal by 4 feet (to a maintained depth of -54 feet MLLW[1]) as the national economic development plan because it maximizes net benefits. Alternative E – deepening the pathways to Elizabeth – Port Authority Marine Terminal by 4 feet (to a maintained depth of -54 feet MLLW) and Port Jersey – Port Authority Marine Terminal by 5 feet (to a maintained depth of -55 feet MLLW), and Alternative F – deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 5 feet (to a maintained depth of -55 feet MLLW) also have considerable net benefits that are close to the net benefits provided by Alternative D. Further refinement of quantities, cost calculation assumptions, and benefit calculation assumptions may affect the alternative that produces the most net benefits. The national economic development plan is subject to change as a result of further analyses and assumption refinements that will take place subsequent to the release of this draft integrated report (see Section 5.4: Uncertainty and Additional Analyses).

Therefore, this draft integrated report presents the Tentatively Selected Plan as deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by *up to* 5 feet (up to -55 feet MLLW). The Tentatively Selected Plan involves deepening Ambrose Channel, Anchorage Channel, the Kill Van Kull, Newark Bay Channel, South Elizabeth Channel, Elizabeth Channel, and Port Jersey Channel. This Tentatively Selected Plan includes the additional width required for structural stability and for the navigation of the design vessel – with a length of 1,308.0 feet and beam of 193.5 feet – to transit from sea to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal. Channel configurations were designed to avoid and minimize environmental and cultural resource impacts while still meeting navigation safety requirements. The Tentatively Selected Plan reflects the least cost dredged material placement plan, which includes beneficially using dredged material by placing it either upland, at the HARS, or on a reef.

After the Tentatively Selected Plan was selected, quantities and cost estimates were refined for deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet and 5 feet; cost and quantity values from here forward reflect these refinements. The differences in the footprints between the deepening the pathways by 4 feet (to a maintained depth of -54 feet MLLW) and 5 feet (to a maintained depth of -55 feet MLLW) is minimal; therefore, the representation of the extent of the widening for all deepening in Figure 16 and Figure 15 is representative of both deepening by 4 feet (to a maintained depth of -54 feet MLLW) or by 5 feet (to a maintained depth of -55 feet MLLW). The dimensions, characteristics, and dredged material composition for a 4-foot deepening to a maintained depth of -54 feet MLLW are displayed in Table 26 and Table 27. The dimensions, characteristics, and dredged material composition for a 5-foot deepening to a maintained depth of -55 feet MLLW are displayed in Table 28 and Table 29. Please note that the maintained depth, authorized channel level, and total (dredged) depth of the various channels may differ. The authorized

[1] In the future with- and without-project conditions, Ambrose Channel is consistently maintained 3 feet deeper reflecting underkeel clearance allowances for wave action.

channel level is used as it is defined in Engineering Regulation 1110-2-1613, and reflects the loaded summer saltwater draft of the design vessel together with gross underkeel clearance (including allowances for squat, salinity, wave motion, and safety clearance). Maintained depth is understood in relation to the authorized channel level. The maintained depth only differs from the authorized channel level in areas in which the channel bottom is composed of rock or otherwise hard material. In rock-bottomed or hard-bottomed areas, an additional 2 feet of safety clearance is required. The total (dredged) depth of the channel is the sum of the authorized channel level and the dredging tolerance (paid overdepth). See Appendix B1 – Channel Design for more details on the design.

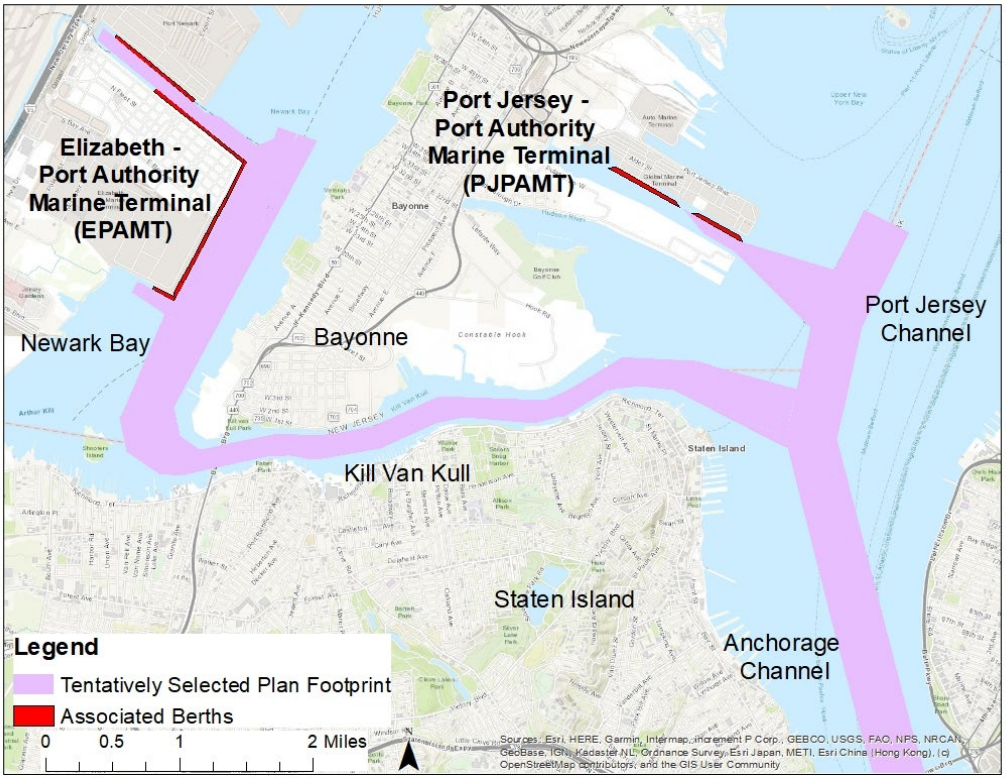


Figure 15: Tenatively Selected Plan – Inner Harbor

Figure 16: Tenatively Selected Plan – From Sea to Ports

Table 26: Deepen Pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to -54 feet MLLW – Dimensions and Characteristics

	Proposed Maintained Channel Level[a] [ft MLLW]	Proposed Authorized Channel Level[b] [ft MLLW]	Total Depth[c] [ft MLLW]	Length of Improve-ment [ft]	Quantity to be Dredged (cy)	Channel Bottom Width	Predominant Side Slope	Predominant Channel Bottom Material Type
Ambrose Channel	-57	-57	-58	89,510	4,137,000	2,000	3:1	Sand
Anchorage Channel	-54	-54	-55.5	31,262	2,551,000	2,000	3:1	Sand
Port Jersey Channel	-54	-56	-57.5	5,960	2,744,000	450 to 2,313	3:1/1:1 against berths	Sand/sediment
Kill Van Kull	-54	-56	-57.5	28,047	3,237,000	800 to 2,313	3:1/1:1 through rock	HARS suitable material & moderately hard rock and till
Newark Bay	-54	-56	-57.5	12,860	13,181,000	1,740 to 2,008	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till
South Elizabeth Channel	-54	-56	-57.5	1,586	379,170	500 to 640	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till
Port Elizabeth Channel	-54	-56	-57.5	7,689	855,000	500 to 750	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till

[a]Maintained channel level includes the summer salt water draft, squat, salinity, wave motion, and safety clearance. The channels will be maintained at this depth.
[b]The authorized channel level includes additional safety clearance needed for hard bottom.
[c]The total depth includes an additional dredging tolerance (paid overdepth). This is the sum of the depths and specific to each plan.

Table 27: Deepen Pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to -54 feet MLLW – Quantities (Cubic Yards)

	Ambrose Channel	Anchorage Channel	Port Jersey Channel	Kill Van Kull	Newark Bay	S. Elizabeth Channel	Elizabeth Channel	TOTAL (cubic yards)
HARS suitable sand (HARS placement)	4,137,000	2,076,000	1,420,000	438,000	1,042,000	--	--	9,113,000
Non-HARS suitable sand/ sediment (upland placement)	--	475,000	1,324,000	80,000	5,062,000	152,000	725,000	7,818,000
Moderately Hard Rock/Till[1] (HARS placement)	--	--	--	1,764,000	5,115,000	163,000	99,000	7,141,000
"Harder" Rock[2]	--	--	--	605,000	7,000	--	--	612,000
"Hardest" Rock[3] (reef placement)	--	--	--	350,000	1,955,000	65,000	31,000	2,401,000
Total Quantity to be Dredged	**4,137,000**	**2,551,000**	**2,744,000**	**3,237,000**	**13,181,000**	**379,000**	**855,000**	**27,084,000**

Values may appear off due to rounding.
[1] Pleistocene silt, clay, sand, and gravel, [2] Schist, serpentenite, [3] Diabase, sandstone, and other rock

Table 28: Deepen Pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 5 feet to -55 feet MLLW – Dimensions and Characteristics

	Proposed Maintained Channel Level[a] [ft MLLW]	Proposed Authorized Channel Level[b] [ft MLLW]	Total Depth[c] [ft MLLW]	Length of Improve-ment [ft]	Quantity to be Dredged (cy)	Channel Bottom Width	Predominant Side Slope	Predominant Channel Bottom Material Type
Ambrose Channel	-58	-58	-59	90,000	6,389,000	2,000	3:1	Sand
Anchorage Channel	-55	-55	-56.5	31,000	3,800,000	2,000	3:1	Sand
Port Jersey Channel	-55	-57	-58.5	6,000	3,003,000	450 to 2,313	3:1/1:1 against berths	Sand/sediment
Kill Van Kull	-55	-57	-58.5	28,000	4,451,000	800 to 2,313	3:1/1:1 through rock	HARS suitable material & moderately hard rock and till
Newark Bay	-55	-57	-58.5	13,000	14,148,000	1,740 to 2,008	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till
South Elizabeth Channel	-55	-57	-58.5	2,000	423,000	500 to 640	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till
Port Elizabeth Channel	-55	-57	-58.5	8,000	1,024,000	500 to 750	3:1/1:1 through rock & against berths	Non-HARS suitable material & moderately hard rock and till

[a]Maintained channel level includes the summer salt water draft, squat, salinity, wave motion, and safety clearance. The channels will be maintained at this depth.
[b]The authorized channel level includes additional safety clearance needed for hard bottom.
[b]The total depth includes an additional dredging tolerance (paid overdepth). This is the sum of the depths and specific to each plan.

Table 29: Deepen Pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 5 feet to -55 feet MLLW – Quantities (Cubic Yards)

	Ambrose Channel	Anchorage Channel	Port Jersey Channel	Kill Van Kull	Newark Bay	S. Elizabeth Channel	Elizabeth Channel	TOTAL (cubic yards)
HARS suitable sand (HARS placement)	6,389,000	3,155,000	1,635,000	596,000	1,065,000	--	--	12,840,000
Non-HARS suitable sand/ sediment (upland placement)	--	645,000	1,368,000	87,000	5,215,000	169,000	842,000	8,326,000
Moderately Hard Rock/Till[1] (HARS placement)	--	--	--	2,402,000	5,614,000	176,000	138,000	8,330,000
"Harder" Rock[2]	--	--	--	819,000	11,000	--	--	830,000
"Hardest" Rock[3] (reef placement)	--	--	--	547,000	2,242,000	78,000	43,000	2,910,000
Total Quantity to be Dredged	**6,389,000**	**3,800,000**	**3,003,000**	**4,451,000**	**14,148,000**	**423,000**	**1,024,000**	**33,238,000**

Values may appear off due to rounding.
[1] Pleistocene silt, clay, sand, and gravel, [2] Schist, serpentenite, [3] Diabase, sandstone, and other rock

5.1: Refined Costs

The costs for the deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to a maintained depth of -54 feet MLLW and by 5 feet to a maintained depth of -55 feet MLLW were updated subsequent to the plan selection and quantity refinements. The anticipated volume of maintenance dredging for each channel is calculated based on the estimated rate of sedimentation observed from past operation and maintenance of the harbor applied to any portions of the channel to be widened as part of this project. Consistent with current New York District practice, the Port Jersey channel is anticipated to be maintained by dredging every 10 years, the Anchorage Channel to be maintained every seven years, and all other channels are assumed to be maintained together in a single contract every three years. The present value of the anticipated operation and maintenance costs are estimated to be $8.2 million for the 4 foot deepening plan and $7.8 million for the 5 foot deepening plan. Total costs and average annual equivalent costs are presented in Table 30 and Table 31, respectively.

Table 30: Tentatively Selected Plan Total Costs

ACCOUNT		DEEPEN PATHWAYS TO ELIZABETH-PORT AUTHORITY MARTINE TERMINAL AND PORT JERSEY-PORT AUTHORITY MARINE TERMINAL BY 4 FEET TO -54 FEET MLLW	DEEPEN PATHWAYS TO ELIZABETH-PORT AUTHORITY MARTINE TERMINAL AND PORT JERSEY-PORT AUTHORITY MARINE TERMINAL BY 5 FEET TO -55 FEET MLLW
Project First Cost			
01	LANDS AND DAMAGES	$0.6 million	$1.0 million
02	RELOCATIONS	$327.7 million	$327.7 million
06	FISH & WILDLIFE FACILITIES	$16.0 million	$16.4 million
12	NAVIGATION PORTS & HARBORS	$3,052.6 million	$3,267.6 million
18	CULTURAL RESOURCE PRESERVATION	$3.1 million	$3.1 million
30	PLANNING, ENGINEERING & DESIGN	$301.9 million	$321.4 million
31	CONSTRUCTION MANAGEMENT	$108.1 million	$115.1 million
Total Project First Costs		**$3,810.0 million**	**$4,052.3 million**
Associated Costs (Other Non-Federal Cost)[2]			
12	Navigation Aids[1]	$0	$0
12	Local Service Facilities[2]	$169.9 million	$184.0 million
Total Economic Cost		**$3,979.9 million**	**$4,236.3 million**

Fiscal Year 2021 Price Level and discount rate of 2.5%
[1] Responsibility of another Federal Agency (i.e. U.S. Coast Guard)
[2] Associated financial costs not part of the recommended Federal project but are necessary non-Federal responsibility
Note: Totals may appear off due to rounding

Table 31: Average Annual Equivalent Costs

	DEEPEN PATHWAYS TO ELIZABETH-PORT AUTHORITY MARTINE TERMINAL AND PORT JERSEY-PORT AUTHORITY MARINE TERMINAL BY	
	4 FEET TO -54 FEET MLLW	5 FEET TO -55 FEET MLLW
AAEQ Investment Cost	$160.5 million	$173.0 million
AAEQ Operation and Maintenance Cost	$8.2 million	$7.8 million
Total AAEQ Costs	$168.7 million	$180.7 million

Fiscal Year 2021 Price Level and discount rate of 2.5%

5.2: Benefits

The Tentatively Selected Plan of deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet to a maintained depth of -54 feet MLLW and by 5 feet to a maintained depth of -55 feet MLLW would allow for currently-calling vessels to increase their loads and allow larger vessels to call at the Port of New York and New Jersey. The increase in cargo per vessel call yields economic benefits by allowing for more efficient use of containerships. The average annual equivalent benefits and the benefit-to-cost ratio for both plans are presented in Table 32.

Table 32: Average Annual Equivalent (AAEQ)Benefits

	DEEPEN PATHWAYS TO ELIZABETH-PORT AUTHORITY MARTINE TERMINAL AND PORT JERSEY-PORT AUTHORITY MARINE TERMINAL BY	
	4 FEET TO -54 FEET MLLW	5 FEET TO -55 FEET MLLW
AAEQ Benefits	$329.1 million	$340.1 million
Total AAEQ Costs	$168.7 million	$180.7 million
AAEQ Net Benefits	$160.4 million	$159.3 million
Benefit Cost Ratio	2.0	1.9
Economically Justified?	Yes	Yes

Fiscal Year 2021 Price Level and discount rate of 2.5%

5.3: Economic, Environmental, and Other Social Effects

5.3.1: Other Social Effects: Health and Safety

In the future without-project condition, it is reasonable to consider a situation where carriers adjust routes that take advantage of other ports that have greater depth available than the Port of New York and New Jersey. This may take the form of reversing the route so that vessels of the *Triple E* class could transit the Port of New York and New Jersey light loaded or skip the Port of

New York and New Jersey altogether. In either situation, the least-cost method of the transportation of goods with a destination in the outer region of the port's hinterland may shift to the use of deeper ports and traveling greater distances on land. In the future without-project condition, the least-cost port of call shifts to realize the economies of scale made available through loading larger vessels to capacity. Such a change in conditions would require additional truck or train miles to carry the freight from the farther port to the destination.

The risk of accidents involving tractor trailers is consequently potentially lower in the future with-project condition than the future without-project condition. An increase in average trucking miles translates to higher risk of accidents. Accidents involving trucks involve vulnerabilities that lead to high rates of fatalities. Trucks are much heavier, taller, and have greater ground clearance which can result in cars wedging beneath a truck in an accident. Loaded trucks also require much further distance than cars to stop. Compounded with the risk of driver fatigue, accidents involving trucks result in many fatalities each year. In 2018, 4,136 traffic-related fatalities involved a large truck, which make up 11% of all traffic related fatalities that year[1]. However, large trucks represented approximately 9.4% of highway miles driven in 2018[2]. The overrepresentation of large trucks in traffic-related fatalities demonstrates the perils of highway freight transportation. With the tentatively selected plan in place, it is expected that fewer highway miles would be driven, reducing the exposure of the region to traffic-related fatalities involving large trucks.

The risk of air pollution (and coincident health effects) associated with tractor trailers and train engines is potentially lower in the future with-project condition than the future with-project condition. This risk differential follows similar logic to the above conclusion. Should the least-cost port of call shift and require greater distance to be traveled over land to carry the freight to its destination, there may be a subsequent increase in the risk of air pollution and the coincident health effects. The air pollution is particularly troublesome for respiratory problems given the higher incidence of oxides of nitrogen and particulate matter associated with diesel emissions relative to vehicles with gasoline engines. Research shows that intermodal transportation methods or methods dependent on sea-based container vessels produce less emissions than transportation methods that rely on large trucks alone (Comer, et al., 2010; Fan, Perry, Klemes, & Lee, 2018; Fan, Perry, Klemes, & Lee, 2018). In fact, Fan and Wee (2018) find that intermodal transportation methods are the most economically efficient for intermodal methods inclusive of sea-based container vessels, and emissions are decreasing per kilometer-tonne of freight with the size of the container vessel[3]. This research suggests that a greater dependence on large trucks for distribution networks in the without-project condition will result in greater carbon emissions. Such emissions include diesel particulate matter which is a majority contributor to airborne particulate matter, and such matter is known to be responsible for causing respiratory mortality and morbidity (Robinson, Grieshop, Donahue, & Hunt, 2010; Pope III & Dockery, 2006). As such, the exposure in the region to respiratory mortality and morbidity conditional on diesel emissions resulting from the transportation of containers is lower with the

[1] Source: https://www.iihs.org/topics/fatality-statistics/detail/large-trucks

[2] Source: https://www.fhwa.dot.gov/policyinformation/statistics/2018/vm1.cfm

[3] The only method more environmentally efficient in terms of carbon emissions is transport by electric train in the case that the electricity is generated using nuclear energy.

tentatively selected plan implemented.

5.3.2: Other Social Effects: Economic Vitality

The investment in the New York and New Jersey Harbor supports the economic vitality of the region through the continued economic development and investment that has occurred in the communities that are economically tied to the harbor. Economic vitality relates to the ability of a community to retain and attract businesses, the availability to provide employment opportunities for residents, a person or group's standard of living, and the local tax base and coinciding ability to provide municipal services. Each of these components of economic vitality are supported through the New York – New Jersey Harbor Deepening Channel Improvements Tentatively Selected Plan. With the tentatively selected plan in place, the Port of New York and New Jersey is expected to remain among the busiest ports in the nation and the first port of call for the largest vessels calling the East Coast.

In the future with-project condition, the Port of New York – New Jersey maintains its place amongst the lower cost and highest volume routes. The least cost access for import and export activities is a decision factor for businesses currently residing in the port's hinterlands and for businesses considering relocation to the port's hinterlands. For firms operating on thin margins such as light industry, transportation (transaction) cost plays an important role in the long-term decisions of a firm. Survey evidence suggests that stability of transportation costs and shipping time/customer proximity are two important factors in the decisions of firms considering relocating to the United States (Tate, Ellram, Schoenherr, & Petersen, 2014). The tentatively selected plan therefore supports the region's ability to retain and attract business.

The Port of New York and New Jersey is a crucial driver for the availability of jobs in the region and a high standard of living afforded by these jobs. A study by the North Jersey Transportation Planning Authority reported that the Port of New York and New Jersey directly supports 229,000 workers and indirectly supports 171,000 jobs associated with the port (Cushman & Wakefield Research, 2018). The port is responsible for $25.7 billion in personal income and $64.8 billion in business income in the region. The tentatively selected plan promotes the continued economic vitality in the availability of jobs and the high standard of living that is derived from this robust facet of industry.

In the near-to-mid-term, the deepening of the federal navigation channels also supports jobs and regional economic development which in turn supports the economic vitality of the region. The tentatively selected plan consists of a multibillion-dollar blasting and dredging project with a construction duration of several years. The resulting job security and secondary economic impacts also support the economic vitality of the region.

5.4: Uncertainty and Additional Analyses

During plan formulation and evaluation, Alternative D – deepening the pathways to Elizabeth - Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by 4 feet was identified as the national economic development plan because it maximizes net benefits. However, the Alternative E – deepening the pathways to Elizabeth - Port Authority Marine Terminal by 4 feet and Port Jersey – Port Authority Marine Terminal by 5 feet, and Alternative F

– deepening the pathways to Elizabeth - Port Authority Marine Terminal and Port Jersey - Port Authority Marine Terminal by 5 feet also have considerable net benefits that are close to the net benefits provided by Alternative D (Table 26). Further refinement of quantities, cost calculation assumptions, and benefit calculation assumptions may affect the alternative that produces the most net benefits. Additional analysis will be completed after the draft integrated report is released to refine assumptions and confirm the national economic development plan. Since there is uncertainty as to what plan will maximize net benefits after the additional analyses, this draft integrated report presents the impact analyses of deepening the pathways to Elizabeth – Port Authority Marine Terminal and Port Jersey – Port Authority Marine Terminal by both 4 feet and 5 feet.

It is not anticipated that any single refinement will affect the identification of the national economic development plan. However, refinements to multiple assumptions may jointly have an impact. Assumptions that will be reconsidered relate to:

- fleet transition
- vessel capacity utilization
- sailing draft distribution and underkeel clearance
- tide constraints/modeling rules
- blasting
- utility relocations
- disposal
- plant operations
- berth deepening
- efficiency component evaluation

5.5: Environmental Operating Procedures

The Environmental Operating Principles are an essential component of USACE's risk management approach in decision making, allowing the organization to offset uncertainty by building flexibility into the management and construction of infrastructure. The Environmental Operating Principles are:

- Foster sustainability as a way of life throughout the organization
- Proactively consider environmental consequences of all USACE activities and act accordingly
- Create mutually supporting economic and environmentally sustainable solutions
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE's actions in a collaborative manner
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities

Plan selection considered these principles to ensure the sustainability and resiliency of the NED plan while considering the environmental consequences of implementation. In addition to construction best management practices to maintain water quality standards, other opportunities to implement sustainable measures that are cost effective and comply with USACE construction standards will be further evaluated during the pre-construction engineering and design (PED) phase. If out-of-kind mitigation (e.g. vegetated wetlands) is warranted, planting plans will utilize native vegetation that support pollinator species, have a lower susceptibility to disease or pests, and are more adaptable to climate change. The study team considered avoiding and minimizing adverse impacts to existing environmental resources and cultural resources within the project area to the extent practicable during the plan formulation process. Where impacts to these resources are unavoidable, compensatory mitigation will be performed.

Continuous coordination with the Port Authority of New York and New Jersey, the states of New York and New Jersey, federal resource agencies, and the public occurred throughout the study to ensure an open and transparent process that respects views of individuals and groups. The project will be constructed in compliance with all applicable environmental laws and regulations.

Chapter 6: Environmental Consequences*

This chapter describes the existing and projected future conditions for each of the resources that reasonably could be expected to be impacted by the project and its Area of Potential Effect. Existing and projected future condition descriptions include physical, chemical, biological, and sociological conditions. These conditions are described without implementation of the alternative actions and with implementation of the alternative actions. The comparison of without-project (which assumes no dredging activity and continued navigation use as at present) and with-project conditions defines the impacts of the alternatives. Table 33 provides a summary of the impacts for the resources that could be potentially affected by implementation of the Tentatively Selected Plan and the No Action alternative, which serves as a baseline for assessing the impacts of the Tentatively Selected Plan.

Table 33: Summary of Impacts

RESOURCE	NO ACTION ALTERNATIVE/FUTURE WITHOUT-PROJECT ALTERNATIVE	ACTION PROJECT ALTERNATIVE
Topography and Bathymetry	Permanent, Negligible to Minor	Permanent, Minor
Flood Levels	No Effect	No Effect
Environmental Justice	No Effect	No Effect
Geology and Soils	No Effect	No Effect
Water Resources and Water Quality	Temporary, Negligible to Minor	Temporary, Minor
Vegetation, Wetlands, and Submerged Aquatic Vegetation and unvegetated littoral habitat	Temporary, Negligible to Minor	Permanent, Minor
Essential Fish Habitat	Temporary, Negligible to Minor	Permanent, Minor
Wildlife	Temporary, Negligible to Minor	Temporary to Permanent, Minor
Benthic Fauna	Temporary, Minor	Temporary, Minor
Special Status Species	Temporary, No Effect to Minor	Pending
Floodplains	No Effect	No Effect
Cultural Resources	No Effect	Permanent, Minor
Recreation	Temporary, Negligible	Temporary, Negligible to Minor
Aesthetics and Scenic Resources	Permanent, Negligible	Permanent, Negligible to Minor
Hazardous, Toxic, and Radioactive Wastes	No Effect	Temporary, Negligible
Air Quality	No Effect	No Effect
Noise and Vibration	No Effect	Temporary, Minor

6.1: Topography and Bathymetry

6.1.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations, dredged material placement/disposal, and navigation within the Action Area would continue. The existing sediment within the dredging footprint in the channel would continue to be removed as needed. Continued maintenance of the channel system should have no effect on seismicity because the Action Area is not within a seismically-active geologic setting.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEUs over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City Greater Metropolitan Area is almost entirely built out and redevelopment is more likely. None of these activities are expected to significantly alter the topography in the project Action Area, and therefore would have no effect.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. Erosion and loss of estuarine and ocean beaches is anticipated to occur with sea level rise. Over the course of time, more landforms may become submerged, and other areas may become lower-lying and flood more frequently, particularly within the coastal physiographic province in which this project is located. This could alter local topography and bathymetry significantly unless actions are taken to prevent alterations to current elevations and landforms. Effects to the bathymetry and topography from implementation of the No Action/Future Without-Project Alternative are predicted to be negligible to minor and permanent.

6.1.2: Action Project Alternative

The proposed dredging will alter the bathymetry in and adjacent to the navigation channels, deepening and widening them, and removing sediments needed to achieve the desired depth.

Potential impacts of channel sideslope failure include damage to structures located near the top of the slope and frequent maintenance dredging if shoaling is produced by failure of sideslopes. A channel sideslope stability analysis will need to be performed to identify structures which may be impacted by extending channel sideslopes laterally.

The Action Project Alternative is anticipated to have minor permanent effects to topography and bathymetry.

6.2: Environmental Justice

6.2.1: No Action/Future Without-Project Alternative

Executive Order 12898 directs Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on

minority and low-income populations. Under the No Action/Future Without-Project Alternative, maintenance dredging will continue. No effect is expected to environmental justice communities.

6.2.2: Action Project Alternative

Consistent with Executive Order 12898, an evaluation of the population in the vicinity of the New York and New Jersey Harbor was conducted to determine the potential for the project to adversely affect minority and low-income populations.

Since all dredging activities will take place in or adjacent to existing navigation channels, no primary direct impacts related to environmental justice issues will occur in landside residential areas. In order to identify landside areas that may experience secondary direct project impacts, such as odor or noise, a one mile "buffer area" was delineated around all deepening and/or widening areas with the use of Geographic Information System (GIS) software. Census tracts with any portion of their area falling within this buffer were then evaluated for minority and low-income populations. The buffer area consists of sections of Union, Essex, and Hudson Counties in New Jersey, and sections of Richmond and Kings Counties in New York.

Census block groups are adjudicated based on criteria defined by the New York State Department of Environmental Conservation, in the Commissioner Policy 29 (NYSDEC, 2003). A census block group is considered to be an environmental justice community if it meets the NYSDEC threshold for a low-income community and/or a minority population. Specifically, for the purposes of this analysis, a low-income community is defined as "a census block group, or contiguous area with multiple census block groups, having a low-income population equal to or greater than 23.59% of the total population." A minority population is defined as "a census block group, or contiguous area with multiple census block groups, having a minority population equal to or greater than 51.1%...."

Based on the 2016 American Community Survey (US Census Bureau, 2016a and 2016b), within the one mile buffer of all measures there are 190 census block groups. Of these 190 census block groups, 87 census block groups (or 45.7% of the total census block groups) meet the NYSDEC criteria outlined above to be considered an environmental justice community (Figure 6-1). See Table 34 for a breakdown of census block groups by county.

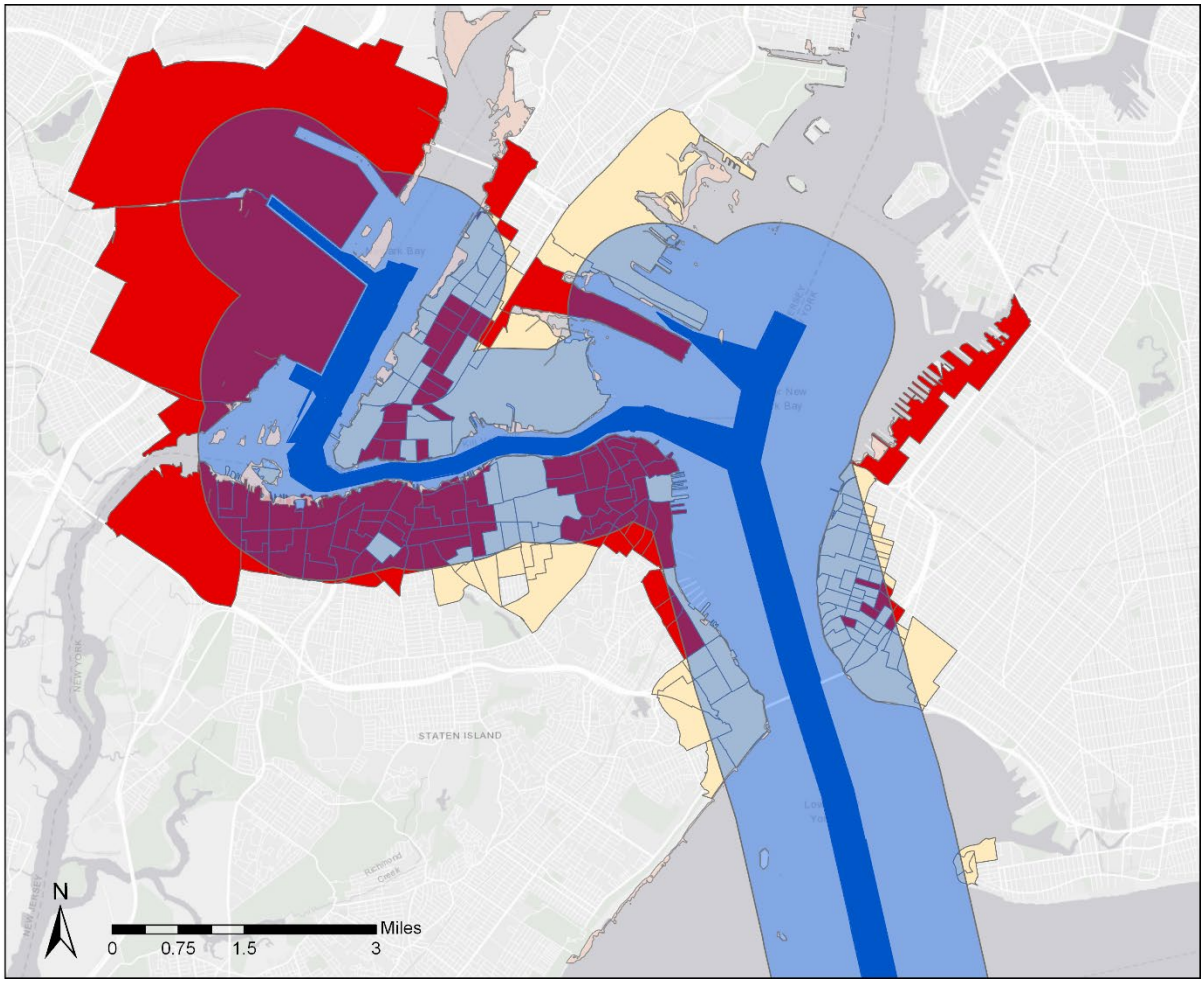


Figure 17: Environmental Justice Analysis

Action Alternative in dark blue, 1-mile buffer in light blue. Environmental Justice community Census Block Groups in red, non-Environmental Justice community census block groups in yellow.

Table 34: Breakdown of Census Block Groups by County

COUNTY	UNION	ESSEX	HUDSON	RICHMOND	KINGS	TOTAL
Environmental Justice census block groups	2	1	19	58	7	87
Total census block groups	3	2	44	86	55	190

Based on this analysis, there exist several concentrations of minority and/or low-income populations within the buffer area. However, these concentrations do not comprise a significant portion of the overall population within the buffer area, and therefore, minority populations are not disproportionately represented in the area of potential impact.

6.3: Geology and Soils

6.3.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations, dredged material placement/disposal, and navigation within the Action Area would continue. The existing sediment within the dredging footprint in the channel would continue to be removed as needed.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEUs over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City Greater Metropolitan Area is almost entirely built out and redevelopment is more likely. None of these activities are expected to significantly alter the geology in the project Action Area. No effect.

6.3.2: Action Project Alternative

No adverse impacts on the geology of the project area are expected. Although deepening of the channels may affect the rate of sediment accumulation and scour, none of this is expected to affect existing geology. No economically important or significant mineral deposits have been mapped in the area to be deepened. In addition, no effects are expected on existing faults or shear zones.

6.4: Water Resources and Water Quality

6.4.1: No Action/Future Without-Project Alternative

Temporary and negligible to minor adverse impacts to water quality that result from current maintenance operations that include increased Total Suspended Solids, turbidity, and nutrient levels would continue at dredging sites. Overall impacts to water quality with current operations are temporary, adverse and negligible to minor.

All maintenance dredging activity within the boundaries of present navigation channels would comply with current Water Quality Permits for the New York and New Jersey Harbor system of connected channels. Sediments will be tested in accordance with the Evaluation of Dredged Material for Discharge in Waters of the U.S.-Testing Manual (USEPA, 1998) and the USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (USACE, 2003) prior to commencement of dredging to ensure appropriate placement/disposal of dredged material. The dredging operations would result in temporary, adverse impacts to water quality that are negligible to minor.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the Action Area and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, which may increase the number of vessels transiting New York Harbor. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEUs over time.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause changes in the nature and character of the estuarine ecosystem in the Action Area. The pH within surface waters will likely drop as ocean acidification occurs. Higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in alterations to the local ecosystem, but hypoxic conditions are not expected due to the high flushing rates and strong currents within the project Action Area. Rising seas, due to climate change, may increase salinity as the amount of saltwater relative to freshwater input is altered.

6.4.2: Action Project Alternative

Implementation of the Action Alternative may result in a temporary increase in Total Suspended Solids and turbidity in the dredging footprint and adjacent areas. There may be a slight, temporary increase in the level of dissolved nutrients (N and P) in the water column as well following dredging activities as nutrients in sediment are released by dredging. These adverse water quality impacts would be temporary in nature and are anticipated to result in minor levels of impact, primarily in the sediment plume, which should quickly settle due to the predominant sand sediments to be dredged.

Increased depths from dredging in estuarine environments also has the potential to alter salinity levels within the dredging footprint and can also potentially result in changes in Dissolved Oxygen levels. These changes in salinity and decreases in dissolved oxygen, and flushing rates are anticipated to cause permanent, minor impacts to water quality that are, based on prior water quality modeling for the original Harbor Deepening Project, negligible and not significant in nature. The proposed dredging will alter the bathymetry in and adjacent to the navigation channels and may also potentially increase the tidal prism in the area of the channel. No significant adverse impacts to water quality were found for the 50-foot channel deepening, and similarly, none are expected for the channel improvements. However, further hydrodynamic modelling, including water quality parameters, will be required.

Groundwater flow through bedrock is also unlikely to be affected. Blasting will likely widen fractures in exposed bedrock, but this widening will be limited to the navigation channel and will not produce significant effects on groundwater.

Possible effects of removal of the sediment blanket over potential artesian aquifers should be investigated, as geologic data become available from USACE. No continuous water-bearing, unconsolidated formations are expected to be disturbed or exposed as a result of channel deepening. Although the Magothy and Raritan Formations are important aquifers in the project area, preliminary information indicates that they are overlain by a considerable thickness of Pleistocene and Recent sediments. This finding should be confirmed when preliminary project plans and geologic maps (based on sediment borings) are finalized. Anticipated depths of current mining of sand from the Ambrose Channel should be considered when evaluating the depth of cover over the Magothy Formation.

6.5: Vegetation, Wetlands, and Submerged Aquatic Vegetation

6.5.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations and navigation within the Action Area would continue. These operations can cause minor turbidity, siltation, and boat wakes within the Action Area. However, there is no submerged aquatic vegetation in the Action Area.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the Action Area. In general, wetlands both inside and outside of Action Area as well as submerged aquatic vegetation are at increased risk of damage and loss from potential increases in sea level rise and salinity shifts. The locations of these resources may shift in response to climate change and the ensuing sea level rise. Wetlands may erode further or be at increased risk of becoming too inundated to support vegetation. As a result, they may transition into mudflats and/or subaqueous bottom. Alternatively, sea level rise may cause estuarine wetlands to retreat inland, by converting existing uplands to wetlands. In addition, higher salinity levels in waterways in combination with increased sea level may result in inundation of freshwater wetlands further upstream in the Hudson River and other waterways connecting to New York Harbor, or conversion to estuarine wetlands due to salinity shifts.

The Action Area itself is already a highly developed city and port with substantial navigation and shipping operations, with few wetland areas and modest vegetative cover. Therefore, continuing maintenance dredging operations would not likely cause substantial shifts to these community types in future conditions.

6.5.2: Action Project Alternative

Similar to the No Action/Future Without Project Alternative, there would be no impacts to SAV with implementation of the Action Alternative. There would be up to 1.92 acres of state-regulated unvegetated shallow subtidal habitat (-6 feet MLLW or shallower) converted to deep water habitat. Compensatory mitigation is planned for these impacts.

Figure 18: Shallow Subtidal Habitat Impacts

Channel bottom to be deepened in blue, side slopes in light blue, and widenings in grey. Shallow subtidal habitat (6 feet MLLW or shallower) in tan, with impacted shallow subtidal habitat (1.92 acres) in red.

6.6: Essential Fish Habitat

6.6.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations and navigation within the Action Area would continue. Current dredging and navigation operations that may affect egg, larval, juvenile, and adult life stages of fishes within the Action Area include direct removal or burial, turbidity/siltation effects, temporary shifts in dissolved oxygen during dredging operations, entrainment, visual and noise disturbances, and alteration of habitat. The impacts to essential fish habitat would be negligible to minor and temporary.

As a result of climate change, global temperatures and sea level are expected to rise in the foreseeable future. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling, and weather patterns all have the potential to affect the nature and character of the estuarine and coastal ecosystem in the Action Area.

Sea level rise may result in an increase in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young of the year). There could be shifts in breeding habitat availability and timing, and the effects of this change on fish populations could be detrimental although relatively uncertain at this time. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability, which could also cause detrimental effects to fish resources and habitats. These impacts related to climate change, mainly warming waters, are being observed about species range and distribution (Nye et al., 2009; Rose, 2005).

6.6.2: Action Project Alternative

Based on the 2017 Harbor Deepening Project Conservation Recommendations, potential impacts from the proposed Federal action of deepening and widening existing deep-water channels currently comprising the NYNJHDCI could include:

- Physical disturbance and re-suspended sediments/re-deposition of suspended sediments (short-term direct and indirect impacts including potential burial and/or release of contaminants)
- Entrainment of early life stages (eggs and larvae) as a form of short-term direct impact due primarily due to hydraulic dredging and capture of eggs and possibly larvae in the dredge
- Loss of essential fish habitat function as a long-term indirect impact due to increased sedimentation and/or changes in depths, currents, substrate types, and/or in-water structures that reduce or eliminate the suitability of habitat for essential fish habitat-managed species.

For specific species assessments, please see Appendix A4.

6.7: Wildlife

6.7.1: No Action/Future Without-Project Alternative

Fish

Existing maintenance dredging operations and navigation within the Action Area would continue. Current dredging and navigation operations that may affect egg, larval, juvenile, and adult life stages of fishes within the Action Area include direct removal or burial, turbidity/siltation effects, temporary shifts in dissolved oxygen during dredging operations, entrainment, visual and noise disturbances, and alteration of habitat. The impacts to fish resources would be negligible to minor and temporary.

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Sea level rise may result in an increase in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young of the year). There could be shifts in breeding habitat availability and timing, and the effects of this change on fish populations could be detrimental although relatively uncertain at this time. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability, which could also cause detrimental effects to fish resources and habitats. These impacts related to climate change, mainly warming waters, are being observed about species range and distribution (Nye et al., 2009; Rose, 2005).

Birds

Existing maintenance dredging operations, and navigation within the Action Area would continue. Operation of vessels and dredging equipment may flush wildlife, such as waterfowl or other birds foraging or resting in the open waters of the project Action Area out of the area. The increased Total Suspended Solids and turbidity resulting from dredging operations may temporarily disrupt foraging abilities for some wildlife. This results in temporary, negligible to minor, adverse impacts to wildlife.

6.7.2: Action Project Alternative

Fish

Potential impacts to fish and fish habitat from the Action Alternative, the Gravesend Hybrid Plan, result from dredging vessels transiting to dredging locations, and dredging. Offshore disposal of dredged material at HARS and any impact it may have has already been addressed in prior NEPA documents (USEPA, 1997). Decreases in light penetration in the water column can result in behavioral responses from fishes due to the disturbance effect and also potentially limit visibility. Increased depths from dredging in estuarine environments also has the potential to alter salinity levels within the dredging footprint and can also potentially result in changes in Dissolved Oxygen levels.

Prior water quality modeling, as noted in the water quality section of this NEPA document, indicated no significant changes to salinity or dissolved oxygen from the 50-foot deepening of the harbor, and, therefore, we expect no significant impacts to fish due to changes in salinity or dissolved oxygen due to the dredging, either during or post-dredging. Dredging has the potential to release nutrients and/or contaminants from sediments, which can impact fishes, prey, and habitat.

Historical investigations have been conducted between at least 1990 and 2016 to assess concentrations of contaminants in the Lower Passaic River into Newark Bay (U.S. Fish and Wildlife Service et al 2020). Sampling analysis included several contaminants of concern, including dioxins, polychlorinated biphenyls (PCBs), pesticides, polycyclic aromatic hydrocarbons (PAHs) and mercury. A Damages Report prepared by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration and published in January 2020 reviews the ecological impact to the estuary and aquatic species. While the Damages Report specifically discusses the damages associated with the Diamond Alkali Superfund Site, the report found that these contaminants of concern are present in the sediments of the Lower Passaic River and Newark Bay and additionally, are also present within many species of fish and bird tissues tested (USFWS and NOAA, 2020). Currently Newark Bay is undergoing remedial investigation under the oversight of the USEPA to further assess the extent and presence of contaminants of concern and it is likely that remedial actions will occur sometime in the future. Dredging actions occur within the existing navigation channels and are expected to continue for the next 50 years. While current dredging operations, as well as the proposed deepening dredge operations, temporarily resuspend sediments, the material is tested under dredged material placement criteria, removing associated sediment from Newark Bay to an appropriate placement facility. Placement criteria sampling analysis for the proposed deepening will take place during the preconstruction engineering and design phase.

Fishes can also be impacted by potential strikes from dredging vessels/equipment. Fish may be impacted by noise disturbances which may cause species to flee the area of impact or potentially alter other behaviors, including foraging success. Fishes and their habitat could potentially be impacted by releases of munitions, explosives of concern or unexploded ordnance during construction operations. There has been concern in the past regarding the occurrence of munitions, explosives of concern or unexploded ordnance in that, historically, chances for an encounter increases as the further south towards Raritan Bay and southward along the New Jersey coastline dredging occurs. Due to its location in a heavily urban area and based on current dredging operations, we do not expect any munitions, explosives of concern or unexploded ordnance in the dredging footprint.

The temporary increase in Total Suspended Solids and turbidity in the water column at the dredging site has the potential to directly impact fishes and fish habitat. The impacts to fish species from Total Suspended Solids and turbidity are directly related to: the species tolerance, exposure rate, duration of the exposure, and life stage. Deposition of suspended sediments may induce impacts to fish eggs and larvae through deposition, abrasion, and or smothering, especially in the dredging and disposal areas (Wilbur and Clarke, 2001). However, in species, such as the white perch, the deposition of particulate matter on eggs does not demonstrate any adverse effects. White perch eggs can tolerate concentrations of 500 mg/L of particulate matter without any adverse effects. Winter flounder, a local species which lays demersal eggs, as well as Atlantic sturgeon, are essential fish habitat species and will be addressed in detail within the essential fish habitat assessment attached to this document.

Increases in Total Suspended Solids and turbidity can impact prey species' predator avoidance response due to visual impairments caused by decreased water clarity (Gregory and Northcote, 1993; Wilbur and Clarke, 2001). Turbid waters can also visually impair predator species that rely on sight to forage. Increased Total Suspended Solids and turbidity alters the ability for light to penetrate the water column; this impairs both physical and biological processes in the affected area (Johnston, 1981; Wilbur and Clarke, 2001). Increased turbidity can impact primary productivity and respiration of organisms within the project area.

The behavioral response of estuarine fish species to Total Suspended Solids and turbidity has been documented in a number of studies; it has been found that the suspension of fine particles hinders gas exchange with the water by coating the respiratory epithelia of juvenile and adult fish (Wilbur and Clarke, 2000). The larger suspended particles can be trapped in the gill filaments and fill the opercular cavity, which may lead to asphyxiation by prohibiting the passage of water through the gills (Johnston 1981; Wilbur and Clarke, 2000). Even so, increased sediment loading in the water column is predicted to be temporary and small in scale relative to the surface acreage and volume of local Action Area waters, with the effects subsiding within hours of ceasing operations with a return to normal within a day or two at most, as the majority of the material to be dredged settles quickly. Another behavioral response may be for fish and/or prey species to move away from the disturbance and visual effects. It is anticipated that demersal species, especially those that could be foraging in the project area, such as flounder, red and silver hake, and other demersal fish will be most affected and leave the immediate dredging footprint.

While dredging operations could temporarily increase Total Suspended Solids and turbidity,

these impacts will be minor when compared to background levels. The flushing rate (due to the water exchange and tidal fluctuations) within the Action Area will minimize potential Total Suspended Solids/turbidity plumes and cause them to disperse quickly, minimizing long term impacts to water quality. The extent and duration of turbidity plumes is dependent on factors such as dredge type, sediment composition, and hydrologic and environmental conditions in the Action Area. The Action Area is largely composed of coarse to silty sand, with some rock. Sediments with larger grain sizes tend to settle out of the water column at a faster rate than fine sediments, so it is predicted that turbidity plumes predominately composed of sands will settle faster than those with fine grained, muddy benthic sediments. The faster settling rate of suspended sands in the water column generally results in turbidity plumes of lesser extents than plumes composed of fine grained sediments; the water column also returns to pre-dredging conditions faster, thus minimizing adverse impacts to sensitive egg and larval life stages, although this is dependent on the hydrological and environmental conditions at the time of dredging and/or placement activities.

Direct removal of benthic substrate by dredging may impact fish habitat by removing important prey species (i.e. benthic organisms), food species (i.e. macroalgae), or by alteration of nursery and/or spawning areas. Recolonization of the newly exposed substrate after dredging is not only a function of site-specific characteristics (i.e. bathymetry, tidal energy), but also of substrate requirements of the larvae of re-colonizing species (Rhoads and Germano, 1982). Any deviation from the existing benthic floor changes the habitat complexion for smaller species that utilize the area for foraging and living space. Additionally, some demersal species require specific substrates for foraging and spawning. Therefore, dredging and dredged material placement/disposal will likely result in the temporary loss of some fish habitat, including foraging grounds.

Entrainment is defined as the direct uptake of aquatic organisms by the suction field generated at the suction intake of a hopper dredge or capture by a mechanical dredge. The entrainment of fishes during dredging operations can lead to direct injury and/or death to the entrained fishes. During dredging, a possible impact to fish species is the entrainment of eggs, larvae, juveniles, and adult life stages. Life stages with limited or no swimming ability, especially eggs and larvae, have a higher potential to be entrained.

Egg, larvae, and juvenile entrainment is possible depending on the location and time or year that dredging occurs. Typically, major concerns of juvenile entrainment relate to fish below 200 mm (Hoover et al., 2005; Boysen and Hoover, 2009). Burton et al. (1992) used modeling software to predict the rate of entrainment of striped bass (*Morone saxatilis*), herring (*Alosa* spp.), and white perch (*Morone americana*) larvae. This simulation involved the continuous use of four hydraulic dredges to determine a conservative estimate of mortality and entrainment. Despite the large amount of material being dredged in this simulation, the authors concluded that less than one percent of the total larval fish population would be lost. Therefore, we expect the impacts to fish to be minor, adverse but not significant.

Juveniles and adults can also be entrained by dredge operations. One factor influencing potential entrainment for larger fish is based on the swimming stamina and size of the individual fish at risk (Boysen and Hoover, 2009). Swimming stamina is positively correlated with total fish length. Entrainment of larger finfish is unlikely due to the increased swimming performance. In

a separate study on juveniles and adults involving 15 species of commercial and sport fish, entrainment rates varied from 0.001 to 0.135 fish per cubic yard for both cutterhead and hopper dredging operations. Out of the entrained fish, approximately 37.6 percent of the fish were mortally entrained. Over a four-year period, Larson and Moehl (1990) observed entrainment rates ranging from less than 0.001 to 0.341 fish entrained per cubic yard of material dredged, distributed among fourteen species of fish. As expected, the majority of the fish entrained during this study were demersal species. Entrainment and mortality rates are anticipated to range from negligible to minor for all fish species, especially when fish mortality is compared to the amount of material dredged and duration anticipated.

Due to the open-water environment of the New York-New Jersey Harbor and the vast width of the Federal channels, the likelihood of vessel strikes to managed fish species and their prey is possible, but is not likely as it is not anticipated to be a substantial threat due to the limited amount of time the dredging vessels/equipment will be operating and the ability of motile fishes to move away from potential dredging impacts. Eggs, larvae, and species with limited swimming ability would be at highest risk of strike impacts. Effects to managed fish species and their prey from dredging vessel equipment/strikes is anticipated to range from negligible to minor and be temporary in duration and not significant. Minor impacts due to noise on local fish populations are expected from dredging (USACE, 2012b) and blasting (USACE, 2004b).

Once dredging is complete, impacted benthic areas will likely begin to re-colonize with organisms similar to those from adjacent non-impacted areas. However, benthic organisms and habitats are expected to recover to near pre-construction conditions following a dredging or dredged material placement/disposal event. Overall, the adverse effects fish and fish habitats are expected to be minor and range from temporary to permanent impacts, but not significant.

Bird

Compared to current operations, operation of vessels and dredging equipment could temporarily flush additional wildlife out of the area. The increased Total Suspended Solids and turbidity resulting from additional dredging operations with implementation of the Action Project Alternative may disrupt foraging abilities for some wildlife. This would result in temporary, negligible to minor, adverse impacts to wildlife.

The dredging is also anticipated to have a temporary, negligible to minor, adverse impact to benthic invertebrates and fish. This potentially impacts some of the prey species of birds. However, because of the already disturbed nature of the majority of the Action Area and the amount of other available habitat for prey species, current additional dredging and dredged material placement is not anticipated to have any substantial impact on any prey invertebrate or fish populations.

6.8: Benthic Fauna

6.8.1: No Action/Future Without-Project Alternative

Monitoring in the general project area (USACE, 2011) indicated that within the Ambrose Channel, which consists primarily of sand sediments, blue mussels predominate in biomass and number, accounting for 86% of the total organisms found, followed by amphipods and

polychaetes, with an average density of 3,696 animals/meters^2 . Further upriver, the Anchorage channel consisted of mostly polychaetes, with arthropods and molluscs following in abundance with few blue mussels found as would be expected in a more silt-dominated bottom habitat. Various annelid species (*Spio setosa*) were the most numerous, followed by amphipods and a small clam, the northern dwarf tellin (*Tellina agilis*) with an average density of 2,580 animals/meters^2.

Existing maintenance dredging operations and navigation within the Action Area would continue, which, while infrequent, is likely to cause removal or entrainment of benthic organisms, strikes and crushing of benthic organisms. Additionally, benthic organisms outside the dredging footprint could be impacted temporarily by increased levels of Total Suspended Solids and turbidity from some maintenance dredging. The siltation of benthic organisms may prevent or reduce respiration and/or foraging for filter-feeding organisms. However, the sediment plume during dredging operations will likely not be significant enough to result in more than minor mortality of benthic life outside the channel, as quantities of Total Suspended Solids released should not result in burial of the benthos deep enough such that they will be unable to survive.

Dredging activities often generate no more increased suspended sediments than commercial shipping operations, bottom fishing or than those generated during severe storms (Parr et al. 1998). Furthermore, natural events such as storms, floods and large tides can increase suspended sediments over much larger areas and for longer periods than dredging operations (International Association of Dredging Companies, 2015). It is therefore often very difficult to distinguish the environmental effects of dredging from those resulting from natural processes or normal navigation activities (Pennekamp et al., 1996).

Maintenance dredging will cause minor, adverse impacts to the benthic community resulting from direct removal or entrainment of benthic organisms, strikes and crushing of benthic organisms, and turbidity/siltation effects that could include burial and potentially impact respiration of benthic organisms. The existing and projected future adverse impacts to the benthic community are temporary, minor and adverse.

6.8.2: Action Project Alternative

It is anticipated that impacts to benthic habitats will involve the potential loss and displacement of non-motile benthic organisms at the dredging site. McCauley et al. (1977) documented that the total abundance of benthic organisms at a dredging site returned to pre-dredging levels seven to 28 days after dredging was completed. In a similar study conducted on the nearby James River, Diaz (1994) revealed that almost all species of benthic organisms had recolonized the disturbed areas within three weeks after the dredging was completed. Diaz (1994) also demonstrated that benthic organisms continued to sustain pre-disturbance population densities three months after a dredging event.

6.9: Special Status Species

6.9.1: No Action/Future Without-Project Alternative

Federally Endangered and Threatened Species

Existing dredging operations and navigation within the Action Area would continue and are anticipated to continue for the next 50 years. There is no history of takes of sturgeon, whales or sea turtles due to navigational dredging in the New York Harbor. Adverse impacts to Federally listed species that range from no impact to minor, adverse impacts resulting from existing, though infrequent, dredging operations will continue. Adverse impacts to Federally listed species that occur with the No Action/Future Without-Project Alternative would be similar and at the same impact threshold to those that would occur with implementation of the Action Alternative but most impacts would be relatively less due to the temporary increase in dredging activity to construct the channel improvements. Impacts to state listed species, which do not include any additional species not already protected under the Federal Endangered Species Act of 1973, would be at the same impact threshold as those described in the Action Alternative Section but would be relatively less.

Marine Mammals

According to Todd et al. (2014), there are few studies on the effects of dredging on marine mammals due to dredging activities in isolation. In terms of direct effects, vessel collisions are possible, but improbable because dredges operate either in a stationary position or at low speeds. The risk of injury to marine mammals from collisions with dredge-related vessels is considered discountable considering the species mobility and slow speed of the dredge vessels (10 knots or less) and associated barges and scow. Also, trained personnel that know how to recognize the presence of threatened and endangered whale and sea turtle species are always onboard to help ensure that vessel interactions are avoided. No marine mammal strikes with dredge-related vessels has ever been reported to occur in the Action Area.

Within a noisy harbor area such as New York Harbor, ongoing exposure to underwater noise may cause a masking effect such that the noise of an oncoming vessel may not be detected. Marine mammals may habituate to the noisy harbor and simply not respond to an oncoming vessel as they are so adapted to the sound of vessels. In addition, the noise of the dredging vessel/equipment, and also the vessels in the harbor itself, has an adverse effect to listed whales in the Action Area and may interfere with their ability to communicate and forage for prey in addition to the vessel strike risks. Todd et al. (2014) noted that while dredging noise levels vary greatly and depend partly on the method and the material being dredged, limited data seem to indicate that dredging is unlikely to cause physiological damage to marine mammal auditory systems.

Effects of turbidity are often localized with minimal direct impact on marine mammals (Todd et al., 2014). No Level A or B harassment to marine mammals occurs with existing dredging and dredged material placement/disposal operations. Todd et al. (2014) note that the indirect effects of dredging are more complex, and less understood. In general, literature has suggested that dredging can cause reductions in biomass and varying levels of prey availability, depending on the surrounding conditions. However, it is also noted that marine mammals can likely

compensate for small-scale changes in prey by switching prey species or moving to other foraging areas (Todd et al., 2014).

Marine mammals that may occur in the Action Area are accustomed to the busy harbor of which the Action Area is a portion. They are also highly mobile, and it is expected that they would move away from disturbance such as noise or equipment operations. The Action Area is also limited relative to the surrounding area available for use. Therefore the species are likely to move and forage elsewhere during the operation. Noise generated by dredge activities would not be expected to affect migration, nursing, breeding, feeding, or sheltering.

Overall, no Level A or Level B harassment to marine mammals from implementation of the Action Alternative is anticipated. Overall, no substantive disruption of behavioral patterns to migration, breathing, nursing, breeding, feeding or sheltering would be anticipated.

Species Protected under the Migratory Bird Treaty Act of 1918 and Executive Order 13186 and Other State Listed Bird Species

Migratory birds have the potential to forage, rest, and/or migrate through the Action Area. The noise and temporary turbidity plume caused by dredging actions may cause migratory birds to move away from the disturbance; however, this is a negligible to minor, and temporary impact that does not substantially impact their long-term foraging or breeding success. Dredging operations have a temporary, negligible to minor adverse impact to benthic invertebrates and fish. This dredging may impact some of the prey species of migratory birds. Future shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to migratory birds. However, because of the already disturbed nature of the majority of the Action Area and the amount of other available habitat for prey species, current dredging operations, which are infrequent in the New York Harbor area, should not have any substantial impact on any prey invertebrate or fish populations.

6.9.2: Action Project Alternative

An assessment by the USACE of the potential impacts of implementation of the Action Project Alternative on Federally listed species is provided in the Biological Assessment (Appendix A1). The results of the impacts assessment are summarized there. Please note that best management practices/mitigation measures for Federally listed species are described in the BA found in Appendix A1 as well. Effect determination will remain pending until receipt of the NMFS Biological Opinion.

Atlantic Sturgeon

From reviewing the best available information on Atlantic sturgeon life history, and their behavior in and around the study area or Action Area, it appears that Atlantic sturgeon are present in the vicinity of the area primarily while migrating between spawning grounds in the Hudson River and their offshore oceanic environments, via the Ambrose and Anchorage channels. Several generic threats to Atlantic sturgeon from dredging and blasting activities have been identified. However, as summarized below, those most closely associated with and given the physical nature and actions associated with the area are not deemed to impact the continued existence and recovery of the species.

Proposed construction for the NYNJHDCI will occur in the Ambrose, Anchorage- Port Jersey, Kill Van Kull and Newark Bay main channels, as well as into South Elizabeth and Elizabeth Channels. The potential impacts of dredging and blasting on benthic resources (e.g., Atlantic sturgeon prey) within the Kill Van Kull-Newark Bay complex indicate a temporary and short-term loss and/or shift in benthic community within those localized contract areas. Given the nature of the impact, the availability of resources available to Atlantic sturgeon in those areas of the project where they are documented as primarily occurring and are ubiquitous, such as the Lower Bay and entire Raritan Bay, and that Atlantic sturgeon are indiscriminate feeders, the impacts associated with dredging on benthic resources is unlikely to have an adverse impact on the species.

Given the information described in this section, the greatest potential risk for indirect or direct impacts to Atlantic sturgeon from the NYNJHDCI is therefore limited to the Ambrose channel areas since this channel not only is situated as the major migratory spawning pathway for the New York Bight Distinct Population Segment, but, it is also the only channel at which a large hopper dredged will be deployed. The District is committed to minimizing impacts of hopper dredging activities on Atlantic sturgeon. To reiterate, because the area of impact from the contract areas in Ambrose channel is so small relative to the surrounding Lower and Raritan Bays, there are many opportunities available for Atlantic sturgeon to avoid active dredges. Additionally, as part of the conditions outlined in the NMFS 2012 Biological Opinion, the District currently equips hopper dredges in the Ambrose channel with sea turtle deflectors (and unexploded ordnance screens) on the draghead. This measure is meant to reduce the risk of interaction with protected species that may be present in the dredge area.

As part of the Terms and Conditions of the 2012 Biological Opinion, USACE has been required to use NMFS-approved protected species observers to monitor for takes onboard hopper dredges on deep draft navigation projects, as appropriate (ex. Ambrose Channel).

Additionally, a number of best management practices (in addition to observers) were reviewed and agreement between NMFS and the District was reached regarding the conduct of a pilot study, as an element of mitigation, to explore the feasibility of designing and deploying a tickler chain apparatus to attach to the raghead, which would serve to move bottom-dwelling individuals (turtles or Atlantic sturgeon) out ahead of and away from the area of effect of the draghead intake. This study has been deployed on one of the Districts' Coastal Storm Reduction projects (Fire Island to Moriches Inlet (FIMI)) and was concluded 2020. The technical team comprised of USACE's Engineer Research and Development Center's subject matter experts (mechanical engineer and endangered species specialists) and District biologists have the report under preparation, currently, and the draft report will be coordinated with the NMFS team upon its completion this fall. The study is intended to identify the feasibility of deploying new best management practices, as well as identify any other best management practices for future feasibility investigations that could reduce the risk to protected species with the Districts' AOR.

Based on this BA, potential impacts to Atlantic sturgeon as part of the proposed improvements to the NYNJHDCI appears to be limited to a temporary and short-term loss and/or shift in benthic community and potential risk of entrainment by hopper dredges in the Ambrose channel, as well as possible adverse effects due to blasting activities in the Newark Bay-Kill Van Kull Complex. These potential impacts are not likely to jeopardize the continued existence of Atlantic sturgeon

due to the use of best management practices during blasting activities that significantly reduce the adverse effects to finfish, and the implementation of seasonal restrictions (i.e. no dredging or blasting from March 1 to June 30) protective of anadromous fish throughout the Newark Bay-Kill Van Kull Complex. Construction activities at the Ambrose Channel are unlikely to increase risk to sturgeon due to the expansiveness of the Lower Bay permitting ease of passage of sturgeon to and from their upriver spawning grounds, and to/from feeding, overwintering and offshore migratory pathways. The District will continue to actively work with NMFS to ensure that any potential impacts of the planned activities are minimized.

In addition to the limited effects of dredging activities there are a variety of other factors that may contribute to the vulnerability of Atlantic sturgeon to habitat impacts and potential further population collapse, many of which are more likely to impact the Atlantic sturgeon than a dredging project exercising prudent measures to avoid/minimize takes. These factors include: their unique life history characteristics, vessel strikes, overfishing, dam construction and operation, water quality modifications, bycatch and poaching. For recovery efforts to succeed, it is vital to practically address all potential threats to Atlantic sturgeon.

Sea Turtles

Sea turtles are not expected to occur in the Upper Bay-Port Jersey or Newark Bay-Kill Van Kull complex areas of the project because it is a highly congested and trafficked area, and the physical habitat characteristics in the area do not suggest that it would represent a concentration area for sea turtles.

If present at all in the New York Bight, sea turtles are more likely to be present as transients in the Lower Bay, well outside of the Ambrose Channel contracts footprint.

In the 2012 Biological Opinion, hopper dredging, particularly utilizing large hopper dredges, was identified as a dredging type of concern for entraining sea turtles. Although a hopper dredge will be used to remove material from the Ambrose contract areas, the likelihood of adversely affecting a sea turtle will be rare.

Based on the many years of documented sea turtle observer data (1993-2010), there was only one observed Loggerhead turtle take out of 13 projects in New York, New Jersey and New England; the total dredged quantity during the turtle season was approximately 18.7 million cubic yards of material. The take was considered a freak incidence and occurred during a beach re-nourishment project along the Sandy Hook to Barnegat Inlet in 1997 (Long Branch borrow area), which is along the New Jersey shore and well away from the contract areas in the Ambrose Channel. Also, when compared to other dredging projects along the East Coast (see Sea Turtle Warehouse at: http://el.erdc.usace.army.mil/seaturtles), the overwhelming majority of turtle takes has been in the Gulf (200 takes) and South Atlantic Regions (446 takes) where sea turtles cluster to over winter, not in the North Atlantic (67) or New York District (1) where juveniles migrate to feed. Based on this information, observed take appears to be a rare occurrence within the District and should be an indication that sea turtle occurrence is rare in the contract areas for the NYNJHDCI, and new methods to monitor such an unlikely event are not warranted. Therefore, turtle deflectors will continue to be used, as appropriate, as well as an onboard lookout to determine the deflectors are deployed properly and to identify presence of turtles to vessel operators so they can be avoided.

Based on this BA, impacts to the leatherback, green, Kemp's Ridley and Northwest Atlantic Ocean distinct population segment of loggerhead sea turtles as part of the proposed construction of the NYNJHDCI appears to be limited to a temporary and short-term loss and/or shift in benthic community and potential, low risk of entrainment by hopper dredges in the Ambrose channel. These impacts are not likely to jeopardize the continued existence of these sea turtle species. The District will continue to actively work with NMFS to ensure that any potential impacts of the planned activities are minimized, such as the continued use of sea turtle deflectors or, as applicable and permitted by NMFS, the use of the tickler chain apparatus on the dragheads of hopper dredges. The District has determined that potential impacts to turtles are negligible.

Whales

Endangered Species Act of 1973 listed species of whales will not occur in or utilize the Upper Bay or NB complex areas of the project. The Ambrose Channel element of the HDCI is the only area where whales would likely be found. Because whales forage upon pelagic prey items (e.g., krill, copepods), dredging and its impacts on the benthic environment will not have any direct effects on whale prey/foraging items. Additionally, as dredging operations will not be undertaken within the vicinity of ESA listed species of whales, migratory behaviors of ESA listed whales will also not be affected.

Impacts to listed species of whales during deepening of the Ambrose Channel are unlikely because the hopper dredge would move very slowly at $\leq$ 2.6 knots, a speed at which whales can easily avoid contact with the dredge. Collisions with a transiting hopper dredge between the dredge site and the placement site could occur at offshore placement sites, such as the HARS. An analysis by Vanderlaan and Taggart (2006, as referenced in Harbor Deepening Project Biological Opinion) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death of a whale increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%. The speed of the dredge in the proposed project is not expected to exceed 2.6 knots while dredging and 9.4 knots while transiting to/from the deepening /placement sites, thereby reducing the likelihood of vessel collision impacts.

Large whales, particularly right whales, are vulnerable to injury and mortality from ship strikes. Ship strike injuries to whales take two forms: (1) propeller wounds characterized by external gashes or severed tail stocks; and (2) blunt trauma injuries indicated by fractured skulls, jaws, and vertebrae, and massive bruises that sometimes lack external expression (Laist et al.2001). Collisions with smaller vessels may result in propeller wounds or no apparent injury, depending on the severity of the incident. Laist et al. (2001) reports that of 41 ship strike accounts that reported vessel speed, no lethal or severe injuries occurred at speeds below ten knots, and no collisions have been reported for vessels traveling less than six knots. Most ship strikes have occurred at vessel speeds of 13-15 knots or greater (Jensen and Silber 2003; Laist et al. 2001). An analysis by Vanderlaan and Taggart (2006) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%.

Collisions with a slowly transiting hopper might occur, but the suggested reduced speed (10

knots) during transit lessens the probability of a ship strike resulting in death. Although vessel strikes are acknowledged as being one of the primary known sources of whale mortality in the northeast, ship strikes remain relatively rare events and a small increase in vessel traffic within the project area does not necessarily translate into an increase in ship strike events (2012 BA). Onboard lookouts would also reduce the risk of vessel-whale collisions. If the lookout on board the hopper dredge observes a whale in the vicinity of the vessel during transit throughout the project area, maximum vessel speeds would be limited to 10 knots. If a Right Whale is observed, the vessel would maintain a 500-yard buffer from the whale. For all other whale species, a 100-yard buffer would be maintained. The District concludes that the potential impacts to whales is negligible.

6.10: Floodplains

6.10.1: No Action/Future Without-Project Alternative

The No Action/Future Without-Project Alternative would have No Effect on floodplains. This was dismissed from detailed analysis due to lack of any impacts.

6.10.2: Action Project Alternative

The Action Project Alternative would have No Effect on floodplains. This was dismissed from detailed analysis due to lack of any impacts.

6.11: Cultural Resources

6.11.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations and navigation within the project area would continue under the no action alternative. Presently, maintenance dredging and navigation is causing no effect to cultural resources. When the 50-foot navigation channel was being designed, cultural resource surveys were conducted to identify any National Register Eligible resources within the area of potential effect. Six national register eligible shipwrecks were recorded by these efforts, and the New York District mitigated for impacts to these shipwrecks with recordation and salvaging important elements from the shipwrecks to be curated in a museum. Continuing maintenance dredging does not affect any additional cultural resources and neither does the navigation of ships through the project area.

6.11.2: Action Project Alternative

Under the action alternative, there are potential adverse impacts to National Register Eligible cultural resources. There is one National Register Eligible shipwreck within the project's construction limits. This is one of the shipwrecks that the New York District already mitigated for during the previous 50-foot harbor deepening project. Since the action alternative includes widening the existing federal navigation channels (hence, a larger Area of Potential Effect than the previous 50-foot harbor deepening project) additional cultural resources surveys will be required to complete the identification of cultural resources in the area of potential effect. Both

remote sensing surveys for shipwrecks and geomorphic surveys for submerged Native American sites will be carried out. Based on the high number of cultural resources around the Area of Potential Effect (see chapter 2, Existing Conditions), it is highly likely that additional survey work will identify additional National Register Eligible resources within the Area of Potential Effect. Based on this likelihood, the New York District expects this project to have adverse impacts to National Register Eligible cultural resources. To guide the identification and evaluation of historic properties in the Area of Potential Effect a Programmatic Agreement is being coordinated between the New York District, New York and New Jersey State Historic Preservation Offices, New York City Landmarks Preservation Commission, Federally Recognized Tribes, and Interested parties. Appendix A9 presents the details of this coordination. The PA outlines that any properties requiring mitigation will be addressed with a treatment plan. Potential mitigation measures include recordation following State Historic Preservation Office or Historic American Building Survey/Historic American Engineering Record guidelines, salvage and donation of significant structural elements to museums, or data recovery for archaeological sites eligible for the National Register of Historic Places under criterion D.

Part of the action alternative will cause the blasting of bedrock. Since bedrock blasting creates vibrations, historic structures within 500-feet of the blasting will need to be monitored for vibration levels to ensure that no damage is done to them during bedrock blasting. It is the New York District's goal to have no effect to historic properties during bedrock blasting, so blasting intensity will be lowered in areas near historic structures to avoid impacting them. During the Pre-Construction Engineering and Design phase, blasting plans will be developed with the respective New York and New Jersey State Historic Preservation Offices. The guidelines for this coordination are laid out in the draft Programmatic Agreement in Appendix A9.

6.12: Recreation

6.12.1: No Action/Future Without-Project Alternative

Existing maintenance dredging operations, dredged material placement/disposal, and navigation within the Action Area would continue. These operations can cause minor turbidity, siltation, and boat wakes within the Action Area. None of these temporary and minor impacts would have any effect on recreational resources in the project Action Area.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the Action Area. In general, as sea level rises, shoreline recreational sites, including parks and beaches, may become inundated unless preventative actions are taken to maintain elevation over time. Alternatively, sea level rise may cause estuarine wetlands to retreat inland, by converting existing uplands to wetlands, altering the use of shoreline parks that are currently upland vegetation.

The Action Area itself is already a highly developed city and port with substantial navigation and shipping operations, with few nearshore parks and a beach on the western shore of lower New

York Bay. Continuing maintenance dredging operations would not cause any significant impacts to these recreational resources. Adverse impacts to recreational resources with implementation of the No Action/Future Without-Project Alternative are likely to be temporary and negligible.

6.12.2: Action Project Alternative

Similar to the No Action/Future Without-Project Alternative, there would be no significant impacts to local recreational resources with implementation of the Action Alternative. There may be minor, temporary and negligible impacts to recreational resources in the project Action Area during construction, due to the presence of dredging vessels and any support vessels during construction. Recreational fishermen may need to move their vessels from the immediate vicinity of dredging vessels due to vessel noise and localized turbidity, which will temporarily disturb fish in the local area as described in the noise and fishery sections of this EA. While parks provide views of the project Action Area, the majority of parks are some distance from the navigation channel and proposed improvements, which have frequent commercial vessel traffic. The exception to this are several parks along the Kill Van Kull, which range from 50-500 feet from proposed work. Minor, temporary adverse impacts to recreational resources as a result of project implementation are expected.

6.13: Aesthetics and Scenic Resources

6.13.1: No Action/Future Without-Project Alternative

Under the No Action/Future Without-Project alternative, existing navigational uses within the project area (industry, commerce, military, and recreation) would continue and the view sheds and vistas would reflect the continued industrial land use within the area. Over time, deep draft navigation would likely increase slightly with the predicted growth in commodity movement assumed to occur over the 50-year period of analysis.

6.13.2: Action Project Alternative

Initial construction of the recommended plan would require deepening and widening of the navigation channels and adjacent areas. Once construction is completed, the channels and improvements would need routine maintenance. Construction and maintenance would be consistent with the aesthetic character of the working harbor.

Implementing the Action Alternative would result in temporary negligible effects on the visual resources within the Action Area over the period of construction. There would be a permanent, negligible to minor change to the aesthetic environment of the Action Area as it would continue to be that of a working waterfront with a mix of industrial, commercial, highway transport, naval, marine, and urban shoreline uses, but would allow for a larger class of vessel to transit the area. This may alter the viewshed of the Action Area, though not significantly.

6.14: Hazardous, Toxic, and Radioactive Wastes

6.14.1: No Action/Future Without-Project Alternative

Under the No Action/Future Without-Project Alternative, dredging operations in the existing navigation channels would continue to occur and are anticipated to continue to occur for the next 50 years, therefore it is not anticipated that any federal or state listed hazardous, toxic and radioactive waste site would affect or be affected by the No Action/Future Without-Project Alternative.

6.14.2: Action Project Alternative

The Action Area is heavily urban and, as discussed in Appendix A6, has many known contaminated sites located in the vicinity, both in New Jersey and New York. These sites are primarily located on land and outside of the NYNJHDCI project boundary except for a portion of one Federal and State (New Jersey) listed Superfund site identified as the Diamond Alkali, Newark Bay Operable Unit located in New Jersey. The Diamond Alkali, Newark Bay Operable Unit includes Newark Bay, Arthur Kill and Kill van Kull channels and portions of the Hackensack River, bound by the Lower Passaic River Restoration Project downstream boundary, the Contrail Bridge at the Hackensack River, the Bayonne Bridge, and the Goethals Bridge. The Newark Bay Operable Unit is currently under remedial investigation, which is estimated to be completed with a record of decision by November 2022 as currently published on the USEPA website. The proposed deepening will occur in the existing navigation channels, where dredging operations are currently performed and are anticipated to continue for the next 50 years. The Action Project Alternative is not anticipated to have an adverse impact on the nearby CERCLA sites (Diamond Alkali and the Newark Bay Operable Unit) as the District intends to continue coordination with USEPA and NJDEP. It is not anticipated that any other federal or state listed contaminated site will affect or be affected by the Action Project Alternative as they are located outside of the project boundaries.

A Confined Disposal Facility is in Newark Bay between Port Elizabeth channel and Port Newark channel. Now closed and capped, the Confined Disposal Facility was designed to store contaminated dredge materials and to prevent pollution of the estuary. The Confined Disposal Facility is located outside the proposed dredging areas of the existing navigation channels and will be avoided to ensure no impact to the Confined Disposal Facility.

In accordance with Engineering Regulation 1165-2-132, dredged materials will be tested under dredged material placement criteria for their suitability for beneficial use in accordance with the appropriate guidelines and criteria including, but not limited to, Section 404 of the Clean Water Act and/or Section 103 of the Marine Protection Research and Sanctuaries Act and supplemented by the Corps of Engineers Management Strategy for Disposal of Dredge Material: Containment Testing and Controls.

6.15: Air Quality

6.15.1: No Action/Future Without-Project Alternative

The No-Action Alternative would result in periodic maintenance dredging that would not be subject to General Conformity Rule review and compliance since maintenance dredging is statutorily exempt from the Rule. While regulated emissions from the maintenance dredging may be lower overall than the temporary (construction) emissions from implementing the recommended plan, none of the benefits, such as full mitigation of construction-related emissions and greater navigational efficiency resulting from the channel improvements which would lead to a reduction in vessel emissions accessing the terminals, of the recommended plan would be realized. The No-Action Alternative would permit the continued unmitigated release of regulated emissions related to maintenance construction operations as well as prevent newer, cleaner, larger and fewer vessels faster and safer access to the terminals.

6.15.2: Action Project Alternative

The project will produce temporary localized emission increases from the diesel-powered dredging equipment and marine vessels working on the project. The localized emission increases from the diesel-powered equipment will last only during the project's construction period and then end when the project is over, thus any potential impacts from the construction will be temporary in nature.

As stated in the Air Quality Section (Section 2.22), the counties in which the project will be performed (New Jersey counties of Essex, Hudson, and Union, and New York counties of Kings and Richmond) have been designated with the following attainment status with respect to the National Ambient Air Quality Standards for criteria pollutants: 'serious' nonattainment area for the 2008 8-hour ozone standard, 'moderate' nonattainment for the 2015 8-hour ozone standard, and 'maintenance' for the 2006 particulate matter less than 2.5 microns standard. In addition, Essex, Hudson, and Union Counties, all in New Jersey, are part of a 'maintenance' area for the 1971 carbon monoxide standard (40 Code of Federal Regulations Section 81.331). The ozone nonattainment counties are part of a larger Ozone Transport Region. Ozone is controlled through the regulation of its precursor emissions, which include oxides of nitrogen and volatile organic compounds. Volatile organic compounds are emitted at a fractional rate compared to oxides of nitrogen emissions. In addition, sulfur dioxide is a precursor for particulate matter less than 2.5 microns. Because of these designations and since the project is a Federal Action taken by the USACE, this project triggers a General Conformity Review under 40 Code of Federal Regulations Section 93.154. General Conformity ensures that Federal Actions do not have a negative impact on State Implementation Plans. For the pollutants that will be emitted as part of the project, the annual de minimis levels are: 50 tons of oxides of nitrogen or volatile organic compounds, 100 tons of CO, 100 tons of particulate matter less than 2.5 microns, and 100 tons of sulfur dioxide. Projects that don't have any annual emissions exceeding these threshold levels are presumed to be in conformity with the State Implementation Plan.

The emissions associated with the project are estimated as part of the General Conformity Review and are summarized below, by calendar year.

Table 35: Estimated Emissions

Estimated Emissions, tons per year															
Pollutant	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
NO_x	428	497	497	497	433	436	436	436	436	436	358	279	279	279	105
VOC	14	17	17	17	15	15	15	15	15	15	13	10	10	10	4
$PM_{2.5}$	20	24	24	24	21	21	21	21	21	21	18	14	14	14	5
SO_2	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
CO	56	64	64	64	55	55	55	55	55	55	44	32	32	32	12

The emission levels of oxides of nitrogen will exceed the ozone 'de minimis' level for General Conformity; therefore, applicable oxides of nitrogen emissions will need to be fully offset as part of the project. Because oxides of nitrogen will be fully offset, by rule, the net oxides of nitrogen emissions increase will be zero and therefore will produce no significant impacts.

A Statement of Conformity will be utilized to ensure that the project meets the General Conformity requirements. The associated mitigation and tracking over the life of the project will be coordinated through the Regional Air Team that consists of: USEPA Region 2, NYSDEC, NJDEP, USACE New York District, and other agencies associated with the mitigation efforts associated with the Harbor Deepening Project, the Hurricane Sandy-related restoration projects, and the current Project. This approach has been successfully used to fully offset emissions from the Harbor Deepening Project and the Hurricane Sandy-related restoration projects, which covered lengthy construction periods between 2005 and 2020.

The mitigation options for oxides of nitrogen include the use of available Surplus Oxides of Nitrogen Emission Offsets generated by the Harbor Deepening Project and/or subsequent Marine Vessel Engine Replacement Programs, establishment of a new Marine Vessel Engine Replacement Program, the purchase of USEPA Cross-State Air Pollution Rule ozone season oxides of nitrogen allowances, statutory exemption, and/or State Implementation Plan accommodation. The final combination of the above options will be coordinated and tracked through the Regional Air Team. The draft Statement of Conformity is provided as Appendix A5. In meeting the General Conformity requirements, the project will not incur significant impacts.

6.16: Noise and Vibration

6.16.1: No Action/Future Without-Project Alternative

Existing dredging operations, dredged material placement, and navigation would continue in the Action Area. Current maintenance operations would continue to generate construction related noise from vessels and equipment (e.g., dredge operation, pumps, transportation, and final dredged material placement/disposal). Recreational use of local Action Area waters is also expected to continue, such as recreational fishing and cruise liners calling at local port facilities. The lower New York Harbor is a region of major shipping and recreational boat traffic and background noises, both in air and underwater, reflect this and current background noise from these activities are expected to continue.

6.16.2: Action Project Alternative

Local noise in the immediate construction area within the project Action Area would increase with implementation of the Action Project Alternative, as compared to the No Action/Future Without-Project Alternative because of the increased duration of construction and maintenance operations required to do the proposed dredging. Additionally, 17% of the project will require blasting, which will cause a temporary, minor increase in noise. At a range of 1-meter, confined blasting has a peak level of 220dB, compared to a peak range of 175-190dB for dredging, depending on the type of dredge (see Table 36) (Suedel et al., 2019).

Table 36: Sound levels of Natural and Anthropogenic Sources
(Note this table spans two pages)

SOUND SOURCE	SOURCE LEVEL dB re 1µPa at 1m, (unless otherwise noted)
Natural	
Biological	
Sperm whale click	236 (RMS)
Snapping shrimp	183 - 189 (peak)
Harbor porpoise click	205 (peak)
Physical	
Waves	~40 – 80
Weather (rain, thunder)	~80
Ambient Harbor[a]	60 - 73.2
Anthropogenic	
Offshore Construction	
Explosives	272-287 (peak)
Confined Blasting	220 (peak)
Pile Driving	243-257 (peak)
Seismic surveys	
Airgun array	260-262 (peak)
Sonar	
Echosounders	235 (peak)
Military sonar (low-frequency)	215 (peak)
Military sonar (mid-frequency)	223-235 (peak)
Offshore industrial activities	
Wind turbine	142 (RMS)
Drilling	145-190 (RMS)
Shipping	
Small boats and ships	160-180 (RMS)
Large vessels	189-190 (RMS)
New York-New Jersey Harbor (ambient)[b]	75-125
Dredging	

SOUND SOURCE	SOURCE LEVEL dB re 1µPa at 1m, (unless otherwise noted)
Cutter suction dredge	168-175
Trailing suction hopper dredge	172-190
Grab dredge	107-124[c]
Backhoe dredge	163-179

[a]Ambient sound measured at Cook Inlet, Alaska (absent of shipping noise)
[b]Ambient harbor sounds (with shipping) measured at 3 m depth
[c]124 dB was measured at 158 m from sound source
Peak = maximum pressure, RMS = root mean square

6.17: Summary of Mitigation

The various mitigation measures being considered to avoid, minimize, reduce or compensate for the adverse environmental impacts expected from implementation of the proposed action are summarized in Table 37.

Table 37: Summary of Mitigation Measures

SHALLOW SUBTIDAL HABITAT
Compensatory mitigation for 1.92 acres of shallow subtidal habitat impacted through purchasing of credits from a mitigation bank, an in-lieu fee program, or the restoration and/or enhancement of habitat equal to or greater than the Habitat Units being disturbed, as determined by the Port Habitat Functional Assessment Model (see Appendix A11).
CULTURAL RESOURCES
The project has the potential to have an adverse impact on historic properties, however, additional investigation is required to determine what sites will be impacted. A Programmatic Agreement (see Appendix A9) between the New York District, New York and New Jersey State Historic Preservation Offices, New York City Landmarks Preservation Commission, Federally Recognized Tribes, and Interested parties is being coordinated to guide identification and evaluation of historic properties. Both remote sensing surveys for shipwrecks and geomorphic surveys for submerged Native American sites will be carried out.
AIR QUALITY
The mitigation options for oxides of nitrogen include the use of available Surplus Oxides of Nitrogen Emission Offsets generated by the Harbor Deepening Project and/or subsequent Marine Vessel Engine Replacement Programs, establishment of a new Marine Vessel Engine Replacement Program, the purchase of USEPA Cross-State Air Pollution Rule ozone season oxides of nitrogen allowances, statutory exemption, and/or State Implementation Plan accommodation. The final combination of the above options will be coordinated and tracked through the Regional Air Team. The draft Statement of Conformity is provided as Appendix A5.

6.18: Compensatory Mitigation

As described in section 6.5.2, the recommended plan includes up to 1.92 acres of impact to unvegetated shallow subtidal habitat. These impacts will be mitigated, either through purchasing of credits from a mitigation bank, an in-lieu fee program, or the restoration and/or enhancement of habitat (see Appendix A11). In-kind, in-place mitigation is preferable. If none such sites exist, out-of-kind and/or out-of-place sites will be used. Potential mitigation sites will be identified through the Comprehensive Restoration Plan for the Hudson Raritan Estuary (USACE, 2016), among other sources. All impact areas and potential mitigation sites will be evaluated using a project-specific habitat assessment model currently undergoing the approval review process by the Corps Ecosystem Restoration Planning Center of Expertise and is anticipated to be approved prior to finalization of the Feasibility Report and Environmental Assessment.

Chapter 7: Coordination and Compliance with Environmental Requirements*

Compliance with the following environmental laws (and implementing regulations) and Executive Orders is required for the project alternatives under consideration (Table 7-1) (note: this is not necessarily an exhaustive list of all applicable environmental requirements).

7.1: Table of Environmental Compliance, Executive Orders, and Permitting Requirements

Table 38: Environmental Compliance
(Note this table spans two pages)

TITLE OF LAW	U.S. CODE	COMPLIANCE STATUS
Abandoned Shipwreck Act of 1987	43 United States Code (U.S.C.) 2101	In Progress
American Bald and Golden Eagle Protection Act of 1962, as amended	16 U.S.C. 668	N/A
American Indian Religious Freedom Act of 1978	Public Law No. 95-341, 42 U.S.C. 1996	N/A
Anadromous Fish Conservation Act of 1965	16 U.S.C. 757 a et seq.	In Progress
Archaeological and Historic Preservation Act of 1974	Public Law 93-291 and 16 U.S.C.469-469c	In Progress
Archaeological Resources Protection Act of 1979	16 U.S.C. 470aa–470mm	N/A
Clean Air Act of 1972, as amended	42 U.S.C. 7401 et seq.	In Progress
Clean Water Act of 1972, as amended	33 U.S.C. 1251 et seq.	In Progress
Coastal Barrier Resources Act of 1982	Public Law 114-314	N/A
Coastal Zone Management Act of 1972, as amended	16 U.S.C. 1451 et seq.	In Progress
Comprehensive Environmental Responses, Compensation and Liability Act of 1980	42 U.S.C. 9601	In Progress
Deepwater Port Act of 1974, as amended	33 U.S.C. 1501	N/A
Emergency Wetlands Resources Act	16 U.S.C. 3901-3932	N/A
Endangered Species Act of 1973	16 U.S.C. 1531	In Progress

TITLE OF LAW	U.S. CODE	COMPLIANCE STATUS
Estuary Protection Act of 1968	16 U.S.C. 1221 et seq.	N/A
Fish and Wildlife Coordination Act of 1958, as amended	16 U.S.C. 661	In Progress
Flood Control Act of 1970	33 U.S.C. 549	In Progress
Land and Water Conservation Act	16 U.S.C. 460	N/A
Magnuson-Stevens Fishery Conservation and Management Act	16 U.S.C. 1801	In Progress
Marine Mammal Protection Act of 1972, as amended	16 U.S.C. 1361	N/A
Marine Protection, Research, and Sanctuaries Act of 1972	33 U.S.C. 1401	In Progress
Migratory Bird Conservation Act of 1928, as amended	16 U.S.C. 715	N/A
Migratory Bird Treaty Act of 1918, as amended	16 U.S.C. 703	N/A
National Environmental Policy Act of 1969, as amended	42 U.S.C. 4321 et seq.	In Progress
National Historic Preservation Act of 1966, as amended	54 U.S.C. Section 300101	In Progress
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001	In Progress
Noise Control Act of 1972, as amended	42 U.S.C. 4901	N/A
Resource Conservation and Recovery Act of 1976	42 U.S.C. 6901 et seq.	N/A
River and Harbor Act of 1888, Section 11	33 U.S.C. 608	N/A
River and Harbor Act of 1899	33 U.S.C. 401 et seq.	N/A
Safe Drinking Water Act of 1974, as amended	42 U.S.C. 300	N/A
Submerged Lands Act of 1953	43 U.S.C. 1301 et seq.	N/A
Toxic Substances Control Act of 1976	15 U.S.C. 2601	N/A

Table 39: Executive Orders

TITLE OF EXECUTIVE ORDER	EXECUTIVE ORDER NUMBER	COMPLIANCE STATUS
Protection and Enhancement of Environmental Quality	11514/11991	In Progress
Protection and Enhancement of the Cultural Environment	11593	In Progress
Floodplain Management	11988	N/A
Protection of Wetlands	11990	N/A
Federal Compliance with Pollution Control Standards	12088	N/A
Offshore Oil Spill Pollution	12123	N/A
Federal Compliance with Right-to-Know Laws and Pollution Prevention	12856	N/A
Federal Actions to Address Environmental Justice and Minority and Low-income Populations	12898	In Progress
Protection of Children from Environmental Health Risks and Safety Risks	13045	N/A
Invasive Species	13112	N/A
Marine Protected Areas	13158	N/A
Consultation and Coordination with Indian Tribal Governments	13175	In Progress
Responsibilities of Federal Agencies to Protect Migratory Birds	13186	N/A
Facilitation of Cooperative Conservation	13352	N/A
Planning for Federal Sustainability in the Next Decade (2015)	13693	N/A

Table 40: Permitting Requirements

LAW	AGENCY RESPONSIBLE	PERMIT, AGREEMENT, AUTHORIZATION, OR NOTIFICATION REQUIRED
Comprehensive Environmental Responses, Compensation and Liability Act of 1980, as amended	U.S. Environmental Protection Agency (USEPA)	In Progress
Clean Water Act, Section 401	NYSDEC	In Progress
Coastal Zone Management Act (CZMA)	NYDOS	In Progress
Endangered Species Act of 1973	NMFS	In Progress
Endangered Species Act of 1973	FWS	In Progress
Fish and Wildlife Coordination Act (FWCA)	FWS	In Progress
Magnuson-Stevens Fishery Conservation and Management Act	NMFS	In Progress
Marine Mammal Protection Act of 1972, as amended	NMFS	N/A
Marine Protection, Research, and Sanctuaries Act of 1972*	USEPA	N/A
Migratory Bird Treaty Act of 1918, as amended	FWS	N/A
National Historic Preservation Act of 1966, as amended	NYSDPRHP	Programmatic Agreement being negotiated
Noise Control Act of 1972	USEPA	N/A
Resource Conservation and Recovery Act of 1976	USEPA, NYSDEC	Testing, quantification, and notification for any hazardous materials.

N/A = Not Applicable; NYSDEC = New York State Department of Environmental Conservation; NMFS = National Marine Fisheries Service; NYSDPRHP = New York State Department of Parks, Recreation and Historic Preservation; USEPA = U.S. Environmental Protection Agency; FWS = U.S. Fish and Wildlife Service

7.2: National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 *et seq.*

The NEPA requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. This approach promotes the integrated use of natural and social sciences in planning and decision-making that could have an impact on the environment. This document follows the Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, published in the Federal Register on July 16, 2020, and

affects all documents, including this one, published on or after September 14, 2020 (85 FR 43304). NEPA requires the preparation of an Environmental Impact Statement for any major Federal action that could have a significant impact on quality of the human environment and the preparation of an Environmental Assessment (EA) for those Federal actions that do not cause a significant impact but do not qualify for a categorical exclusion. The NEPA regulations issued by Council on Environmental Quality provide for a scoping process to identify and the scope and significance of environmental issues associated with a project. The process identifies and eliminates from further detailed study issues that are not significant. USACE used this process to comply with NEPA, and an Environmental Impact Statement was initially identified as the appropriate NEPA document. However, after gathering data, performing preliminary impact analysis, and conducting initial scoping (including a November 2019 Interagency Meeting), it was determined that an Environmental Assessment was the appropriate NEPA document to prepare for this project. This choice was especially prudent given the Environmental Impact Statement, and four supplemental Environmental Assessments prepared for original review of the original 50-foot Harbor Deepening Project. The study was focused on an Integrated Feasibility Report/Environmental Assessment on those issues most relevant to the environment and the decision-making process. A 30-day agency, tribal, and public review of the Draft Feasibility Report/Environmental Assessment will be completed after district quality control and simultaneous with agency technical review during autumn 2020. All comments/edits will then be addressed in the Final Feasibility Report/Environmental Assessment and the comment responses will be provided in the Final Feasibility Report/Environmental Assessment. The Final Feasibility Report/Environmental Assessment, including all appendices, the Finding of No Significant Impact (FONSI) and supporting documentation fulfills the requirements of the NEPA for the New York New Jersey Harbor Deepening Channel Improvements Feasibility Report. Upon completion of the Final Feasibility Report/Environmental Assessment, and the signing of the Finding of No Significant Impact, the project will be in full compliance with the NEPA. A draft Finding of No Significant Impact is provided in Appendix A10.

7.3: Clean Water Act

The USACE will obtain Water Quality Certifications from the States of New York and New Jersey pursuant to the Clean Water Act during pre-construction engineering and design. This Feasibility Report/Environmental Assessment contains sufficient information to demonstrate that the recommended plan is in compliance with the Clean Water Act. All dredged material placement actions will comply with water quality standards as regulated by the States of New York and New Jersey. Prior to commencement of construction, dredged material will undergo evaluation procedures including chemical and biological testing in accordance with Federal guidance and regulations to provide information to reach a factual determination concerning Clean Water Act, Section 404 requirements (40 Code of Federal Regulations 230.11) and applicable state water quality standards. A water quality certification support letter from each affected state will be requested finalization of this integrated report.

7.4: Wetlands

Section 404 of the Clean Water Act and 33 Code of Federal Regulations 36(c)(4) and 33 Code of

Federal Regulations 320.4(b) require the USACE to avoid, minimize, and mitigate impacts to wetlands. No direct or indirect impacts to intertidal or freshwater wetlands are anticipated with implementation of this project. All impacts to state regulated shallow subtidal habitat anticipated with implementation of this project will be mitigated.

7.5: Federal Coastal Zone Management Act, 16 U.S.C. 1451 *et seq.*

The Federal Coastal Zone Management Act requires each Federal agency activity performed within or outside the coastal zone (including development projects) that affects land or water use, or natural resources of the coastal zone to be carried out in a manner which is consistent to the maximum extent practicable, i.e. fully consistent, with the enforceable policies of approved state management programs unless full consistency is prohibited by existing law applicable to the Federal agency.

To implement the Coastal Zone Management Act and to establish procedures for compliance with its Federal consistency provisions, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, promulgated regulations which are contained in 15 Code of Federal Regulations. Part 930. As per 15 Code of Federal Regulations 930.37, a Federal agency may use its NEPA documents as a vehicle for its consistency determination.

The State of New York's Coastal Management Program was established under the guidelines of the National Coastal Zone Management Act (1972) as a state-Federal partnership to comprehensively manage coastal resources. The NYSDOS is the designated state coastal management agency and is responsible for the implementation of the state's Coastal Management Program. Implementation includes the direct regulation of impacts to coastal resources within the critical areas of the state including coastal waters, tidelands, beaches and beach dune systems; and indirect certification authority over Federal actions and state permit decisions within the eight coastal counties. In addition, the City of New York has established a coastal zone under the Local Waterfront Revitalization Program. The Local Waterfront Revitalization Program includes 10 policy statements applicable to the City's Coastal Zone (see Appendix A3).

The State of New Jersey administers its coastal zone program through the NJDEP Land Use Regulation Program. The Coastal Zone Management Rules (N.J.A.C. 7:7E, as amended through 2/3/2003) regulate the use and development of coastal resources, and are used by NJDEP in reviewing permit applications under the Coastal Area Facility Review Act (CAFRA), N.J.S.A. 13:19-1 et seq. (as amended to July 19, 1993) and Federal Consistency Determinations (307 of the Federal Coastal Zone Management Act) among others.

In accordance with the Coastal Zone Management Act, it has been determined that the proposed channel improvements would be carried out in a manner that is fully consistent with the enforceable policies of the New York Coastal Management Program, the New Jersey Coastal Management Program, and the NYC Local Waterfront Revitalization Program (The Federal Consistency Determination with the Coastal Zone Management Act is provided in Appendix A3).

7.6: Clean Air Act, as amended, 42U.S.C. 7401 *et seq.*

A draft Statement of Conformity, including regulated emission estimates and mitigation measure to be implemented, is included in Appendix A5 for 30-day public review, as required under 40 CFR Section 93.154. Upon consideration and documentation of responses to public and agency comments, the Statement of Conformity will be finalized and signed upon finalization of the Environmental Assessment.

7.7: U.S. Fish and Wildlife Coordination Act, 16 U.S.C.661-666(c)

Coordination with the U.S. Fish and Wildlife Service and the State of New York is ongoing.

7.8: Endangered Species Act

Coordination with the FWS and the NMFS, pursuant to Section 7 of the Endangered Species Act of 1973, is ongoing. Compliance documentation is in progress and is provided in Appendices A1 and A7.

7.9: Marine Mammal Protection Act, 16 U.S.C. 1631 et seq.

The Marine Mammal Protection Act prohibits the take of marine mammals including the West Indian manatee, and all cetaceans found in the Action Area. The project is being coordinated with FWS and NMFS. No Incidental Take Authorization from the NMFS is anticipated with implementation of the Preferred Alternative.

7.10: Section 106 and 110(f) of the National Historic Preservation Act, 16 U.S.C. 470 *et seq.*

The National Historic Preservation Act applies to properties listed in or eligible for listing in the National Register of Historic Places; these are referred to as "historic properties." Historic properties eligible for listing in the National Register of Historic Places include prehistoric and historic sites, structures, buildings, objects, and collections of these in districts. Section 106 of the National Historic Preservation Act and its implementing regulations at 36 Code of Federal Regulations Part 800, require the lead Federal agency to assess the potential effects of an undertaking on historic properties that are within the proposed project's Area of Potential Effect, which is defined as "the geographic area or areas within which

an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 Code of Federal Regulations Section 800.16[d]).

An initial coordination letter was sent out in October 2019 to the New York State Historic Preservation Office, New Jersey State Historic Preservation Office, New York City Landmarks Preservation Commission, Delaware Nation, Delaware Tribe, Shawnee Tribe, Shinnecock Indian Nation, Stockbridge Munsee Community, and the Unkechaug. In November 2019 thirty-one potential interested parties were contacted to participate in the consultation process. Responses were received from the New York and New Jersey State Historic Preservation Offices,

Stockbridge Munsee, and two interested parties (South Street Sea Port Museum and Intrepid Sea, Air, & Space Museum) that they wished to be included in the consultation process. On September 1, 2020 USACE sent a draft Programmatic Agreement and Historic Properties Summary document to the New York and New Jersey State Historic Preservation Offices, New York City Landmarks Preservation Commission, Delaware Nation, Delaware Tribe, Shawnee Tribe, Shinnecock Indian Nation, Stockbridge Munsee Community, Unkechaug, South Street Seaport Museum, and the Intrepid Sea, Air, & Space Museum.

Once comments on the draft Programmatic Agreement are received, USACE plans to address the comments and send around a final version of the Programmatic Agreement to be signed and executed before the Final Feasibility Report and Environmental Assessment are released for public review. Future survey work to identify and evaluate cultural resources in the area of potential effect will be carried out after the Programmatic Agreement is executed following the stipulations laid out in the agreement.

7.11: Resource Conservation and Recovery Act, as amended, 42 U.S.C. 6901 *et seq*.

The Resource Conservation and Recovery Act controls the management and disposal of hazardous waste. "Hazardous and/or toxic wastes", classified by the Resource Conservation and Recovery Act, are materials that may pose a potential hazard to human health or the environment due to quantity, concentration, chemical characteristics, or physical characteristics. This applies to discarded or spent materials that are listed in 40 Code of Federal Regulations 261.31-.34 and/or that exhibit one of the following characteristics: ignitable, corrosive, reactive, or toxic. Radioactive wastes are materials contaminated with radioactive isotopes from anthropogenic sources (e.g., generated by fission reactions) or naturally occurring radioactive materials (e.g., radon gas, uranium ore). No radioactive waste is expected to be encountered during the proposed dredging.

Dredging within the Action Area of the proposed project is not anticipated to generate material with hazardous levels of contamination based on current dredging operations and historical testing data from the proposed dredged areas.

7.12: Comprehensive Environmental Response, Compensation and Liability Act 42 U.S.C. 9601 *et seq*.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) governs the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous substance disposal sites.

There are several federal and state listed contaminated sites within the nearby vicinity, however, the majority of these sites are located on land and outside of the Action Area. Contaminants of concern originating from these sites may be present within the dredging limits of the Action Area, including but not limited to, volatile organic compounds, dioxins, polychlorinated biphenyls (PCBs), pesticides, and metals. Dredged material will be handled as described in the

Hazardous, Toxic, and Radioactive Waste Appendix A6, which recommends dredged material be tested for placement criteria for beneficial use at an appropriate placement site able to store such material, such as the offshore HARS site. Another placement site would only be used if the analytical results exceed the limits for placement at the offshore HARS site.

7.13: Marine Protection, Research and Sanctuaries Act

The Act has two essential aims: to regulate intentional ocean disposal of materials, and to authorize any related research. While the Marine Protection Research and Sanctuaries Act of 1972 regulates the ocean dumping of waste and provides for a research program on ocean dumping, it also provides for the designation and regulation of marine sanctuaries.

Ocean dredged material placement is regulated under Section 103 of the Marine Protection Resources and Sanctuaries Act of 1972, Public Law 92-532 (Marine Protection Research and Sanctuaries Act of 1972). The law states that any proposed placement of dredged material into ocean waters must be evaluated through the use of criteria published by the USEPA in Title 40 of the Code of Federal Regulations, Parts 220228 (40 Code of Federal Regulations 220-228). The primary purpose of Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 is to limit and regulate adverse environmental impacts of ocean placement of dredged material. Dredged material proposed for ocean placement must comply with 40 Code of Federal Regulations 220-228 (Ocean Dumping Regulations) and 33 Code of Federal Regulations 320-330 and 335-338 (USACE Regulations for discharge of dredged materials into waters of the U.S.) prior to being issued an ocean placement permit. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 Code of Federal Regulations 220-228, the Ocean Testing Manual, and the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities.

All dredged material will be tested as established by the Marine Protection Research and Sanctuaries Act of 1972. Materials from dredge activities from the proposed dredging are expected to be placed at HARS offshore dredged material disposal site. All required testing for placement at HARS, which has its own management plan (USACE and USEPA, 2010) will be followed and confirmed during the pre-construction engineering and design phase.

7.14: Executive Order 11988, Floodplain Management

This Executive Order states that Federal agencies 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 floodplains in carrying out agency responsibilities. The proposed project has no effect on floodplains.

7.15: Executive Order 11990, Protection of Wetlands

This Executive Order directs all federal agencies to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural beneficial values of wetlands in the conduct of the agency's responsibilities. No direct or indirect impacts to jurisdictional

wetlands are anticipated with implementation of this project.

7.16: Executive Order 13112, Invasive Species

Under this Executive Order, the introduction of invasive species has been evaluated in Section 6.22. The project would not induce the introduction or spread of invasive species to the project area.

7.17: Executive Order 12898, Federal Actions to Address Environmental Justice

In accordance with this Executive Order, the USACE has determined that no group of people would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work.

7.18: Executive Order 13045, Protection of Children from Environmental and Safety Risks

This Executive Order ensures that all Federal actions address the unique vulnerabilities of children. In accordance with this Executive Order, the USACE has determined that no children would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work and there should be no effect on children.

7.19: Migratory Bird Treaty Act, 16 U.S.C. 703 *et seq*.; Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds

This Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. Negligible to a minor level of impact are expected on local migratory birds, no significant impacts to migratory birds is expected as a result of project implementation.

7.20: List of Preparers

The project delivery team for the study was extensive. It comprised team members from Districts in the USACE North Atlantic and South Atlantic Division (Norfolk, New York, and Mobile Districts) (Table 41). The team members listed below provided substantial text to the Integrated Feasibility Report/Environmental Assessment.

Table 41: List of Preparers

NAME	CONTRIBUTION/EDUCATION	AFFILIATION
Jesse Miller	Environmental Analyst/BS, Ecology	USACE
Jenine Gallo	Regional Technical Specialist, Environmental	USACE
Anna Jansson	Archaeologist / MA Applied Archaeology	USACE
Cheryl Alkemeyer	Hazardous, Toxic and Radioactive Waste Specialist/BS, Environmental and Occupational Health	USACE
Karen Baumert	Plan Formulator/ Study Manager	USACE
Richard Nugent	Plan Formulator / District Economist	USACE HEC
Walker Messer	Deep Draft Navigation Planning Center of Expertise Economist	USACE
Julie McGuire	Deep Draft Navigation Planning Center of Expertise Economist	USACE
Michael Morgan	Civil Engineer	USACE
Gail Woolley	Civil Engineer	USACE
Christopher Dols	Cost Engineer	USACE
Christopher Hagerman	Structural Engineer	USACE
Jong Hee Kim	Geotechnical Engineer	USACE
Ronn Giang	Real Estate Specialist	USACE
John Butler	Structural Engineer	USACE

Chapter 8: Plan Implementation

8.1: Institutional Requirements

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:

8.2: Real Estate Requirements

USACE projects require the non-federal sponsor provide lands, easements, rights-of-way and relocations for a project. The Tentatively Selected Plan will require the non-federal sponsor to acquire temporary and permanent easements for construction. Since the project is currently at a feasibility-level design, the size of the real estate interests required are preliminary estimates based on available GIS data. The precise size and location of the required real estate interests will be identified during the Preconstruction Engineering and Design phase when Plans and Specifications and detailed drawings are prepared. As a result, the number of required acreage is subject to change with project refinements. The non-federal costs for the value of lands, easements, rights-of-way, and relocations are currently estimated to be $328.3 million for the 4 foot deepening plan (to a maintained depth of -54 feet MLLW) and $328.7 million for the 5 foot deepening plan (to a maintained depth of -55 feet MLLW). Any conclusion or categorization that an item is a utility or facility relocation to be performed by the non-federal sponsor as part of its lands, easements, rights-of-way, and relocations responsibilities is preliminary only. USACE will make a final determination of the relocations necessary for the construction, operation or maintenance of the project after further analysis and completion and approval of a Final Attorney's Opinion of Compensability for each of the impacted utilities and facilities. The non-federal costs for lands, easements, rights-of-way and relocations are estimated to be $363.0 million. Details on cost sharing are provided in Section 8.4: Cost Sharing and Non-Federal Partner Responsibilities , and details on lands, easements, rights-of-way and relocations are provided in Appendix D – Real Estate Plan.

8.3: Implementation Schedule

For Preconstruction Engineering and Design and construction to be initiated, the USACE must sign a Project Partnership Agreement with a non-federal sponsor to cost share Preconstruction Engineering and Design and construction. This project would require congressional authorization for Preconstruction Engineering and Design and construction. The Preconstruction Engineering and Design and construction phases are cost shared 50 percent federal and 50 percent non-federal. Implementation would then occur, provided that sufficient funds are appropriated to design and construct the project.

The draft schedule for plan implementation was developed for planning and cost estimating purpose (Table 42).

Table 42: Draft Tentatively Selected Plan Implementation Schedule

TASK	DATE
Chief of Engineering Report Approval	May 2022
Project Partnership Agreement Execution	July 2022
Pre-Construction Engineering & Design	July 2022 – September 2024
Construction	October 2024 – October 2038

8.4: Cost Sharing and Non-Federal Partner Responsibilities

Cost sharing for the Tentatively Selected Plan will be done in accordance with Section 101 of the the Water Resources Development Act of 1986, as amended, and cost shared as a general navigation feature. The cost share is based on all recommended channel depths being greater than -50 feet. Channel depths greater than -50 feet are cost shared 50 percent non-federal and 50 percent federal. The Port Authority of New York and New Jersey will provide all lands, easements, rights-of-way, and relocations. Disposal necessary for the project is cost-shared as a general navigation feature. An additional 10 percent of the total costs of general navigation features will be repaid by the non-federal sponsor over a period not to exceed 30-years. The sponsor's costs for lands, easements, rights-of-way, and relocations[1], are credited against the additional cash contribution. The Port Authority of New York and New Jersey shall also pay 50% of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of 50 feet. Consistent with current New York District practice, the Port Jersey channel is anticipated to be maintained by dredging every 10 years, the Anchorage channel reaches to be maintained every seven years, and all other channels are assumed to be maintained together in a single contract every three years.

[1] Any conclusion or categorization that an item is a utility or facility relocation to be performed by the non-federal sponsor as part of its lands, easements, rights-of-way, and relocations responsibilities is preliminary only. USACE will make a final determination of the relocations necessary for the construction, operation or maintenance of the project after further analysis and completion and approval of a Final Attorney's Opinion of Compensability for each of the impacted utilities and facilities.

Table 43: Federal and Non-Federal Costs

	FEDERAL COST	NON-FEDERAL COST	TOTAL
DEEPEN PATHWAY TO EPAMT AND PJPAMT BY 4 FEET TO -54 FEET MLLW			
Construction Item			
01 LANDS AND DAMAGES	$0	$0.6 million	$0.6 million
02 RELOCATIONS	$0	$327.7 million	$327.7 million
06 FISH & WILDLIFE FACILITIES	$8.0 million	$8.0 million	$16.0 million
12 NAVIGATION PORTS & HARBORS	$1,526.3 million	$1,526.3 million	$3,052.6 million
18 CULTURAL RESOURCE PRESERVATION	$1.5 million	$1.5 million	$3.1 million
Subtotal	**$1,535.8 million**	**$1,864.2 million**	**$3,400.0 million**
30 PLANNING, ENGINEERING & DESIGN	$150.9 million	$150.9 million	$301.9 million
31 CONSTRUCTION MANAGEMENT	$54.1 million	$54.1 million	$108.1 million
Subtotal	**$205.0 million**	**$205.0 million**	**$410.0 million**
Total Project First Costs	**$1,740.8 million**	**$2,069.2 million**	**$3,810.0 million**
Associated Costs (Other Federal Costs)[1]			
12 Navigation Aids[1]	$0	$0	$0
Associated Costs Subtotal [1]	$0	$0	$0
Associated Costs (Other Non-Federal Cost)[2]			
12 Local Service Facilities[2]	$0	$169.9 million	$169.9 million
Associated Costs Subtotal[1,2]	$0	**$169.9 million**	**$169.9 million**
Project Cost Plus Associated Cost	**$1,740.8 million**	**$2,239.1 million**	**$3,979.9 million**
DEEPEN PATHWAY TO EPAMT AND PJPAMT BY 5 FEET TO -55 FEET MLLW			
Construction Item			
01 LANDS AND DAMAGES	$0	$1.0 million	$1.0 million
02 RELOCATIONS	$0	$327.7 million	$327.7 million
06 FISH & WILDLIFE FACILITIES	$8.2 million	$8.2 million	$16.4 million
12 NAVIGATION PORTS & HARBORS	$1,633.8 million	$1,633.8 million	$3,267.6 million
18 CULTURAL RESOURCE PRESERVATION	$1.5 million	$1.5 million	$3.1 million
Subtotal	**$1,643.5 million**	**$1,972.3 million**	**$3,615.8 million**
30 PLANNING, ENGINEERING & DESIGN	$160.7 million	$160.7 million	$321.4 million
31 CONSTRUCTION MANAGEMENT	$57.6 million	$57.6 million	$115.1 million
Subtotal	**$218.3 million**	**$218.3 million**	**$436.5 million**
Total Project First Costs	**$1,861.8 million**	**$2,190.5 million**	**$4,052.3 million**
Associated Costs (Other Federal Costs)[1]			
12 Navigation Aids[1]	$0	$0	$0
Associated Costs Subtotal [1]	$0	$0	$0
Associated Costs (Other Non-Federal Cost)[2]			
12 Local Service Facilities[2]	$0	$184.0 million	$184.0 million
Associated Costs Subtotal[1,2]	$0	**$184.0 million**	**$184.0 million**
Project Cost Plus Associated Cost	**$1,861.8 million**	**$2,374.5 million**	**$4,236.3 million**

Fiscal Year 2021 Price Level and discount rate of 2.5%
EPAMT = Elizabeth - Port Authority Marine Terminal, PJPAMT = Port Authority Marine Terminal
[1.] Responsibility of another Federal Agency (i.e. U.S. Coast Guard)
[2.] Associated costs not part of the recommended Federal project but necessary non-Federal responsibility

8.5: Views of the Non-Federal Sponsor and Other Agencies

New York District has coordinated with the Port of New York and New Jersey continuously throughout the study. Coordination with the public and resource agencies is ongoing. A public meeting will be held during the comment period of this draft integrated report. New York District has also coordinated with pilots that use the harbor throughout the formulation process. The pilots' input was considered and incorporated into the measures and alternatives considered during plan formulation. The feedback received from the pilots was positive.

The Port Authority of New York and New Jersey staff has indicated their support for releasing this report for public and agency input. The Port Authority of New York and New Jersey's support for the Tentatively Selected Plan will be confirmed through a letter of support following public and agency reviews.

Chapter 9: Draft Recommendation

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 Port Authority of New York and New Jersey, the State of New Jersey, the State of New York, and other non-federal interests.

I recommend that the selected plan for navigation improvements in the New York and New Jersey Harbor be authorized for construction as a Federal project, subject to such modifications as may be prescribed by the Chief of Engineers. The recommended plan is fully detailed in this Final Integrated Feasibility Report and Environmental Assessment. The recommended plan consists of deepening the channels from sea to Port Jersey – Port Authority Marine Terminal and Elizabeth – Port Authority Marine Terminal by up to 5 feet to maintained depth of -55 feet mean lower low water. The plan is estimated to provide $340.1 million in annualized benefits and have a Project First Cost of $4,052.3 million. The plan has a benefit cost ratio of 1.9.

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.

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