Chapter 11: Natural Resources

11.1 INTRODUCTION

This chapter examines the potential impacts from the Hudson Tunnel Project on natural resources in New Jersey (including in the Meadowlands), the Hudson River, and New York. Natural resources evaluated include floodplains, wetlands, groundwater, surface and navigable waters, terrestrial resources, and threatened or endangered species and species of special concern.

This chapter contains the following sections:

11.2 ANALYSIS METHODOLOGY

During development of this Environmental Impact Statement (EIS), the Federal Railroad Administration (FRA) and NJ TRANSIT developed methodologies for evaluating the potential effects of the Hudson Tunnel Project in coordination with the Project's Cooperating and

Participating Agencies (i.e., agencies with a permitting or review role for the Project). The methodologies used for analysis of natural resources are summarized in this chapter.

11.2.1 REGULATORY CONTEXT

A number of Federal and state laws and regulations and Federal Executive Orders (EOs) apply to natural resources within the vicinity of the Project site, including the following. Federal and state regulations related to coastal zone management are discussed in Chapter 21, "Coastal Zone Consistency."

11.2.1.1 FEDERAL

- ***Clean Water Act (33 USC §§ 1251-1387):*** The Clean Water Act, also known as the Federal Water Pollution Control Act, is intended to restore and maintain the chemical, physical, and biological integrity of U.S. waters. It regulates point sources of water pollution (i.e., discharges of municipal sewage, industrial wastewater, stormwater, and the discharge of dredged or fill material into navigable waters and other waters of the U.S.) and non-point source pollution (i.e., runoff from streets, agricultural fields, construction sites, and mining). Section 404 of the Clean Water Act requires authorization from the Secretary of Army, acting through the U.S. Army Corps of Engineers (USACE), before dredged or fill material may be discharged into waters of the United States.
- ***Rivers and Harbors Act of 1899 (33 USC § 403):*** Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the USACE for: the construction of any structure in or over any navigable waters of the U.S.; the excavation from or deposition of material in these waters; or any obstruction or alteration in these waters. The purpose of this Act is to protect navigation and navigable channels.
- ***Executive Order (EO) 11990, Protection of Wetlands:*** In accordance with EO 11990, and U.S. Department of Transportation (USDOT) Order 5660.1a, *Preservation of the Nation's Wetlands*, Federal agencies must avoid undertaking or providing assistance for new construction in wetlands unless there is no practical alternative to such construction and the proposed action includes all practicable measures to minimize harm to the wetland.
- ***Floodplain Management EO 11988, as amended by EO 13690:*** EO 11988 requires Federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. USDOT Order 5650.2, *Floodplain Management and Protection*, contains policies and procedures for implementing EO 11988. For actions with a significant encroachment in the floodplain, the USDOT Order requires a finding that the proposed action is the only practicable alternative and that an evaluation was conducted to identify whether other alternatives are available to avoid or reduce adverse impacts on the floodplain. EO 13690 is a revision of EO 11988 that proposes a new Federal Flood Risk Management Standard (FFRMS) that applies to Federal actions.
- ***Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1883):*** The Magnuson-Stevens Act was established to protect and restore productive fisheries and rebuild depleted stocks in the U.S. The law establishes Essential Fish Habitat (EFH) for nearly 1,000 species of fish. For each species, the EFH is the waters and substrate necessary for fish for spawning, breeding, feeding, or growth to maturity. This law requires Federal agencies to consult with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA-NMFS) on Federal actions that may adversely affect areas designated as EFH.

- ***Marine Mammals Protection Act of 1972 (16 USC § 31) :*** The Marine Mammals 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.
- ***Fish and Wildlife Coordination Act (PL 85-624; 16 USC §§ 661-667d):*** The Fish and Wildlife Coordination Act entrusts the Secretary of the Interior and NOAA with providing assistance to, and cooperation with, Federal, state, and public or private agencies and organizations, to ensure that wildlife conservation receives equal consideration and coordination with other water-resource development programs. These programs can include the control (such as a diversion), modification (such as channel deepening), or impoundment (such as a dam) of a body of water.
- ***Section 1424(e) of the Safe Drinking Water Act (PL 93-523):*** Section 1424(e) of the Safe Drinking Water Act of 1974 provides special protection for aquifers that are the sole or principal drinking water resource for an area.
- ***Endangered Species Act of 1973 (16 USC §§ 1531-1544):*** The Endangered Species Act prohibits the importation, exportation, taking, possession, and other activities involving species covered under the Act. The Act also provides for the protection of critical habitats on which endangered or threatened species depend for survival. This Act requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and NOAA-NMFS for any actions that may jeopardize threatened or endangered species, or destroy or adversely modify their critical habitats.
- ***EO 13112, Invasive Species:*** EO 13112 requires Federal agencies to prevent, to the extent practicable and permitted by law, the introduction of invasive species and provide for their control.
- ***Migratory Bird Treaty Act (50 CFR Parts 10, 20, 21, EO 13186):*** The Migratory Bird Treaty Act (MBTA) makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed therein. Over 800 species are currently protected under the Act.
- ***Bald and Golden Eagle Protection Act (16 USC §§ 668-668c):*** The Bald and Golden Eagle Protection Act (BGEPA) prohibits anyone without a permit issued by the Secretary of the Interior, acting through the USFWS, from "taking" bald or golden eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb."

11.2.1.2 NEW JERSEY

- ***Tidelands Act (NJSA 12:3-1):*** Under this act, a grant, lease, or license is required from the State of New Jersey for activities on state-owned lands that are now tidally flowed, or were formerly tidally flowed.
- ***Freshwater Wetlands Protection Act (NJAC 7:7A):*** These regulations govern activities within freshwater wetland areas of New Jersey. Freshwater wetland areas within the Hackensack Meadowlands District are not subject to the rules at NJAC 7:7A but are subject to USACE 404 regulations under the Clean Water Act.
- ***Surface Water Quality Standards for New Jersey Waters (NJAC 7:9B):*** These standards establish the designated uses to be achieved, provide management guidelines, and specify the water quality criteria necessary to protect the state's waters.
- ***New Jersey Pollutant Discharge Elimination System (NJPDES)(NJAC 7:14A-1)***: Under Section 402 of the Clean Water Act, stormwater discharges to the waters of the U.S. require authorization by a National Pollutant Discharge Elimination System (NPDES) permit or pursuant to an authorized state permit program. New Jersey has established the New

Jersey Pollutant Discharge Elimination System (NJPDES) program as authorized under the Clean Water Act.

- ***Stormwater Management Rules (NJAC 7:8, Stormwater Management):*** The New Jersey Department of Environmental Protection (NJDEP) implements the Stormwater Management Rules through the review of permits issued by the Division of Land Use Regulation (i.e., Flood Hazard, Freshwater Wetlands, the Coastal Area Facility Review Act (CAFRA), Waterfront Development and Coastal Wetlands). These rules set establish the stormwater management design and performance standards for new (proposed) development.
- ***Water Supply Management Act (NJSA 58:1A):*** This act declares that water resources are public assets of the state, held in trust by the state for its citizens in order to maintain an adequate supply of water, present and in the future. NJDEP implements the Act through the Water Supply Allocation Permit rules (NJAC 7:19) through which the agency manages water diversion such as construction dewatering, water quantity and quality, issues permits, and handles drought warnings, water emergencies and water quality emergencies.
- ***Soil Erosion and Sediment Control Act (NJSA 4:24-43):*** Any project proposing more than 5,000 square feet of soil disturbance must have a Soil Erosion and Sediment Control (SESC) Plan certified by the local district to ensure that the project meets the Standards for Soil Erosion and Sediment Control in New Jersey.
- ***Endangered and Nongame Species Act (NJSA 23:2A-2 et seq.; NJAC 7:25-4):*** This act protects species or subspecies of wildlife indigenous to the state listed in the regulations.

11.2.1.3 NEW YORK

- ***Tidal Wetlands Act (Article 25, ECL; 6 NYCRR Part 661):*** Tidal wetlands regulations apply anywhere tidal inundation occurs on a daily, monthly, or intermittent basis, including along the tidal waters of the Hudson River. The regulations govern activities within mapped wetlands or a designated adjacent area.
- ***Protection of Waters (Article 15, Title 5, ECL; 6 NYCRR Part 608):*** The Protection of Waters permit program regulates activities that affect surface waters (streams, lakes, and ponds) of the New York State. Surface water and groundwater quality standards and effluent limitations in New York State are regulated pursuant to 6 NYCRR Parts 701 and 703. Part 701, Classifications–Surface Waters and Groundwater, assigns specific categories to New York waters. These standards establish the designated uses to be achieved and specify the water quality criteria necessary to protect surface waters.
- ***State Pollutant Discharge Elimination System (SPDES) (ECL Article 3, Title 3; Article 15; Article 17, Titles 3, 5, 7, 8; Article 21; Article 70, Title 1; Article 71, Title 19; Implementing Regulations 6 NYCRR Part 750):*** New York State has established the State Pollutant Discharge Elimination System (SPDES) program for controlling wastewater and stormwater discharges to groundwaters and surface waters; the SPDES program is an authorized program under the Clean Water Act.
- ***Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern (ECL, Sections 11-0535[1]-[2], 11-0536[2], [4]; 6 NYCRR Part 182):*** These regulations prohibit the taking, import, transport, possession, or selling of any endangered or threatened species of fish or wildlife, or any hide, or other part of species listed in the regulations.

11.2.2 ANALYSIS TECHNIQUES

This chapter evaluates existing conditions for natural resources using a range of data sources, including those listed below:

- USFWS National Wetland Inventory (NWI) maps
- USFWS Information for Planning and Consultation (IPaC) system results
- U.S. Geological Survey (USGS) topographic maps
- Soils data and maps, U.S. Department of Agriculture (USDA) Web Soil Survey
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs)
- NMFS EFH information
- Coordination with USFWS and NMFS
- NJDEP GeoWeb database tideland maps, wetland maps, and floodplain maps
- Information from NJDEP Office of Natural Lands Management
- NJDEP, Natural Heritage Program (NJNHP)
- New Jersey Sports and Exposition Authority (NJSEA), Natural Resources Management Department
- New York State Department of Environmental Conservation (NYSDEC) tidal wetlands maps
- NYSDEC Environmental Resource Mapper information
- NYSDEC 2000-2005 Breeding Bird Atlas results
- NYSDEC Herp Atlas Project results
- New York State Department of State (NYSDOS) Significant Coastal Fish and Wildlife Habitats maps and information
- Information from New York Natural Heritage Program (NYNHP)
- New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Survey reports
- Hudson River Estuary Program
- Information gathered for the Access to the Region’s Core (ARC) Project Final Environmental Impact Statement (FEIS)
- Results from field reconnaissance
- Published and unpublished studies (see the references listed in Section 11.10 below)

This chapter assesses impacts to natural resources from the Preferred Alternative on the basis of results of empirical studies conducted by other researchers within or near the study area and other relevant studies performed in other geographic areas that relate to the Preferred Alternative, as well as through consultation with regulatory and resource agencies such as the NMFS, NYSDEC, NJDEP, U.S. Environmental Protection Agency (USEPA), and USACE (also see **Appendix 11** for agency correspondence related to natural resource issues and consultation).

11.2.3 STUDY AREAS

The study areas for the assessment of terrestrial natural resources consists of the Project site as described in Chapter 4, “Analysis Framework,” including all areas where the Preferred Alternative would have construction activities or permanent Project features and where the North River Tunnel rehabilitation activities would occur. Where resources such as wetlands or other ecological communities extend beyond the Project site and the Preferred Alternative would have the potential to affect these resources, the study area includes adjacent areas.

The study area for aquatic resources includes Penhorn Creek in the vicinity of the surface alignment in New Jersey, and in the Lower Hudson River where the new tunnel and low-cover area would be located and where the North River Tunnel rehabilitation would occur. Penhorn Creek is a tidal tributary of the Hackensack River.

11.3 AFFECTED ENVIRONMENT: EXISTING CONDITIONS

11.3.1 NEW JERSEY

The western half of the study area within New Jersey is located within the New Jersey Meadowlands, a large complex of tidal marshes and impounded wetlands surrounded by developed areas that include paved parking areas, warehouse and industrial development, and transportation infrastructure such as major highways and secondary roads. Natural areas, including wetland habitats and adjacent upland habitats have been documented, by NJSEA and NJDEP, to provide habitat for many resident and migratory species, including some species that have been listed by state or Federal regulatory agencies as being of special concern, threatened, or endangered. The following sections describe the natural resources within and outside the Meadowlands study area.

11.3.1.1 FLOODPLAINS

A floodplain is any land area susceptible to being inundated by riverine or coastal flood waters. The 100-year floodplain is the area of that has a 1 percent chance of flooding in any given year. That area is mapped by FEMA on its FIRMs. FEMA's maps also indicate the Base Flood Elevation (BFE), which is the height of flooding that can be expected in the 100-year flood within the floodplain. The BFE is measured not from ground or sea level, but from a fixed tidal benchmark established by NOAA called the North American Vertical Datum of 1988 (NAVD88).

As shown in **Figure 11-1**, based on the preliminary FIRM dated January 30, 2015, most of the New Jersey study area, other than the land on the Palisades above the Preferred Alternative's rock tunnel alignment is within the 100-year floodplain, mapped as Zone AE.[1] Small portions of the study areas are within the 500-year floodplain (the area with a 0.2 percent chance of flooding in a given year). Conservatively, the approximate elevation of the 500-year floodplain is +11.7 feet NAVD88 on the basis of the 500-year stillwater elevation at the confluence of Penhorn Creek with the Hackensack River.[2] West of Tonnelle Avenue in North Bergen, NJ, the Project site is within the 100-year floodplain and BFEs range from 8 to 9 feet NAVD88. Between Tonnelle Avenue and the east side of the Palisades, the Project site is not within the 100-year or 500-year floodplain. East of the Palisades the Project site is within the Hudson River floodplain and BFEs range from 11 to 12 feet (**Figure 11-1**). The BFE within the Hudson River is 16 feet and is mapped in the preliminary FIRM as Zone VE, indicating that it is an area subject to additional hazards due to storm-induced velocity wave action, a 3-foot or higher breaking wave.

The dominant source of flooding in the Hackensack River is tidal surge emanating from the Atlantic Ocean through various waterbodies to Newark Bay and the Hackensack River mouth. Tidal flooding west of Tonnelle Avenue propagates from the Hackensack River upstream along Penhorn Creek, a tributary of the Hackensack River, past the Northeast Corridor (NEC) track embankment, which crosses the creek approximately 2.2 miles upstream of its mouth. East of

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1 FEMA 2016.

2 FEMA 2014.

5/2/2017

Preliminary FEMA flood hazard data for NYC and Hudson County: Jan. 2015; Bergen County: August 2014

Project Site

Zone + EL — 1% Annual Chance Flood Hazard (100-year floodplain)

0.2% Annual Chance Flood Hazard (500-year floodplain)

0 — 2,000 FEET

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Flood Hazard Areas, Preliminary FIRM:
New Jersey Study Area

Figure 11-1

the Palisades, tidal surge from the Atlantic Ocean, and to a lesser extent wave runup,[3] is the primary cause of flooding in the study area adjacent to the Hudson River.[4]

11.3.1.2 WETLANDS

The analysis of wetlands in the New Jersey study area included review of the National Wetlands Inventory (NWI) published by the USFWS and of NJDEP wetland maps, and a field reconnaissance in fall 2016. The NWI shows large areas of estuarine wetlands and smaller areas of freshwater wetlands within the New Jersey study area in the Hackensack Meadowlands (see **Figure 11-2**).

The freshwater wetlands shown on the NWI are riverine unknown perennial wetlands that have unconsolidated bottoms and are permanently flooded (designated by USFWS as R5UBH). As shown on the NWI, this R5UBH wetland is mapped on Penhorn Creek as it crosses the NEC east of County Road in Secaucus, NJ and the Project alignments and again near Secaucus Road in Secaucus, NJ, and on a wetland area immediately north of the NEC near the New York Susquehanna & Western Railway (NYSW) right-of-way at the eastern edge of the Meadowlands.

The estuarine tidal wetlands within the study area (see **Figure 11-2**) include an intertidal wetland (designated by USFWS as E2EM5P6) spanning both sides of the NEC from County Road to Penhorn Creek that is irregularly flooded, oligohaline, (i.e., brackish water with a salinity ranging from 0.5 to 3.0 parts per thousand [ppt]), and dominated by emergent *Phragmites australis* (a large perennial reed species that is invasive within the U.S.). Outside Penhorn Creek, the NWI indicates large areas of oligohaline intertidal wetlands along both sides of the NEC east of Secaucus Road that are irregularly flooded, dominated by emergent *Phragmites australis*, and partially drained and ditched (E2EM5Pd6). A wetland mitigation project, implemented by NYSW within their right-of-way in compliance with a USACE permit is located within a portion of the area mapped as E2EM5Pd6 (Section 11.3.1.2.1 below presents a detailed description of this wetland mitigation site). In addition, the NWI indicates subtidal wetlands with the following characteristics in small areas close to Penhorn Creek and County Road: subtidal wetlands with an unconsolidated bottom that is permanently flooded, oligohaline, and excavated (E1UBLx6); and subtidal wetland with an unconsolidated bottom that is permanently flooded (E1UBL). Field reconnaissance conducted in fall 2016 confirmed these wetland types and approximate locations.

NJDEP-mapped wetlands are located in the study area (see **Figure 11-3**). These wetlands are designated by NJDEP with the land use/land cover code and "*Phragmites* Dominate Interior Wetlands." They are located along both sides of the NEC in the Meadowlands area between County Road and the NYSW right-of-way. This wetland type and approximate wetland locations were confirmed during site reconnaissance.

FRA delineated wetlands within the New Jersey study area during November and December 2016 in accordance with USACE's three-parameter approach for identifying wetlands.[5] These wetlands are shown in **Figures 11-4a through 11-4c**; **Appendix 11** provides detailed information on the wetlands delineation. Two of these wetlands are located along the NEC and

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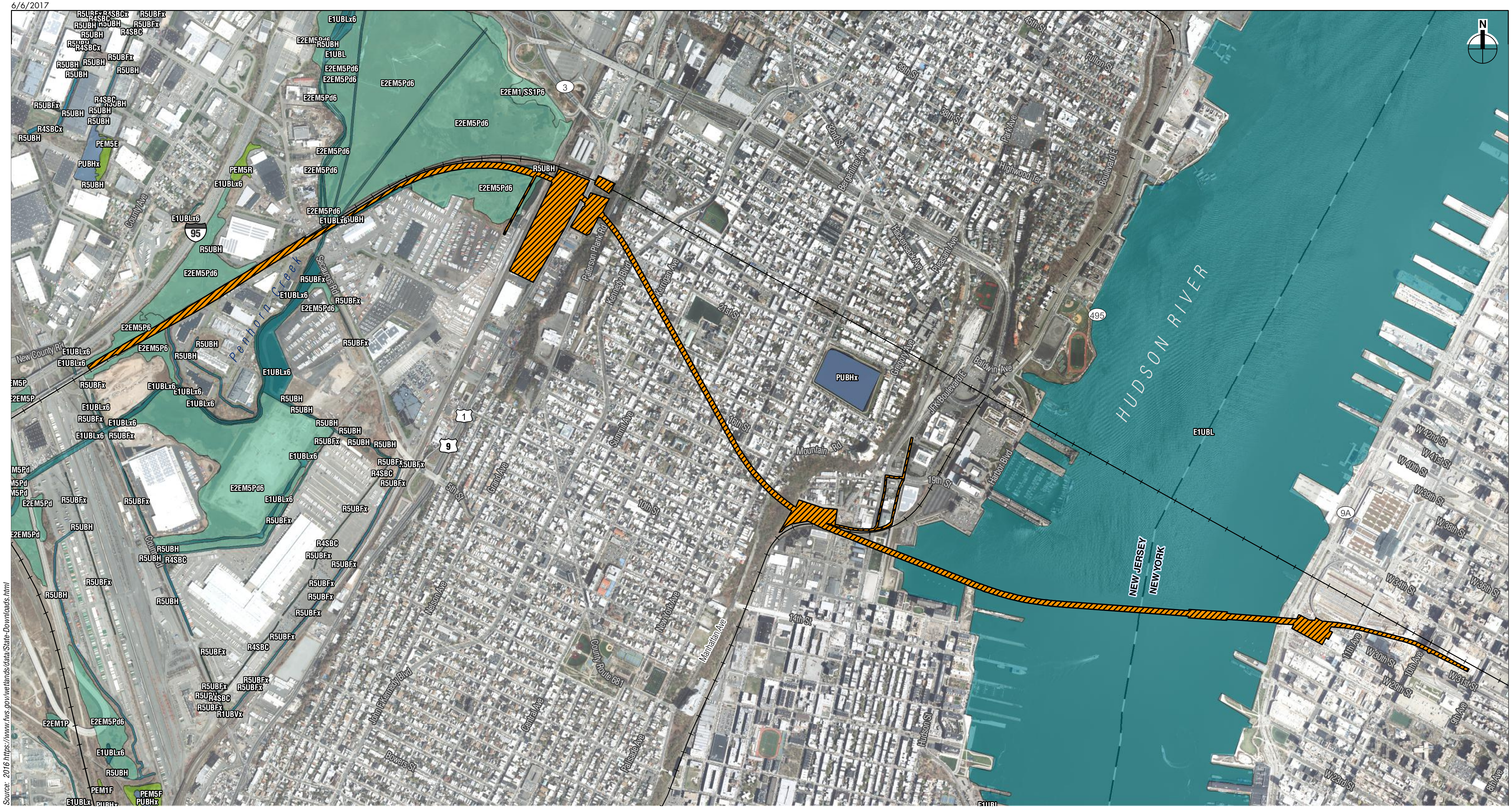
[3] Wave runup refers to the height above the stillwater elevation (tide and surge) reached by the swash, or the fluctuation of the mean water level.

[4] FEMA, 2014

[5] Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Miss; U.S. Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (version 2.0), ed. J.S. Wakeley, R.W. Lichvar, C.V. Noble, and J.F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

6/6/2017



Source: 2016 https://www.fws.gov/wetlands/data/State-Downloads.html

Project Site

Existing Northeast Corridor

Wetland Type (Map Codes)

Freshwater Emergent Wetland (PEM)

Freshwater Pond (PUB, PAB)

Estuarine and Marine Wetland (E2, M2)

Riverine (R)

Estuarine and Marine Deepwater (E1, M1)

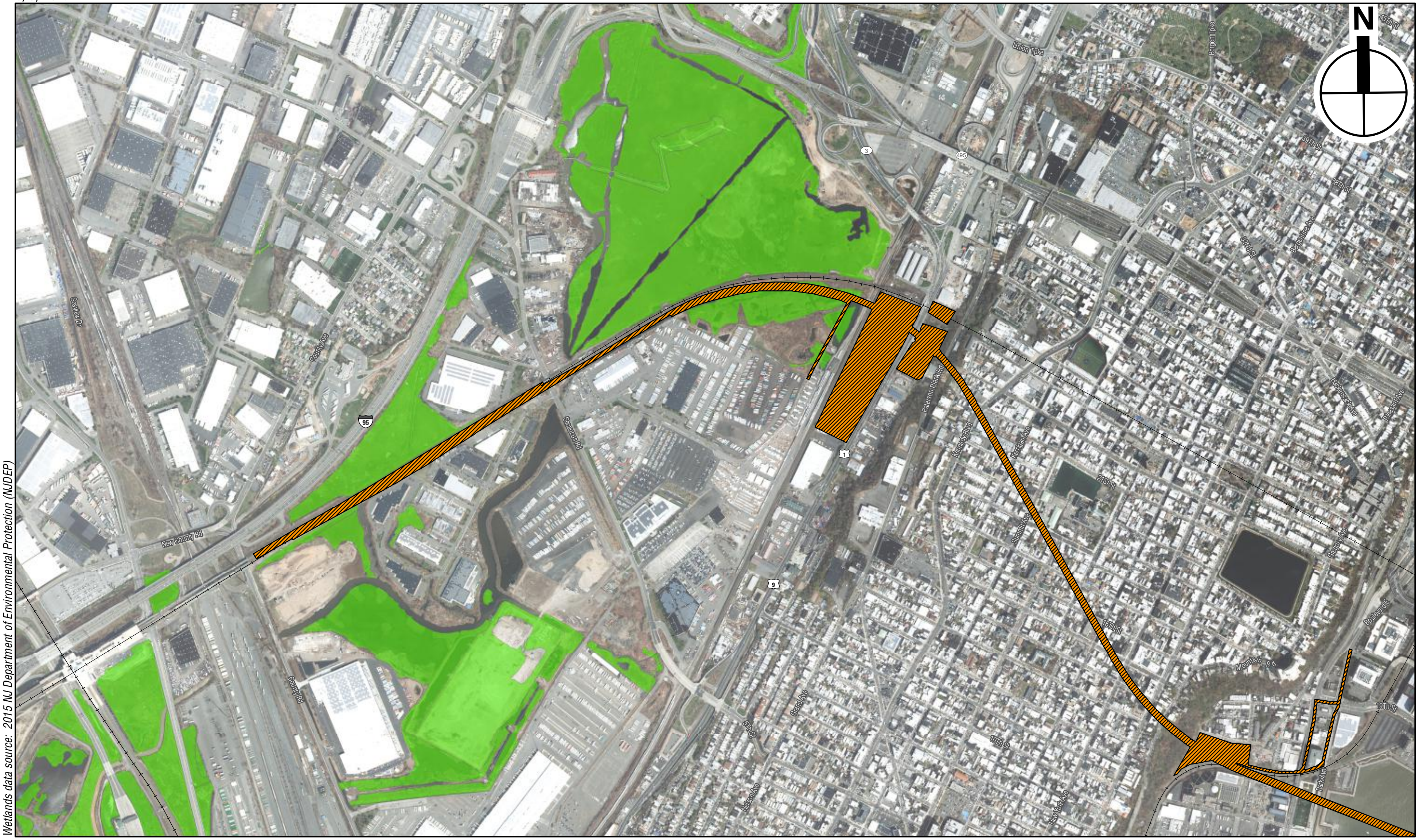
0 5,000 FEET

HUDSON TUNNEL PROJECT

Wetlands Mapped by the National Wetlands Inventory

Figure 11-2

6/5/2017



Wetlands data source: 2015 NJ Department of Environmental Protection (NJDEP)

Project Site

Wetlands

0 2,000 FEET

Wetlands Mapped by the
New Jersey Department of Environmental Protection
Figure 11-3

HUDSON TUNNEL PROJECT

6/5/2017

HUDSON TUNNEL PROJECT

Delineated Wetlands
Figure 11-4a

6/5/2017

Delineated Wetland Boundary

Existing NYSW Wetland MitigationSite

0 500 FEET

HUDSON TUNNEL PROJECT

Delineated Wetlands

Figure 11-4b

5/25/2017

Wetlands data source: 2015 NJ Department of Environmental Protection (NJDEP)

Delineated Wetland Boundary

0 500 FEET

HUDSON TUNNEL PROJECT

Delineated Wetlands
Figure 11-4c

are tidally influenced emergent marshes that correspond with the locations of NWI-mapped wetlands E2EM5P6, R5UBH, E1UBLx6, and E2EM5Pd6. The other two emergent wetlands are not associated with any NWI-mapped wetlands. One of these two wetlands is an isolated wetland along the NEC determined not to the under USACE jurisdiction. The other is located along the Hudson-Bergen Light Rail (HBLR) right-of-way in Hoboken. The Hoboken wetland is not mapped by NJDEP, but may have a possible nexus to the Hudson River through a tide gate located near Harbor Boulevard in Weehawken and was determined to be under USACE jurisdiction.

11.3.1.2.1 NYSW Wetland Mitigation Site

An existing USACE-approved wetland mitigation site is located within the Project area in Secaucus, NJ just south of the NEC, to the west of Tonnelle Avenue, along the western side of the NYSW Secaucus yard (see **Figure 11-4b**). The USACE approved the implementation of a plan within a 3-acre portion of the NYSW right-of-way to mitigate for the NYSW's activities undertaken in North Bergen, New Jersey that resulted in 3 acres of fill to waters of the U.S. As designed, the wetland mitigation project is to include palustrine scrub-shrub, emergent, aquatic bed, and open water habitats. NYSW implemented the mitigation plan in 2014. North Bergen Combined Sewer Overflow (CSO)[6] outfall 011A discharges to the southernmost end of the mitigation site. NJDEP holds a conservation easement on the mitigation site.

11.3.1.3 GROUNDWATER

The New Jersey portion of the study area lies within the Piedmont physiographic province of the Appalachian Highlands (for a detailed discussion of the geology of the study area, see Chapter 15, "Soils and Geology"). The western half of the New Jersey study area is within the Hackensack River basin. The eastern portion of the study area includes the Palisades diabase sill[7] underlying Union City and Hoboken and into the formations underlying the Hudson River. Groundwater is found in both the consolidated bedrock formations (i.e., bedrock aquifers[8]) and in overlying unconsolidated deposits throughout the study area in New Jersey (i.e., surficial aquifers[9]).[10] Most of the wells in the study area draw water from the bedrock aquifers where groundwater is stored and transmitted in fractures (separations in rock that divides it into two or more pieces).

No sole-source aquifers, community or non-community water supply wells, or well-head protection areas exist within the vicinity of the study area in New Jersey.[11] Eleven water supply wells (including domestic, industrial, and irrigation wells) are located within a quarter-mile of the Project site, as shown in **Figure 11-5**.[12] On the basis of the thickness of unconsolidated

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6 A combined sewer overflow (CSO) is the discharge or release of water from a combined sewer system (a sewer system designed to collect storm water runoff, domestic sewage, and industrial wastewater in the same pipe and bring it to wastewater treatment facilities) caused by snowmelt or stormwater runoff.

7 An intrusion of crystalline, igneous rock that is rich in magnesium and iron, emplaced at medium to shallow depths within the earth's crust.

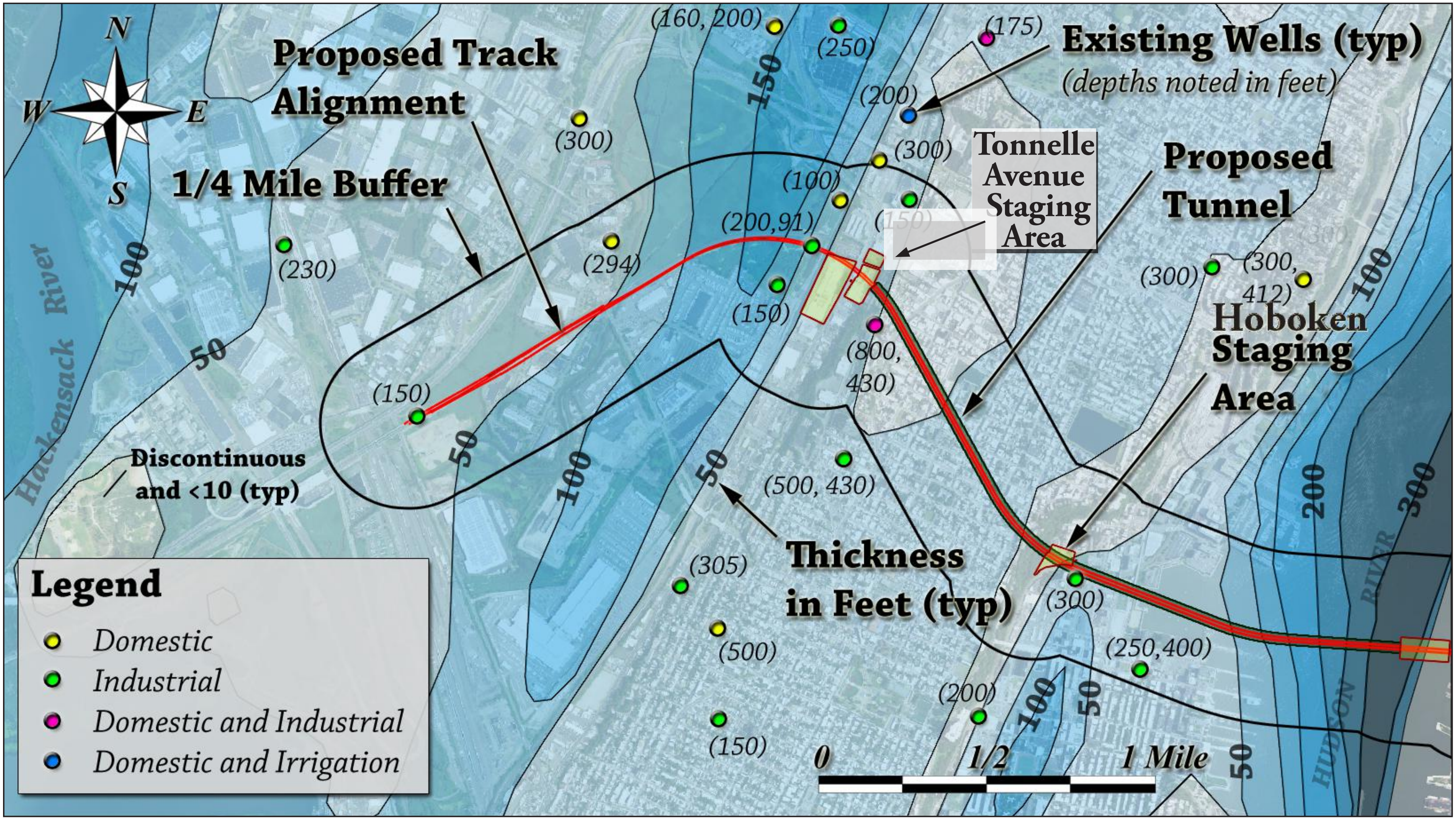
8 Bedrock aquifers within the New Jersey study area include fractured-rock aquifers of the Newark Basin part of the Piedmont Region (Brunswick Aquifer, Lockatong Formation, Stockton Formation), and igneous and metamorphic rocks of the Manhattan Prong.

9 Surficial glacial aquifers and confining units in New Jersey include lake-bottom sediment and sand and gravel.

10 Herman 1998.

11 NJDEP, 2016b.

12 NJDEP, 2016a.



Source: NJ GeoWeb, 2016b; NJDEP, 2016a; modified by AKRF

HUDSON TUNNEL PROJECT

Thickness of Unconsolidated Sediments and Groundwater Wells

Figure 11-5

sediments overlying the bedrock aquifers within the study area and the well depths, these wells are likely supplied by bedrock aquifers.

Groundwater in the study area is classified as "Class II Ground Water for Potable Water Supply."[13] According to the following NJDEP Ground Water Quality Standards:

> The primary designated use for Class II ground waters is the provision of potable ground waters with conventional water supply treatment, either at their current water quality (Class II-A) or subsequent to enhancement or restoration of regional water quality so that the water will be of potable quality with conventional water supply treatment (Class II-B).

As discussed in Chapter 16, "Contaminated Materials," currently or formerly contaminated sites in the vicinity of the Project site have the potential to result in groundwater contamination in the study area. As a result, NJDEP has identified groundwater contamination Classification Exception Areas (a designation indicating there is groundwater pollution in a localized area caused by a discharge at a contaminated site) in which one or more water quality parameters exceeds the Class II Groundwater Quality Standard at NJAC 7:9C.

11.3.1.4 SURFACE AND NAVIGABLE WATERS

The surface alignment portion of the Project site crosses through the Penhorn Creek watershed (see **Figure 11-6**) within the Meadowlands, which the Meadowlands Environmental Research Institute (MERI, 2016a) divides into four subwatersheds. Penhorn Creek is a tributary to the Hackensack River and drains a portion of the Meadowlands to the east of the Hackensack River. The ridgeline of the Palisades sill forms the eastern boundary of Penhorn Creek's watershed, and the ridgeline running through Secaucus forms the western boundary of the watershed. Dikes formed by roadway fill constructed across the Meadowlands and the Hackensack River form the northern and southern boundaries of the watershed, respectively. Penhorn Creek's bed elevation is lower than much of the tidal range in the Hackensack River; however, its waters are regulated by a tide gate at St. Paul's Avenue (see **Figure 11-6**) near its mouth (NJMC, 2006).

Several municipal CSO outfalls[14] discharge to the Penhorn Creek watershed (see **Figure 11-6**). As discussed previously, the CSO outfall closest to the Project site, the North Bergen CSO outfall 011A (NJPDES Number NJ0108898), discharges to the NYSW wetland mitigation site, which then drains to the wetlands within the Project site (see **Figure 11-6**). No surface waters other than the Hudson River are located within the portion of the study area east of the Palisades that is within the Hudson River watershed. Instead, runoff within this urbanized area is conveyed to the Hudson River by storm sewers and CSO outfalls (see **Figure 11-6**).

11.3.1.4.1 Water Quality

Surface Water Quality Standards for New Jersey Waters (NJAC 7:9B) establish the designated uses to be achieved, provide management guidelines, and specify the water quality criteria necessary to protect the state's waters. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. These are reflected in use classifications assigned to specific waters.

All waters of Penhorn Creek are classified FW2-NT/SE2. FW2-NT represents fresh waters that are non-trout and not in the Pinelands. SE2 waters are saline waters of estuaries. The combined classification, FW2-NT/SE2 includes waterways where there may be a salt water/fresh water

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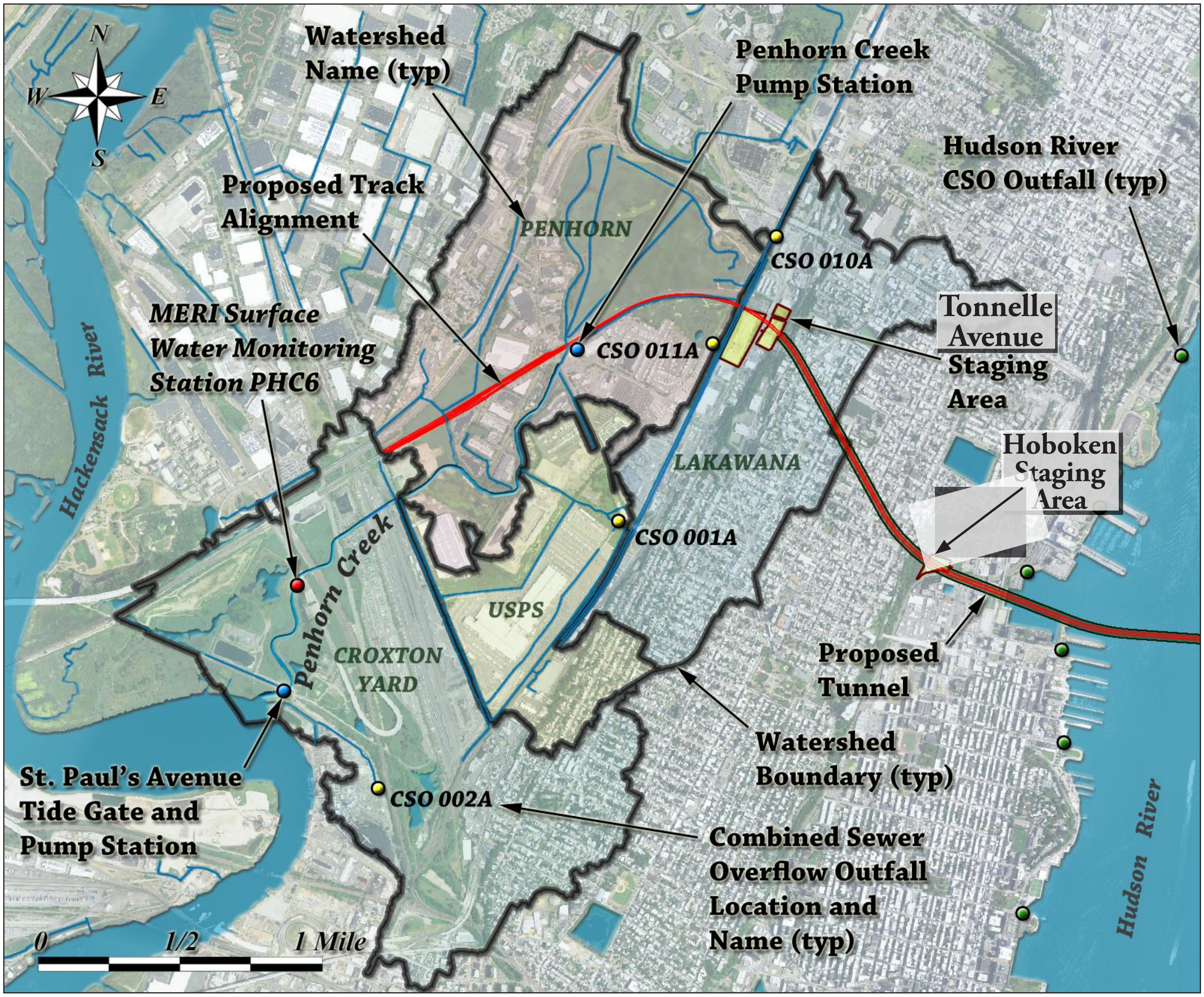
[13] NJAC 7:9C: State of New Jersey, 2010.

[14] http://www.nj.gov/dep/dwq/cso.htm, last accessed May 2017.



Source: NJDEP, 2016; modified by AKRF

Penhorn Creek Drainage
Figure 11-6

interface. The exact point of demarcation between the fresh and saline waters is defined as "that point where the salinity reaches 3.5 parts per thousand at mean high tide".[15]

MERI operates a surface water monitoring station, station PHC6, on Penhorn Creek (MERI, 2016b) (see **Figure 11-6**). With the exception of a sample collected on February 19, 2014, all measured salinity concentrations, which have been collected quarterly from 1993 to the present, were below 3 parts per thousand (ppt), indicating that the waters may be below the salinity threshold for the saline waters classification and therefore classified as FW2-NT. However, concentrations at PHC6 are highly dependent on the condition of the downstream tide gate. A malfunction of this tide gate would have the potential to allow higher salinity water from the Hackensack River to move up Penhorn Creek with the flood tide, increasing the salinity of the creek, thus resulting in the freshwater and saline water classification for the creek.

The NJPDES permit for North Bergen Township Municipal Utilities Authority's (MUA's) CSO outfall 011A[16] indicates that the Penhorn Creek tributary receiving the discharge is classified SE2. The NJPDES permit also indicates that it is a C2 or Category Two water, which is New Jersey's lowest antidegradation designation below Outstanding National Resource Waters[17] and Category One waters.

Table 11-1 summarizes water quality parameters and heavy metal concentrations reported for MERI Station PHC6, as well as the NJDEP surface water quality standards for Class SE2 waters, including Penhorn Creek. Both dissolved oxygen (DO) and biological oxygen demand (BOD) have increased over the years, indicating some improvement in water quality (increased DO) but also some level of continued pollution (increased BOD). Except for copper, dissolved heavy metal concentrations remained below their respective acute standards from 1996 through 2015.

[15] NJAC 7:9B.

[16] NJDEP, 2015.

[17] An USEPA designation that applies to New Jersey surface waters classified as freshwater 1 waters and "Pinelands waters;" these waters are considered nondegradation waters that are set aside because of their unique ecological significant, exceptional recreational significance, or exceptional water supply significance.

Table 11-1
NJDEP Water Quality Standards and Data for Penhorn Creek Sampling Station PHC6

Parameter	NJDEP SWQS for Class SE2 Waters	Water Quality Data (Average)				
		1993-1995	1996-2000	2001-2005	2006-2010	2011-2015
Ammonia (mg/L)	0.115 (acute); 0.030 (chronic)	3.85	1.97	2.42	1.27	2.25
BOD (mg/L)	No standard	5.37	4.66	9.20	8.67	9.33
Dissolved oxygen (mg/L)	Not less than 4.0 at any time	4.69	6.22	5.87	6.01	7.39
Nitrate (mg/L)	No standard	-	0.30	2.91	1.70	6.78
Temperature (°C)	Summer seasonal average shall not exceed 29.4°C	18.3	15.0	13.5	13.7	13.6
Cadmium (µg/L)[1]	40 (acute); 8.8 (chronic)	30.7	4.8	3.8	1.4	1.4
Chromium (µg/L)	No standard	23.8	5.5	8.0	7.2	3.5
Copper (µg/L)[1]	4.8 (acute); 3.1 (chronic)	24.7	9.3	13.8	16.3	79.0
Lead (µg/L)	210 (acute); 24 (chronic)	69.4	50.2	41.1	33.2	21.9
Nickel (µg/L)[1]	64 (acute); 22 (chronic)	27.6	22.7	22.9	9.1	7.0
Zinc (µg/L)[1]	90 (acute); 81 (chronic)	155.7	37.4	43.6	61.5	62.2

Notes:

1. The NJDEP surface water quality standards for cadmium, copper, nickel, and zinc are based on water hardness and expressed in terms of dissolved criteria.

Except for nitrate, for which fewer samples were collected in each year range, average values were based on 10 samples for 1993-1995, 20 samples for 1996-2000, 16 samples for 2001-2005, 20 samples for 2006-2010, and 19 samples for 2011-2015.

Sources: MERI 2016; NJAC 7:9B Surface Water Quality Standards.

11.3.1.4.2 Aquatic Biota

11.3.1.4.2.1 Macroinvertebrates

The portion of the study area along the NEC in the Meadowlands features aquatic biota[18] in the wetlands and Penhorn Creek. These include two common mollusks: the mud snail (*Nassarius obsoleta*) and ribbed mussel (*Geukensia demissa*). Common epibenthic[19] crustaceans of the tidal and semi-tidal (impounded) streams and wetlands in this area include blue crab (*Callinectes sapidus*), fiddler crabs (*Uca* spp.), white-fingered mud crabs (*Rhithropanoepus harrisii*), mysid shrimp (*Neomysis americana*), sand shrimp (*Crangon septemspinosa*), grass shrimp (*Palaemonetes pugio*), and several species of amphipods.[20] Neither the NJDEP's Landscape Project–Piedmont Plains nor the USFWS's IPaC databases list any threatened or endangered invertebrate species in the study area.

11.3.1.4.2.2 Fish

The most abundant and commonly occurring fish in the New Jersey Meadowlands, which are therefore likely to occur in the Meadowlands portion of the study area, include mummichog (*Fundulus heteroclitus*), Atlantic silverside (*Menidia menidia*), inland silverside (*Menidia beryllina*), white perch (*Morone americana*), blueback herring (*Alosa aestivalis*), Atlantic tomcod (*Microgadus tomcod*), brown bullhead (*Ameriurus nebulosus*), striped killifish (*Fundulus majalis*),

[18] Aquatic biota are organisms living in or depending on the aquatic environment.

[19] Epibenthic crustaceans are those that live on the surface of sediments at the bottom of a water body.

[20] Cerrato 2006.

striped bass (*Morone saxatilis*), pumpkinseed sunfish (*Lepomis gibbosus*), American eel (*Anguilla rostrata*), and bay anchovy (*Anchoa mitchilli*). An inventory of fisheries resources conducted by the Hackensack Meadowlands Development Commission (now the NJS EA) in 1989 (HMDC Inventory of Fisheries Resources 1989) reported that the mummichog, closely associated with salt marsh habitats, comprised 85 percent and 91 percent of the total catches during the two years of sampling of the study. Bragin et al. (2005) reconfirmed that mummichog was the most abundant species in a 2001-2003 fish inventory.

Other common resident fish known to occur in the Hackensack River include white catfish (*Ameiurus catus*) and the non-native common carp (*Cyprinus carpio*); these have the potential to occur in Penhorn Creek. Alewife (*Alosa pseudoharengus*), blueback herring, American shad (*Alosa sapidissima*), Atlantic tomcod, and striped bass are anadromous fish (i.e., fish that migrate from salt water to spawn in fresh water) that use the Hackensack River and associated marshes such as Penhorn Creek in the spring. Some marine fish, such as juvenile Atlantic menhaden (*Brevoortia tyrannus*) and juvenile bluefish (*Pomatomus saltatrix*), also occur in the Hackensack River[21] and have the potential to occur in Penhorn Creek.

11.3.1.5 TERRESTRIAL RESOURCES

11.3.1.5.1 Ecological Communities

The study area includes the wetlands/industrial landscape of the Meadowlands and the urban landscape east of the Palisades in Weehawken and Hoboken. The study area is best described as including railroad[22], mowed lawn[23], urban vacant lot[24], and successional southern hardwoods[25] communities (Edinger et al. 2014[26]). The railroad community represents the NEC tracks and is largely covered by ballast and - unvegetated areas. A few ruderal species (i.e., plants growing in waste places and along roadsides), including common mullein (*Verbascum thapsus*), pokeweed (*Phytolacca americana*), and common mugwort (*Artemisia vulgaris*), are found on the slope adjacent to the railroad tracks. The mowed lawn and urban vacant lot communities are vegetated primarily by herbaceous species, including crabgrass (*Digitaria* sp), Kentucky bluegrass (*Poa pratensis*), English plantain (*Plantago lanceolata*), common mugwort, and clovers (*Trifolium* spp.). The successional southern hardwoods community is confined to narrow bands at the toe of slope of the railroad tracks. Dominant species within the successional

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21 Bragin et al. 2005.

22 Edinger et al. (2014) define this community as “a permanent road having a line of steel rails fixed to wood ties and laid on gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate along regularly maintained railroads. The railroad right of way may be maintained by mowing or herbicide spraying.”

23 Edinger et al. (2014) define this community as “residential, recreational, or commercial land, or unpaved airport runways in which the groundcover is dominated by clipped grasses and there is less than 30 percent cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing and broadleaf herbicide application.”

24 Edinger et al. (2014) define this community as “an open site in a developed, urban area that has been cleared either for construction or following the demolition of a building. Vegetation may be sparse, with large areas of exposed soil, and often with rubble or other debris.”

25 Edinger et al. (2014) define this community as “a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed.”

26 The “Classification of Vegetation Communities of New Jersey: Second Iteration” by Breden et al. does not include descriptions of “cultural” vegetation communities, the category to which the vegetation communities of the study area belong. Therefore, Edinger et al. 2014 was used to classify vegetation communities within the New Jersey and New York study areas.

southern hardwoods community include black locust (*Robinia pseudoacacia*), grey birch (*Betula populifolia*), eastern cottonwood (*Populus deltoides*), princess tree (*Paulownia tomentosa*), and tree of heaven (*Ailanthus altissima*) in the tree stratum; common blackberry (*Rubus allegheniensis*), multiflora rose (*Rosa multiflora*), and winged sumac (*Rhus copallinum*) in the shrub stratum; Asiatic bittersweet (*Celastrus orbiculatus*) and poison ivy (*Toxicodendron radicans*) in the vine stratum; and common mugwort in the herbaceous stratum.

11.3.1.5.2 Wildlife

Approximately half of the study area is located in an industrial and heavily urbanized landscape dominated by buildings, transportation infrastructure, and other impervious surfaces that offers minimal habitat for wildlife other than urban-adapted generalists that are ubiquitous throughout the metropolitan area. The remaining portions of the study area (e.g., the wetland complex associated with Penhorn Creek in the Meadowlands) are capable of supporting more rich and diverse communities of wildlife. These habitats are still subjected to high levels of noise and other indirect and direct forms of human disturbance, and are further degraded by invasive species and pollution. As such, the wildlife communities in these areas are lacking in number or diversity of species and dominated by disturbance-tolerant species.

11.3.1.5.2.1 Birds

The most substantive habitat for supporting birds and other wildlife in the study area is the wetland complex around Penhorn Creek. Based on the wetland's relatively large size, the dominance of non-native common reed (*Phragmites australis*) within it and its isolation within a heavily urbanized area, breeding bird species likely to use this habitat include marsh birds, waterbirds, and land birds that are tolerant of degraded habitat conditions and ubiquitous in urban wetland habitats. Examples include red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), swamp sparrow (*Melospiza georgiana*), marsh wren (*Cistothorus palustris*), common yellowthroat (*Geothlypis trichas*), gray catbird (*Dumetella carolinensis*), European starling (*Sturnus vulgaris*), yellow warbler (*Setophaga petechia*), barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), Canada goose (*Branta canadensis*), green heron (*Butorides virescens*), and spotted sandpiper (*Actitus macularia*). Some additional species that nest elsewhere in the region may use this wetland as foraging habitat, including herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), osprey (*Pandion haliaetus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and snowy egret (*Egretta thula*).

During winter, birds likely to use the habitats within the study area likely include only a few temperate migrants and non-migratory species, such as white-throated sparrow (*Zonotrichia albicollis*), European starling, house sparrow (*Passer domesticus*), Canada goose, brant (*Branta canadensis*), herring gull (*Larus argentatus*), and ring-billed gull (*Larus delawarensis*). During spring and fall migration, the same species that nest in the area may also use the wetland as a stopover habitat on route to more northern breeding grounds or southern wintering grounds. Some additional species that are not likely to nest or overwinter in the area, such as the least sandpiper (*Calidris minutilla*), northern harrier (*Circus cyaneus*), and saltmarsh sparrow (*Ammodramus caudacutus*) might also use the wetland as a stopover habitat during their migration.

Elsewhere in the New Jersey portion of the study area, where terrestrial habitat is limited to manicured lawns, street trees, roadside margins of ruderal vegetation, and small, fragmented woodlots, bird species likely to occur during the breeding season and winter would be limited to synanthropic, urban-adapted generalists, many of which are non-native. Examples include the American robin (*Turdus migratorius*), European starling, house sparrow, rock dove (*Columba livia*), northern mockingbird (*Mimus polyglottos*), and American crow (*Corvus brachyrhynchos*). Some additional species may occur in these areas very briefly during spring and fall migration, and include common songbirds such as the yellow-rumped warbler (*Setophaga coronata*), ovenbird (*Seiurus aurocapilla*), Swainson's thrush (*Catharus ustulatus*), and Baltimore oriole (*Icterus galbula*).

11.3.1.5.2.2 Mammals

Mammals that are expected to occur in the marsh of the Meadowlands near Penhorn Creek include muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), meadow vole (*Microtus pennsylvanicus*), and occasionally, white-tailed deer (*Odocoileus virginianus*). Mammals that may occur elsewhere in the study area include eastern cottontail (*Sylvilagus floridanus*), white-footed mouse (*Peromyscus leucopus*), gray squirrel (*Sciurus carolinensis*), woodchuck (*Marmota monax*), masked shrew (*Sorex cinereus*), eastern mole (*Scalopus aquaticus*), and white-tailed deer.

11.3.1.5.2.3 Reptiles and Amphibians

Common reptile species with potential to occur in the wetlands around Penhorn Creek include snapping turtle (*Chelydra serpentina*), eastern painted turtle (*Chrysemys picta*), northern diamondback terrapin (*Malaclemys terrapin*), eastern garter snake (*Thamnophis setalis*), and northern water snake (*Nerodia sipedon*). Milk snake (*Lampropeltis triangulum*), eastern garter snake, and brown snake (*Storeria dekayi*) may occur in the small areas of woodland and shrub/scrub elsewhere in the study area. The newly described southern leopard frog species (*Rana kauffeldi*; formerly classified as *Rana sphenocephala utricularius*) that is endemic to the New York metropolitan area and inhabits coastal freshwater and brackish wetlands[27] also has the potential to occur in the wetlands around Penhorn Creek.

11.3.1.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

FRA consulted with the New Jersey Natural Heritage Program (NJNHP) which identified the following threatened, endangered, special concern, and rare species, wildlife habitats, and ecological communities as having the potential to occur in the study area or its vicinity: glossy ibis (*Plegadis falcinellus*; special concern), little blue heron (*Egretta caerulea*; special concern), osprey (*Pandion haliaetus*; threatened), snowy egret (*Egretta thula*; special concern), yellow-crowned night-heron (*Nyctanassa violacea*; threatened), shortnose sturgeon (*Acipenser brevirostrum*; endangered), black-crowned night-heron (*Nycticorax nycticorax*; threatened), barn owl (*Tyto alba*; special concern), and floating marsh-pennywort (*Hydrocotyle ranunculoides*; endangered) (see **Appendix 11**).[28] Shortnose sturgeon would only occur in the Hudson River and is discussed in Section 11.3.2.4 below.

The NJDEP's Landscape Project–Piedmont Plains database identified the study area as foraging habitat for little blue heron, snowy egret, yellow-crowned night-heron, and glossy ibis.[29]

According to the USFWS's IPaC database, there are no Federal threatened or endangered species or critical habitats (including wildlife refuges or fish hatcheries) within the New Jersey portion of the study area. USFWS's IPaC database identified a number of migratory birds of conservation concern protected under the MBTA and the bald eagle (*Haliaeetus leucocephalus*) protected under the BGEPA as having the potential to occur within the study area

FRA has initiated consultation with NMFS in accordance with Section 7 of the Endangered Species Act and USFWS in accordance with the MBTA and the BGEPA (see **Appendix 11** for correspondence).

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27 Newman et al. 2012, Feinberg et al. 2014.

28 NJNHP 2016.

29 NJDEP 2016.

11.3.1.6.1 Glossy Ibis

NJDEP has records of glossy ibis foraging within the study area. The glossy ibis is a migratory waterbird whose range was limited to Florida before an explosive expansion along the entire Atlantic coast all the way to Maine occurred throughout the 20th century.[30] By the 1970s, the glossy ibis was the most abundant waterbird in New Jersey.[31] Populations then began to decline and the glossy ibis is now listed as a species of special concern at the state level by NJDEP, even though it is considered a fairly common breeding bird in the state.[32] The glossy ibis is a common breeding bird in the coastal marshes around the New York metropolitan area,[33] and has the potential to nest and forage within the wetland around Penhorn Creek. Glossy ibises inhabit freshwater and brackish wetlands and salt marshes, and nest on a variety of substrates, including reed beds, shrubs, and trees.[34] They have been documented nesting in marshes densely invaded by common reed, such as the wetlands in the study area. By commonly nesting in busy areas, such as coastal marshes of the New York metropolitan area[35] and near highways,[36] glossy ibis demonstrate a high tolerance of habitat degradation and indirect human disturbance.

11.3.1.6.2 Little Blue Heron

The little blue heron has been recorded by NJDEP as foraging in the study area. It is considered uncommon, local, and declining in New Jersey[37] and is listed as a species of special concern at the state level by NJDEP. Following a peak in the mid-1990s, recent surveys found only 45 birds in 12 colonies in the state.[38] The little blue heron is primarily a coastal species with preferred habitats including wetlands and forests that border waterbodies. Little blue herons nest in trees or shrubs near fresh, brackish, or salt water. They forage in a variety of freshwater and marine-estuarine habitats, including marshes, swamps, streams and rivers, ponds, lakes, tidal flats, and flooded fields.[39] Penhorn Creek and the surrounding wetlands represent suitable nesting and foraging habitat for little blue herons, thus the species has the potential to occur in this area.

11.3.1.6.3 Osprey

The osprey is listed as threatened at the state level by NJDEP and has been documented by NJDEP nesting and foraging in the study area. Osprey populations in New Jersey have recovered significantly in recent decades following steep range-wide declines that occurred throughout the mid-20th century, and ospreys are currently common in the state.[40] Ospreys nest in dead trees and on a variety of artificial structures such as utility poles, buoy towers, and platforms erected specifically for their use. Ospreys have the potential to nest on trees or artificial structures in and around the wetlands surrounding Penhorn Creek, and have the

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[30] Medler 2008.

[31] Boyle Jr. 2011.

[32] Boyle Jr. 2011.

[33] Medler 2008.

[34] Davis and Kircher 2000.

[35] Medler 2008.

[36] Davis and Kircher 2000.

[37] Boyle Jr. 2011.

[38] Boyle Jr. 2011.

[39] Rodgers Jr. and Smith 2012.

[40] Boyle Jr. 2011.

potential to occur over the open waters of the wetlands while foraging for fish. Ospreys are not likely to occur anywhere else within the New Jersey portion of the study area.

11.3.1.6.4 Snowy Egret

The snowy egret is listed as a species of special concern at the state level by NJDEP and has been documented by NJDEP foraging in the study area. Populations in the state have declined sharply in recent years.[41] In New Jersey, snowy egrets typically nest in colonies with other wading birds in thick vegetation on barrier, dredge-spoil, and salt-marsh islands in estuarine areas. They also most commonly use estuarine habitats for foraging.[42] The marshes around Penhorn Creek have the potential to sometimes be used as foraging habitat by snowy egrets, but nesting is unlikely and nowhere else in the study area is there suitable nesting or foraging habitat for snowy egrets.

11.3.1.6.5 Yellow-Crowned Night Heron

Yellow-crowned night herons are scarce in New Jersey and the species is listed as threatened at the state level by NJDEP. Their breeding range within the state is primarily limited to Cape May and Atlantic Counties,[43] where they nest on barrier, spoil, and bay islands in coastal areas, and in swamps, forested wetlands, and forested uplands near lakes, rivers, and creeks in more inland areas.[44] Nests are located in shrubs or trees, usually near water.[45] Although yellow-crowned night herons are not known to nest within the study area, they have the potential to use Penhorn Creek and its associated wetlands as foraging habitat. Yellow-crowned night herons from nesting colonies around New York City are known to use the Meadowlands for foraging[46] and NJDEP has a record of yellow-crowned night herons foraging in the study area. Therefore, yellow-crowned night herons are considered by NJDEP to have the potential to occur in the wetlands on the western side of the study area, around Penhorn Creek, while foraging. Yellow-crowned night herons would not be expected to occur elsewhere within the study area.

11.3.1.6.6 Black-Crowned Night Heron

The breeding population of black-crowned night herons in New Jersey declined throughout the mid-20th century, but numbers appear to have stabilized in recent years and the species is still considered locally common during the summer.[47] Black-crown night herons are listed as threatened at the state level. Black-crowned night herons will nest in a variety of wetlands, including freshwater, brackish, and salt marshes. They will use an even wider array of habitats for foraging, including swamps, streams, rivers, ponds, lakes, lagoons, tidal mudflats, salt marshes, freshwater marshes, ditches, canals, reservoirs, and wet agricultural fields.[48] NJDEP has a record of black-crowned night herons foraging in the study area, and black-crowned night herons are considered to have the potential to forage within Penhorn Creek and the surrounding wetlands. Black-crowned night herons will nest on a variety of substrates, including common reed, and numerous species of trees and shrubs. Black-crowned night herons therefore have the

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[41] Boyle Jr. 2011.

[42] Parsons and Master 2000.

[43] Boyle Jr. 2011.

[44] Watts 2011.

[45] Watts 2011.

[46] Boyle Jr. 2011.

[47] Boyle Jr. 2011.

[48] Hothem et al. 2010.

potential to nest within the wetlands around Penhorn Creek, although NJDEP does not have any records of black-crowned night herons nesting anywhere within the study area.

11.3.1.6.7 Barn Owl

The barn owl is uncommon and local throughout the year in New Jersey,[49] and is listed as a species of special concern at the state level by NJDEP. The majority of the population in the state is concentrated around the Delaware Bayshore, the Hackensack Meadowlands and lower Hudson River, and the Piedmont and Highlands.[50] NJDEP has a record of a non-breeding season sighting of a barn owl in the study area. Barn owls use a variety of open habitats, including marshes, grasslands, old fields, and agricultural fields, and will commonly nest on or in buildings and other human-made structures. They can often be found nesting in metropolitan areas, including New York City.[51] Barn owls have the potential to occur in the study area, and would be most likely to occur in the wetland complex surrounding Penhorn Creek.

11.3.1.6.8 Floating Marsh-Pennywort

NJDEP identifies the state-endangered floating marsh-pennywort as occurring in the study area just north of the NEC. Floating marsh-pennywort is a perennial floating aquatic plant in the Apiaceae family. It is found in shallow, slow-moving or stagnant waters or in muddy soils. Threats to populations of floating marsh-pennywort include development, herbicide runoff, and displacement by invasive species.[52] FRA observed a population of floating marsh-pennywort within the study area on November 1, 2016, and it is documented as occurring within the NYSW mitigation site.

11.3.2 HUDSON RIVER

11.3.2.1 AQUATIC RESOURCES

The Project site is located within the Lower Hudson River Estuary, a tidally influenced portion of the Hudson River that is part of the New York–New Jersey Harbor Estuary, which also includes upper and lower New York Harbor, Arthur Kill, Kill Van Kull, East River, Raritan Bay, and Jamaica Bay. Saltwater from Upper New York Harbor enters the Lower Hudson River Estuary during the flood phase of the tidal cycle and lower salinity water is discharged from the Estuary to the Harbor during the ebb phase. The typical tidal range in the Hudson River is approximately 5 feet.[53] Average tidal velocities near the Project site are about 2.4 feet per second, and the average predicted ebb flow is about 2.6 feet per second.[54] Freshwater and higher salinity waters are well mixed during low-flow conditions, but are stratified under high-flow conditions when freshwater inflow from upriver overrides the denser saltwater layer.[55] Ristich et al. (1977) classified the lower Hudson River as polyhaline (indicating moderate salinity, less than seawater, with salinity of 18-30 ppt) in summer and fall months and mesohaline (less salinity, 5-18 ppt) in spring and early summer.

USACE maintains a Federally authorized navigation channel at a depth of 40 to 48 feet below mean low water (MLW) from the mouth of the Hudson River upstream to approximately 59th

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49 Boyle Jr. 2011.

50 Boyle Jr. 2011.

51 Marti et al. 2005.

52 WDNR 2005.

53 Geyer and Chant 2006.

54 NOAA 2013.

55 Moran and Limburg 1986.

Street.[56] Bathymetric surveys[57] conducted by USACE in April 2016 showed depths ranging from about 36 to 48 feet below mean lower low water (MLLW)[58] on the eastern side of the navigation channel, and depths from 33 to 51 feet below MLW on the western side of the navigation channel in the Project vicinity.[59] Shallower depths were found near or adjacent to piers and other structures, and depths rapidly increased to 40 feet or more over a distance of less than 200 feet from these structures. NOAA's Nautical Chart #12335 shows current water depths ranging from 3 to 17 feet below MLLW around the piers outside the navigation channel, and from 40 to 54 feet below MLW within the navigation channel. At the edges of the channel, depths are about 20 to 30 feet below MLLW.[60] Sedimentation in the lower Hudson River tends to be highest in the shallows on the west side of the river.[61] Sedimentation within the interpier areas where current velocities are lower ranges from 1 to 2 feet per year.[62]

11.3.2.1.1 Water Quality

Federal agencies such as USACE, multi-jurisdictional agencies such as the Port Authority of New York & New Jersey (PANYNJ), the states of New Jersey and New York, New York City, and cooperative efforts such as the New York–New Jersey Harbor Estuary Program (HEP) have implemented programs to monitor and improve water quality in the New York–New Jersey Harbor and connected waterbodies. These programs have, over time, resulted in water quality improvements documented by monitoring programs such as the Harbor-Wide Water Quality Monitoring Report for the New York–New Jersey Harbor Estuary and the NYCDEP New York Harbor Water Quality Report. The City of New York has monitored harbor water quality with an annual survey for more than 90 years.

NYSDEC classifies the lower Hudson River as Class I saline surface waters from Battery Park in Manhattan upstream to Spuyten Duyvil, New York, including the Project site area. Suitable uses of Class I waters are secondary contact recreation[63], fishing, and fish propagation and survival. NJDEP classifies the lower Hudson River in the Project site area as SE2 saline surface waters. Suitable uses of SE2 waters are secondary contact recreation, maintenance and propagation of biota, and maintenance of diadromous fish[64] and wildlife. **Table 11-2** presents the surface water quality standards for the Project area in the Hudson River for both New Jersey and New York jurisdictions.

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[56] USACE 2016.

[57] Bathymetry is the study of underwater depths of a water body; the underwater equivalent to underwater topography. Bathymetric surveys chart seafloor relief or terrain as contour lines (called depth contours or isobaths).

[58] Mean lower low water, as defined by NOAA, represents the average height of the lowest tide recorded at a tide station each day over the National Tidal Datum Epoch.

[59] USACE 2016, sheet 5 of 11.

[60] NOAA 2016.

[61] Geyer 1995.

[62] Smith 1992.

[63] "Secondary contact recreation" means recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing.

[64] A fish that migrates between fresh and salt waters. Diadromous fish include anadromous fish (fish that spend most of their lives in saltwater and migrate to freshwater to spawn such as striped bass and sturgeon) and catadromous fish (fish that spend most of their lives in freshwater and migrate to saltwater to spawn such as the American eel).

Table 11-2
NYSDEC and NJDEP Surface Water Quality Standards

Parameter	NYSDEC Class I Waters	NJDEP Class SE2 Waters
Temperature	No standard	Summer seasonal average shall not exceed 29.4°C (84.9°F)
Salinity (psu)	No standard	No standard
pH	Normal range shall not be extended by more than 0.1 pH unit	6.5 – 8.5
Dissolved oxygen (DO) (mg/L)	Not less than 4.0 at any time	Not less than 4.0 at any time
Fecal coliform (cfu/100mL)	Monthly geometric mean, from a minimum of five examinations, shall not exceed 2,000 cfu/100mL	Monthly geometric mean, based on a minimum of five samples shall not exceed 770 cfu/100mL
Enterococcus (cfu/100mL)[(1)]	EPA Bathing Standard = 35 cfu/100mL	EPA Bathing Standard = 35 cfu/100mL
Secchi transparency (ft)	No standard	No standard
Total suspended solids (mg/L)	None from sewage, industrial wastes or other wastes that will impair usage	None of which would render the water unsuitable for the designated uses

Note: (1) NYSDEC does not identify a standard for enterococcus; however, USEPA provides a standard for bathing of 35 cfu/100mL; NJDEP does establish enterococcus standards, but not for SE2 waters.

Sources: 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations; NJAC 7:9B Surface Water Quality Standards; EPA Recreational Water Quality Criteria (Office of Water 820-F-12-058)

11.3.2.1.1.1 New York Water Quality Monitoring

The Project site falls within the NYCDEP Harbor Survey Inner Harbor study area, which includes the Hudson River from the New York City–Westchester County line through the Battery to the Verrazano Narrows; the Lower East River from north end of Roosevelt Island to the Battery; and the Kill Van Kull–Arthur Kill system.[65] Class I portions of the Hudson River in New York County are listed as impaired for polychlorinated biphenyls (PCBs) and other toxins, which may include mercury, dioxins/furans, polycyclic aromatic hydrocarbons (PAHs), pesticides, and other heavy metals (NYSDEC 2016).Results of recent Harbor Surveys conducted by NYCDEP (2010, 2012, 2013, 2014) show that the water quality of New York–New Jersey Harbor, including the lower Hudson River within the Inner Harbor, has improved since the 1970s as a result of measures undertaken by New York City (e.g., improvements to wastewater treatment plants and increased capture of stormwater runoff) and others.[66] Recent water quality data (2000-2015) from NYCDEP Harbor Survey stations N3B, N4, and N5, which are located in the vicinity of the study area are presented below in **Table 11-3**. Station N4 is located closest to the Project site, just to the north off 42nd Street. Station N3B is located at the northern end of Manhattan off 125th Street and Station N5 is located at the southern end of Manhattan at the Battery, where the lower Hudson River meets the Upper New York Harbor.

[65] NYCDEP 2013.

[66] NYCDEP 2013.

Table 11-3
NYCDEP Water Quality Data for Lower Hudson River Sampling Stations N3B, N4, and N5 (2000-2015, all months)

Parameter	Station N3B						Station N4*						Station N5					
	Surface Waters			Bottom Waters			Surface Waters			Bottom Waters			Surface Waters			Bottom Waters		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Temperature (°F)	32.5	82.1	66.6	35.3	78.4	64.3	32.3	80.8	66.2	34.9	77.7	63.8	33.3	79.4	65.0	31.7	77.3	62.8
Salinity (psu)	0.2	23.1	11.7	0.2	27.9	20.3	0.3	25.1	14.0	0.3	30.5	22.5	0.6	28.6	17.5	2.9	32.8	25.3
pH	6.9	8.6	7.6	7.0	8.5	7.5	6.9	8.7	7.6	6.5	8.3	7.5	6.8	8.4	7.5	7.0	8.2	7.6
Dissolved oxygen (mg/L)	1.2	15.0	7.7	1.1	13.4	6.3	0.7	14.7	7.6	0.6	13.5	6.3	0.8	14.5	7.4	0.6	13.2	6.6
Fecal coliform (cfu/100 mL)[1]	1	4,240	120	-	-	-	1	4,000	161	-	-	-	1	22,000	231	-	-	-
Enterococcus (cfu/100mL)	1	860	31	-	-	-	1	790	30	-	-	-	1	400	24	-	-	-
Secchi transparency (ft)	0.5	5.5	2.6	-	-	-	0.5	6	2.7	-	-	-	0.5	8	3.4	-	-	-
Total suspended solids (mg/L)	0.4	89.0	12.6	-	-	-	0.3	72	12.2	-	-	-	0.2	137	11.5	-	-	-

Notes:

All three stations are located in Class I waters. Station N4 (*) is located at 42nd Street, nearest the study area.

Fecal coliform, enterococcus, secchi transparency, and total suspended solids were either not measured at all or not measured consistently in bottom waters.

(1) Compliance with the fecal coliform standard is based on a monthly geometric mean comprising at least 5 measurements, for which data are not available to calculate, and not on the basis of the maximum fecal coliform value presented here. The maximum values occurred in 2011, a year characterized by higher than usual precipitation (NYCDEP 2013).

Source: NYCDEP Harbor Survey Water Quality Data 2000-2015.

Between 2000 and 2015, temperature, salinity, and pH were similar from Station N3B downstream to Station N5. Temperatures ranged from about 32 to 81°F, with an average of 66°F at the surface and 64°F at the bottom. As a tidal estuarine system, the lower Hudson River exhibits a wide range of salinity, from less than 1 ppt to 30.5 ppt[67] at Station N4 near the Project site. Average dissolved oxygen measurements upstream and downstream from the Project site showed similar variation, ranging from 7.4 to 7.7 mg/L at the surface and 6.3 to 6.6 mg/L at the bottom. Dissolved oxygen near the Project site fell below the standard for Class I waters only once at the surface and 13 times at the bottom over the 15-year period. These data are consistent with those reflecting Harborwide improvements in dissolved oxygen levels over the past couple of decades.[68] NYCDEP (2013) indicates that by 2012, fecal coliform[69] levels had not exceeded the standard at any of its monitoring sites in the Harbor since the early 1990s. Similarly, enterococci[70] levels did not exceed the bathing standard at monitoring sites in the lower Hudson River.[71]

11.3.2.1.1.2 New Jersey Water Quality Monitoring

Water quality within the New Jersey waters of the Inner Harbor is monitored as part of the New York Harbor Water Quality Report, on which NYCDEP and NJDEP collaborate. Through the HEP, data are collected from NYCDEP and the New Jersey Harbor Dischargers Group (NJHDG) in order to develop water quality trend assessments for the New York–New Jersey Harbor Estuary. NJHDG's water quality reports focus on a total of 68 sampling sites throughout the harbor, including those monitored as part of NYCDEP's Harbor Survey and discussed above. Data for New Jersey waters collected by NJHDG at Stations 32 and 33 are presented in **Table 11-4** below. Station NJHDG-32 is located closest to and north of the Project site near Harbor Survey Station N4. Station NJHDG-33 is located south of Project site near the Holland Tunnel.

Water quality measurements that NJHDG took in New Jersey waters were consistent with NYCDEP's Harbor Survey measurements over the same sampling period. Average temperatures ranged from about 33°F to 82°F, both at and downstream of the Project site. Salinity ranged from 0.9 ppt to 31.4 ppt, similar to salinities measured at NYCDEP Station N4. Dissolved oxygen ranged from 3.0 mg/L at both stations to 18.2 mg/L at NJGDG-32 and 17.9 mg/L at NJHDG-33; averages were about the same for both stations, at 7.8 mg/L for NJHDG-32 and 7.9 mg/L for NJHDG-33. Over the sampling period, dissolved oxygen measurements fell below the standard 11 times at NJHDG-32 and six times at NJHDG-33. Average fecal coliform levels were 97 cfu/100mL at the Project site and 76 cfu/100mL downstream of the Project site. NJHDG et al. (2011) reported that long-term trends showed improvement in fecal coliform levels. Near the Project site, seasonal geometric means for fecal coliform ranged from 0 to 50 cfu/100mL in the summers of both 2006 and 2009.[72] Similar long term trends have been demonstrated for enterococcus, which has decreased over much of the Harbor except at

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[67] Salinity measurements in practical salinity units (psu) and parts per thousand (ppt) are nearly equivalent. Historically, salinity has been presented in ppt.

[68] NYCDEP 2013.

[69] Coliform bacteria generally originate in the intestines of warm-blooded animals. Waters are tested for fecal coliform as an indicator of possible presence of disease causing organisms to determine suitability for consumption of the water.

[70] Enterococci are bacteria that live in the intestinal tracts of warm-blooded animals, including humans. Waters are tested for enterococci as an indicator of possible contamination by fecal waste and the possible presence of disease causing organisms.

[71] NYCDEP 2013.

[72] NJHDG et al. 2011.

stations in the Raritan River and Arthur Kill systems.[73] These trends are consistent with those recorded by NYCDEP's Harbor Survey program.

Table 11-4
NJHDG Water Quality Data for Sampling Stations 32 and 33 (2003-2015, all months)

Parameter	NJHDG-32			NJHDG-33		
	Min	Max	Avg	Min	Max	Avg
Temperature (°F)	32.8	81.8	62.5	33.0	81.6	62.2
Salinity (psu)	0.9	29.7	16.3	1.3	31.4	18.4
pH	5.4	8.5	7.5	5.5	8.6	7.6
Dissolved oxygen (mg/L)	3.0	18.2	7.8	3.0	17.9	7.9
Fecal coliform (cfu/100 mL)(1)	0	7,100	97	0	1,600	76
Enterococcus (cfu/100mL)	1	400	27	1	384	24
Secchi transparency (ft)	1.0	6.0	2.5	1.0	7.0	2.8
Total suspended solids (mg/L)	0	494	53.4	6.0	342	42.1

Notes: All numbers represent surface water samples; no bottom water samples were taken. Water quality data from NJHDG sampling stations are available starting in 2003.
(1) As with the NYCDEP Harbor Survey data, compliance with the fecal coliform standard is based on a monthly geometric mean comprising at least 5 measurements, for which data are not available to calculate, and not on the basis of the maximum fecal coliform value presented here.

Sources: New Jersey Harbor Dischargers Group Water Quality Data, obtained from the National Water Quality Monitoring Council (www.waterqualitydata.us/provider/STORET/NJHDG)

11.3.2.1.2 Sediment Quality

Complex flow patterns lead to widely variable sediment characteristics throughout the New York–New Jersey Harbor and connected waterbodies. Lower Hudson River sediments are primarily silt and clay.[74] Typical of most urban watersheds, sediments in the New York–New Jersey Harbor, including the lower Hudson River where the Project site is located, are contaminated due to a history of surrounding industrial uses. EPA's (2012) National Estuary Program Coastal Condition Report rates overall New York–New Jersey Harbor sediment quality as poor, based on sediment toxicity, contamination, and/or total organic carbon levels. The lower Hudson River is listed as being impaired for PCBs and other toxic materials,[75] and the suspected source for these impairments is contaminated sediment. EPA has designated the 200-mile stretch of the Hudson River from the Battery upstream to Hudson Falls, New York, a Superfund site as a result of PCB contamination. Contaminants found throughout the New York–New Jersey Harbor Estuary include pesticides such as chlordane and DDT, heavy metals like mercury, cadmium, lead, and copper, PCBs, and various PAHs.[76] While the sediments of the harbor are generally contaminated, the concentrations of most sediment contaminants (e.g., dioxin, DDT, PCBs, and mercury) have decreased on average by an order of magnitude over the past few decades, mainly due to control measures implemented through the Clean Water Act.[77]

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[73] NJHDG et al. 2011.

[74] USACE 1999, EEA 1988.

[75] Other toxic materials may include mercury, dioxins/furans, PAHs, pesticides, and other heavy metals.

[76] Rohmann and Lilienthal 1987.

[77] Steinberg et al. 2004.

11.3.2.1.3 Aquatic Biota

The New York–New Jersey Harbor Estuary, including the lower Hudson River, supports a diverse and productive aquatic community of more than 100 species of finfish, more than 100 invertebrate species, and a variety of phytoplankton and zooplankton.

11.3.2.1.3.1 Primary Producers

Primary producers are plants or microorganisms that can convert light energy or chemical energy into organic matter (e.g., plant growth or cell growth) which is then eaten by other organisms. Primary producers are the base of the aquatic food chain. In the Hudson River, primary producers include phytoplankton[78] and macroalgae.[79] Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Light penetration, turbidity, and nutrient concentrations are important factors in determining phytoplankton productivity and biomass. Diatoms such as *Skeletonema costatum* and *Thalassiosira* spp. generally dominate the phytoplankton community within the lower Hudson River, with lesser contributions from dinoflagellates[80] and green algae.[81] Phytoplankton sampling in the lower Hudson River between 1991 and 2000 resulted in the collection of 71 taxa[82]; the most abundant species were *Nannochloris atomus* and *Skeletonema costatum*.[83] Phytoplankton sampling from 1996-2003 on the Hudson River near Pier 26, downstream of the Project site, found that the most dominant species were: *Asterionella japonica*, *Chaetoceros subtilis*, *Coscinodiscus excentricus*, *Ditylum brightwelli*, *Eucampia zodiacus*, *Gyrosigma* sp., *Nitzchia reversa*, *Pseudonitzchia seriata*, *Rhizosolenia setigera*, and *Ebria tripartite*.[84] The most common benthic macroalgae, or large multicellular algae, present in the Project site area include sea lettuce (*Ulva* spp.), green fleece (*Codium fragile*), and brown algae (*Fucus* spp.).[85] While nutrient concentrations in most of the harbor are high, low light penetration has often precluded the occurrence of phytoplankton blooms. Limited light penetration also restricts the distribution of submerged aquatic vegetation (SAV) in the vicinity of the Project site.[86] Extensively developed shorelines and swift currents further limit SAV growth in this area.

11.3.2.1.3.2 Zooplankton

Zooplankton are an integral component of aquatic food webs; they are primary grazers on phytoplankton and detritus, and serve as prey for higher trophic level organisms. Consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species in their early life stages, such as striped bass and white perch. Zooplankton sampling in the Hudson River between 1991 and 2000 resulted in the collection of 16 taxa, most commonly *Tintinnopsis* spp. and nauplius of copepods.[87]

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[78] Microscopic marine plants. The two main classes of phytoplankton are dinoflagellates and diatoms.

[79] Large algae that can be seen by the naked eye.

[80] Dinoflagellates are a type of photosynthetic plankton (a microscopic marine plant that uses sunlight to synthesize foods from carbon dioxide and water).

[81] Brosnan and O'Shea 1995.

[82] Plural of "taxon." Organisms identified down to the lowest taxonomic unit possible (i.e., not always down to species) for example: a phylum, order, family, genus, or species.

[83] NYCDEP 2007.

[84] Levandowsky and Vaccari 2004.

[85] PBS&J 1998.

[86] Olson et al. 1996.

[87] NYCDEP 2007.

11.3.2.1.3.3 Benthic Invertebrates

Major benthic invertebrate groups in the New York–New Jersey Harbor Estuary include: aquatic earthworms (oligochaetes), segmented worms (polychaetes), snails (gastropods), bivalves, barnacles, cumaceans, amphipods, isopods, crabs, and shrimp.[88] Most benthic invertebrates that have been found in the area are classified as pollution-tolerant species.[89] A study conducted between the summers of 2002 and 2004 collected a total of 145 benthic invertebrate taxa in the Hudson River Park area, downstream of the Project site.[90] Abundant species in this sampling program include: polychaetes *Mediomastus* spp., *Streblospio benedicti*, *Leitoscoloplos* spp., *Heteromastus* spp., *Spio setosa*, and *Tharyx* spp.; bivalves *Mulinia lateralis* and *Tellina agilis*; gastropods *Acteocina canaliculata* and *Rictaxis punctostriatus*; crustacean *Leocon americanus*; and oligochaete worms.[91] Blue crab (*Callinectes sapidus*) and American lobster (*Homarus americanus*) may also be present within the Upper Harbor region.[92]

11.3.2.1.3.4 Finfish

The finfish community in the New York–New Jersey Harbor and connected waterbodies is typical of large coastal estuaries and inshore waterways along the mid-Atlantic Bight in that it supports a variety of estuarine, marine, catadromous (migrating from fresh water to spawn in the sea), and anadromous (migrating from salt water to spawn in fresh water) fish species that use its waters for spawning and nursery, migratory, and foraging purposes. The Lower Hudson River and Upper Harbor fish community is spatially and seasonally dynamic. **Table 11-5** lists fish species known to occur within the Harbor Estuary that have the potential to occur in the lower Hudson River near the Project site. A 2002-2004 survey collected a total of 41 fish species from the Hudson River Park region, the most abundant being bay anchovy, Atlantic herring (*Clupea harengus*), striped bass, and blueback herring, all of which use open water habitat.[93]

11.3.2.2 ESSENTIAL FISH HABITAT (EFH)

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The NMFS designates EFH within squares identified by latitude and longitude coordinates. The Project site is within a portion of the Hudson River estuary EFH that includes the Hudson River and Bay from Guttenberg, NJ south to Jersey City, NJ, including the Global Marine Terminal and the Military Ocean Terminal, Bayonne, NJ; Hoboken, NJ; Weehawken, NJ; Union City, NJ; Ellis Island; Liberty Island; Governors Island; the tip of Red Hook Point on the west tip of Brooklyn, NY; and Newark Bay, NJ. **Table 11-6** lists the species for which EFH is designated, and the life stages of those fish identified as having EFH there, in the portion of the Hudson River at and near the Project site.[94] **Appendix 11** provides a full assessment of the EFH in the vicinity of the Project site.

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[88] EEA 1988, EA 1990, Coastal 1987, PBS&J 1998.

[89] Adams et al. 1998.

[90] Bain et al. 2006.

[91] Bain et al. 2006.

[92] NMFS 2001.

[93] Bain et al. 2006.

[94] NOAA 2016.

Table 11-5
Finfish Species with the Potential to Occur in the Lower Hudson River

Common Name	Scientific Name
Alewife[(1)]	*Alosa pseudoharengus*
American eel[(1)]	*Anguilla rostrata*
American sand lance	*Ammodytes hexapterus*
American shad[(1)]	*Alosa sapidissima*
Atlantic cod	*Gadus morhua*
Atlantic croaker[(1)]	*Micropogonias undulatus*
Atlantic herring[(1)]	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic menhaden[(1)]	*Brevoortia tyrannus*
Atlantic moonfish	*Selene setapinnis*
Atlantic needlefish	*Strongylura marina*
Atlantic seasnail	*Liparis atlanticus*
Atlantic silverside[(1)]	*Menidia menidia*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Banded killifish	*Fundulus diaphanous*
Bay anchovy[(1)]	*Anchoa mitchilli*
Black sea bass	*Centropristis striata*
Blueback herring[(1)]	*Alosa aestivalis*
Bluefish[(1)]	*Pomatomus saltatrix*
Butterfish[(1)]	*Peprilus triacanthus*
Clearnose skate	*Raja eglanteria*
Conger eel	*Conger oceanicus*
Crevalle jack	*Caranx hippos*
Cunner[(1)]	*Tautogolabrus adspersus*
Fawn cusk eel	*Lepophidium cervinum*
Feather blenny[(1)]	*Hypsoblennius hentzi*
Fourbeard rockling	*Enchelypus cimbrius*
Foureye butterflyfish	*Chaetodon capistratus*
Four-spot flounder	*Paralichthys oblongus*
Gizzard shad[(1)]	*Dorosoma cepedianum*
Goosefish[(1)]	*Lophius americanus*
Grey snapper	*Lutjanus griseus*
Grubby([1])	*Myoxocephalus aenaeus*
Gulf Stream flounder([1])	*Citharichthys arctifrons*
Hickory shad([1])	*Alosa mediocris*
Hogchoker([1])	*Trinectes maculatus*
Inshore lizardfish	*Synodus foetens*
Lined seahorse[(1)]	*Hippocampus erectus*
Little skate	*Raja erinacea*
Longhorn sculpin	*Myoxocephalus octodecimspinosus*
Lookdown[(1)]	*Selene vomer*
Mummichog	*Fundulus heteroclitus*
Naked goby	*Gobiosoma bosci*
Northern stargazer[(1)]	*Astroscopus guttatus*
Northern kingfish[(1)]	*Menticirrhus saxatilis*
Northern pipefish[(1)]	*Syngnathus fuscus*
Northern puffer	*Sphoeroides maculatus*
Northern searobin[(1)]	*Prionotus carolinus*
Orange filefish	*Aluterus schoepfi*
Oyster toadfish	*Opsanus tau*
Planehead filefish	*Monacanthus hispidus*
Pollock	*Pollachius virens*
Rainbow smelt	*Osmerus mordax*
Red hake[(1)]	*Urophycis chuss*

Table 11-5 (Cont'd)
Finfish Species with the Potential to Occur in the Lower Hudson River

Common Name	Scientific Name
Rock gunnel	*Pholis gunnellus*
Rock sea bass[(1)]	*Centropristis philadelphica*
Rough scad	*Trachurus lathami*
Scup[(1)]	*Stenotomus chrysops*
Seaboard goby[(1)]	*Gobiosoma ginsburgi*
Sheepshead	*Archosargus probatocephalus*
Short bigeye	*Pristigenys alta*
Shortnose sturgeon	*Acipenser brevirostrum*
Silver hake[(1)]	*Merluccius bilinearis*
Silver perch	*Bairdiella chrysoura*
Smallmouth flounder	*Etropus microstomus*
Spot[(1)]	*Leiostomus xanthurus*
Spotfin butterflyfish	*Chaetodon ocellatus*
Spotted hake[(1)]	*Urophycis regia*
Striped anchovy[(1)]	*Anchoa hepsetus*
Striped bass[(1)]	*Morone saxatilis*
Striped burrfish	*Chilomycterus schoepfi*
Striped cuskeel	*Ophidion marginatum*
Striped killifish	*Fundulus majalis*
Striped mullet	*Mugil cephalus*
Striped searobin[(1)]	*Prionotus evolans*
Summer flounder[(1)]	*Paralichthys dentatus*
Tautog	*Tautoga onitis*
Threespine stickleback	*Gasterosteus aculeatus*
Tomcod[(1)]	*Microgadus tomcod*
Weakfish[(1)]	*Cynoscion regalis*
White hake	*Urophycis tenuis*
White mullet	*Mugil curema*
White perch[(1)]	*Morone americana*
Windowpane[(1)]	*Scophthalmus aquosus*
Winter flounder[(1)]	*Pseudopleuronectes americanus*
Yellowtail flounder	*Limanda ferruginea*

Note: (1) Collected by Bain et al. (2006) between 2002 and 2004 at Hudson River Park downstream of Project site.

Sources: Bain et al. 2006, Woodhead 1990, EEA 1988, EA 1990, LMS 1994, 1999, 2002, 2003a, 2003b, Able et al. 1995

Table 11-6
Essential Fish Habitat Designated Species in the Vicinity of the Project Site

Species	Designated Life Stage			
	Eggs	Larvae	Juveniles	Adults
Red Hake (*Urophycis chuss)*		X	X	X
Redfish (*Sebastes fasciatus*)	n/a			
Winter flounder (*Pseudopleuronectes americanus*)	X	X	X	X
Windowpane flounder (*Scophthalmus aquosus*)	X	X	X	X
Atlantic herring (*Clupea harengus*)		X	X	X
Bluefish (*Pomatomus saltatrix*)			X	X
Long-finned squid (*Loligo pealeii*)	n/a	n/a		
Short-finned squid (*Illex illecebrosus*)	n/a	n/a		
Atlantic butterfish (*Peprilus triacanthus*)		X	X	X
Atlantic mackerel (*Scomber scombrus*)			X	X
Summer flounder (*Paralichthys dentatus*)		X	X	X
Scup (*Stenotomus chrysops*)	X	X	X	
Black sea bass (*Centropristis striata*)	n/a		X	X
Surf clam (*Spisula solidissima*)	n/a	n/a		
Ocean quahog (*Arctica islandica*)	n/a	n/a		
Spiny dogfish (*Squalus acanthias*)	n/a	n/a		
King mackerel (*Scomberomorus cavalla*)	X	X	X	X
Spanish mackerel (*Scomberomorus maculatus*)	X	X	X	X
Cobia (*Rachycentron canadum*)	X	X	X	X
Clearnose skate (*Raja eglanteria*)			X	X
Little skate (*Leucoraja erinacea*)			X	X
Winter skate (*Leucoraja ocellata*)			X	X
Bluefin tuna (*Thunnus thynnus*)	X	X	X	X
Smooth dogfish (*Mustelus canis*)	X	X	X	X
Sand tiger shark (*Carcharias taurus*)		X(1)		X
Dusky shark (*Carcharinus obscurus*)		X(1)		
Sandbar shark (*Carcharinus plumbeus*)		X(1)		

Notes: n/a – insufficient data for this lifestage exists and no EFH designation has been made.
(1) These species do not have a free-swimming larval stage; rather they are live bearers that give birth to fully formed juveniles. For the purposes of this table, "larvae" for sand tiger, dusky, and sandbar sharks refers to neonates and early juveniles.

Sources: NMFS. "Summary of Essential Fish Habitat (EFH) Designation" at http://www.nero.noaa.gov/hcd/STATES4/new_jersey/40407400.html and http://www.nero.noaa.gov/hcd/skateefhmaps.htm.
NMFS EFH Mapper at http://www.habitat.noaa.gov/protection/efh/habitatmapper.html.

11.3.2.3 WILDLIFE

On and over the open waters of the Hudson River, urban-adapted waterbirds such as double-crested cormorant (*Phalacrocorax auritus*), ring-billed gull, herring gull, and Canada goose occur year-round. Common terns, least terns, and osprey can also be found foraging for fish over the river during spring, summer, and fall. During winter, additional waterbirds, such as bufflehead (*Bucephala albeola*), red-breasted merganser (*Mergus serrator*), horned grebe (*Podiceps auritus*), brant, lesser scaup (*Aythya affinis*), greater scaup (*Aythya marila*), green-winged teal (*Anas carolinensis*), American widgeon (*Anas americana*), common goldeneye (*Bucephala clangula*), surf scoter (*Melanitta perspicillata*), black scoter (*Melanitta americana*), common loon (*Gavia immer*), canvasback (*Aythya valisineria*), and ruddy duck (*Oxyura jamaicensis*), can also often be found on the river, usually in nearshore areas.[95]

[95] Fowle and Kerlinger 2001.

11.3.2.4 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

NJNHP identified shortnose sturgeon (*Acipenser brevirostrum*) as having the potential to occur in the lower Hudson River study area in 2016. Also in 2016, both NMFS and NYNHP identified shortnose sturgeon and Atlantic sturgeon as having the potential to be present within the lower Hudson River study area. The following sections discuss these species. **Appendix 11** includes the correspondence from these agencies.

11.3.2.4.1 Shortnose Sturgeon

NMFS (2016) indicated that no eggs or larval shortnose sturgeon occur in the saline waters of the lower Hudson River or its adjacent bays and tributaries; however, older life stages are present in the Hudson River and connected waterbodies. The shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the Hudson River from the Battery to the Federal Dam at Troy. Peterson and Bain (2002) estimated that the Hudson River shortnose sturgeon population contained about 61,000 fish. Shortnose sturgeon may occasionally use areas of the lower Hudson River downstream of the George Washington Bridge; however, spawning, nursery, and overwintering areas are located well upstream of the Project site.[96] Although larvae can be found in brackish regions of the Hudson River, juveniles from 2 to 8 years old are predominately confined to reaches upriver from the Project site. Bain et al. (2007) reported that primary summer habitat for shortnose sturgeon is the river channel, where water depths range from 43 to 138 feet, in the middle section of the Hudson River Estuary. However, more recently the New York State Thruway Authority conducted mobile tracking of tagged shortnose sturgeon within the Hudson River north of the Project site, between the George Washington Bridge and Stony Point and found that approximately 58 percent of all detections of shortnose sturgeon were in waters shallower than 20 feet (NMFS 2017a), indicating some use of shallower water habitat within that portion of the Hudson River. The Hudson River south of the Tappan Zee Bridge, including the portion of the lower Hudson River where the Project site is located, is not considered optimal shortnose sturgeon habitat (Bain 1997).

Long-term Hudson River monitoring data collected by the New York utilities and others since the 1970s have also indicated that shortnose sturgeon occur in greatest abundance north of the Tappan Zee Bridge. Hoff et al. (1988) reported most captures of adult shortnose sturgeon during river monitoring efforts by Hudson River electric utilities were made between approximately river mile 24 and river mile 76, or from the Tappan Zee Bridge to Poughkeepsie. Shortnose sturgeon were collected between the Statue of Liberty (south of river mile 0) and the George Washington Bridge (river mile 12) during winter sampling in 2003-2004 and 2004-2005 (15 and 18 shortnose sturgeon, respectively). These sturgeon were collected within the channel, and all but two individuals were collected north of approximately river mile 2 (Young 2005, Mattson 2005), suggesting that shortnose sturgeon are still rare in the lower Hudson River in the vicinity of the Project site. During sampling conducted between 2002 and 2004 near Hudson River Park, just downstream of the Project site, no sturgeon were collected.[97]

11.3.2.4.2 Atlantic Sturgeon

NMFS (2016) indicated that no eggs or larval Atlantic sturgeon occur in the saline waters of the lower Hudson River or its adjacent bays and tributaries; however, older life stages could occur in the study area. The Atlantic sturgeon is an anadromous[98] bottom-feeding species that occurs

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96 Bain et al. 2007.

97 Bain et al. 2006.

98 Fish that spend most of their lives in saltwater and migrate to freshwater to spawn.

within the New York–New Jersey Harbor and Hudson River estuaries (Woodhead 1990). Adults of this species spawn in freshwater rivers and migrate between riverine and coastal marine waters. In the Hudson River, Atlantic sturgeon are found in deeper waters and generally do not occur farther upstream than Hudson, New York. Adults migrate from the ocean upriver to spawn in fresh water above the salt front from late April to early July (Smith 1985, Stegemann 1999). Females migrate from the river back to marine waters following spawning, but males may remain in the river until October or November. Early life stages (i.e., eggs, larvae, and smaller juveniles) are relatively intolerant of salinity; young-of-year Atlantic sturgeon exhibit poor survival at salinities ranging from 5 to 10 ppt, and older juveniles (Age-1 and Age-2) may tolerate salinities up to 12 ppt (Kynard and Horgan 2002, ASMFC 2012).

In the New York–New Jersey Harbor, Atlantic sturgeon typically occur in deeper waters. According to recent surveys conducted by NMFS and multiple state agencies in the region[99], the majority of Atlantic sturgeon occurred in waters between 32 to 49 feet in depth; many of these sturgeon were found off the west coast of Long Island (Dunton et al. 2010). Tagging studies have indicated that Atlantic sturgeon from this aggregation have been detected in the Hudson River north of the Project site (NMFS 2017a). While Atlantic sturgeon are not expected to occur in significant numbers within the study area, transient sub-adults (i.e., larger juveniles that have migrated from the river to the nearshore coastal waters of the Atlantic Ocean) may be present as they move through shallower marine waters along the Atlantic coast; adults are most likely to be seasonal migrants and would occur primarily in the deeper waters of the river channel adjacent to the Project site.

11.3.2.4.2.1 Critical Habitat

The study area is located within an area proposed to be designated as critical habitat for Atlantic sturgeon (NMFS 2016).[100] Critical habitat for Atlantic sturgeon has been proposed for the length of the tidal Hudson River from lower Manhattan to the Federal Dam at Troy. For Atlantic sturgeon, the physical or biological features of critical habitat that are essential to the conservation of the species include:

- Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (0 to 0.5 ppt) for settlement of fertilized eggs, refuge, growth, and development of early life stages;
- Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 ppt and soft substrate downstream of spawning sites for juvenile foraging and physiological development;
- Water of appropriate depth to support: unimpeded movement of adults to/from spawning sites, seasonal movement of juveniles, and staging/resting/holding of subadults or spawning condition adults. Water depths greater than or equal to 1.2 meters (3.9 feet) in the main river channel; and
- Water, especially in the bottom meter of the water column, with temperature, salinity, and oxygen values that support: spawning, annual and interannual survival, and growth, development, and recruitment.

11.3.2.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The NYSDOS has designated 15 Significant Coastal Fish and Wildlife Habitats within New York City. The Project site falls within one of these designated areas, the Lower Hudson Reach.

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[99] The reference for these studies, Dunton et al. 2010, includes an author from NYSDEC and received data from NJ, ME, and MA state agencies.

[100] 81 Federal Register 35702; June 3, 2016.

Significant Coastal Fish and Wildlife Habitats are coastal habitats designated by the NYSDEC based on the uniqueness of the habitat; presence of protected or vulnerable species; recreational, education, and other uses; abundance of ecologically important species; and habitat irreplaceability (NYSDOS 1984). The Lower Hudson Reach includes the 19-mile stretch of the Hudson River from Battery Park to the tip of Manhattan and from there north to Yonkers near Glenwood, and includes areas with deep waters, shallows, piers, and interpier basins. NYSDEC designated the Lower Hudson Reach as a Significant Coastal Fish and Wildlife Habitat in part because it provides an important wintering habitat for young-of-the-year, yearling, and older striped bass. In addition, the Lower Hudson Reach is one of the few large tidal river mouth habitats in the northeastern United States, which is part of the greater Hudson River Estuary system that supports a diverse and historically highly productive ecosystem of fish and invertebrate species (Briggs and Waldman 2002, NYDOS 1992). Significant numbers of other fish species and waterfowl also use the Lower Hudson Reach, including winter flounder, summer flounder, white perch, Atlantic tomcod, Atlantic silversides, bay anchovy, hogchoker, and American eel. The Lower Hudson Reach is potentially important for bluefish and weakfish young of year, American shad, blue crab, Atlantic sturgeon, and shortnose sturgeon. Planktonic and benthic animals that provide an important food source are also present, including copepods, rotifers, mysid shrimp, nematodes, oligochaetes, polychaetes, and amphipods. Wintering waterfowl that use habitat in the Lower Hudson Reach include canvasback, scaup, mergansers, mallards, and Canada geese (NYSDOS 1992). In addition, the portion of the Project site beneath the Hudson River east of the New York pierhead line is located within (beneath) the Hudson River Park Estuarine Sanctuary.

The USFWS (1997) also designated the Lower Hudson River Estuary, from the Battery at the southern tip of Manhattan up to Stony Point at river mile 41, as a Significant Habitat Complex because it is a regionally significant nursery and wintering habitat for a number of anadromous, estuarine, and marine fish species, including striped bass, and is a migratory and feeding area for birds and fish that feed on the abundant fish and benthic invertebrate resources found in this portion of the estuary. Striped bass are anadromous and range from along the North American Atlantic coast from Canada to northern Florida. Striped bass was one of the four most abundant species collected within Hudson River Park from June 2002 through June 2004 (Bain et al. 2006).

Adult striped bass spend much of the year from summer through late winter in the nearshore coastal waters of the Atlantic Ocean. Northward migration of Hudson River fish along the Atlantic coast extends as far north as the Bay of Fundy, Nova Scotia, with older fish tending to travel farther north (Waldman et al. 1990). Although most migrate to sea, some striped bass adults remain in the Hudson River year-round, never migrating. During winter, these resident adults (ages 4 and older) are joined by migratory adults returning to the estuary to spawn. Adults aggregate near the mouths of their natal rivers and begin moving upstream to spawn as water temperatures increase in the spring.

The Hudson River supports one of the principal spawning populations of striped bass along the U.S. Atlantic coast. Other important spawning populations include Delaware Bay, Chesapeake Bay, the Roanoke and Chowan Rivers and Albemarle Sound, North Carolina, the Santee River in South Carolina, and the St. Johns River in northern Florida. Peak spawning in the Hudson River typically occurs between mid-May and mid-June in freshwater areas where currents are moderate to swift, from Indian Point, NY (river mile 42) upstream to Saugerties, New York (river mile 106) (CHGE et al. 1999; ASA 2010). Fecundity depends on age and size and females may produce up to several million pelagic eggs (ASFMC 2015). Utilities' fish surveys conducted from 1998 to 2007 during May and June primarily collected striped bass eggs upstream of Indian Point at river mile 46. Peak densities typically occur near Cornwall, New York (river mile 56 to

61), with very few eggs found south of the Tappan Zee Bridge region. The spawning area is considerably upriver of the Project site.

Larval striped bass recruit to the lower salinity areas of the Hudson River well upstream of the Project site from May to July. Larvae are abundant throughout the Hudson River during this time and are more common from the Tappan Zee Bridge to Hyde Park than the lower estuary. Striped bass juveniles begin to move to shallower nursery habitat in the lower estuary. Juvenile abundances typically peak in July and August upstream of Hyde Park in deeper (greater than 20 feet deep) bottom habitats. Many juvenile striped bass move downstream by the end of their first summer to occupy the lower estuary and into New York Harbor, western Long Island Sound, and along the south shore of Long Island. Juvenile striped bass remain near shore until November or December, before moving to deeper coastal waters; juveniles, however, may overwinter (December through March) in the interpier areas within the Hudson River Park, which is adjacent to the Project site (AKRF, Inc. et al. 1998; Dunning et al. 2009; CHGE et al. 1999). The lower Hudson River, including the area near the Project site, contains striped bass throughout the year and provides important winter habitat (mid-November to mid-April) for young-of-the-year, yearling, and older striped bass (Heimbuch et al. 1994, NYSDOS 1992).

At two to three years old, striped bass leave Atlantic coast estuaries and begin the typical seasonal coastal migration, northward during the spring and summer and southward during the fall. Some individuals are thought to mature and remain year-round in the upper freshwater portion of the estuary, while others adopt an anadromous pattern and, once sexually mature, spend most of their time in coastal saltwater habitats migrating into freshwater and brackish habitats in the spring to spawn (Zlokovitz et al. 2003).

Adult striped bass are top predators and are prey to few other animals. Adult striped bass in the Lower Hudson–Raritan Estuary prey upon at least 20 different taxa, dominated by a variety of small-bodied and juvenile fishes and crustaceans (Steimle et al. 2000; Dunning et al. 2009). The coastal stock is healthy, with spawning stock biomass well above the target level specified in the Interstate Fisheries Management Plan (ASMFC 2015) and stocks at historically high levels (NYSDEC 2010).

11.3.3 NEW YORK

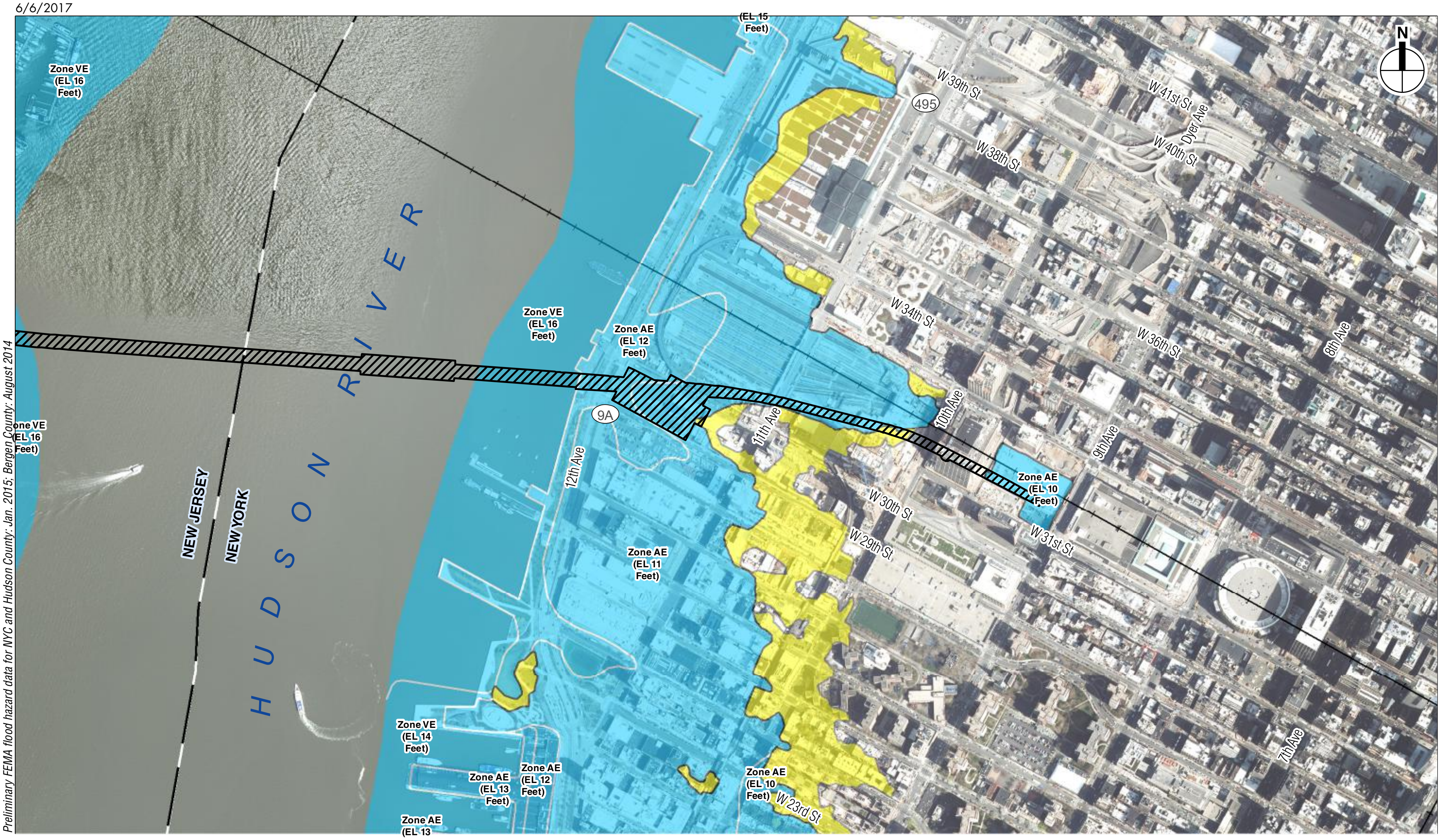
11.3.3.1 FLOODPLAINS

As shown in **Figure 11-7**, based on the revised preliminary FIRM for New York City released in January 2015, most of the Project site in Manhattan falls within the 100-year floodplain of the Hudson River, Zones VE and AE. The portion of the Hudson River floodplain close to the Manhattan shoreline is within Zone VE with a BFE of 16 feet NAVD88, indicating that it is subject to additional hazards due to storm-induced velocity wave action, a 3-foot or higher breaking wave. The upland area of Manhattan within the Project site is within Zone AE with a BFE generally ranging from 11 to 12 feet NAVD88 with a small portion at 10 feet at the A Yard. A small portion of the Project site is within the 500-year floodplain.

11.3.3.2 WETLANDS

The NWI designates the Hudson River as an E1UBL—an estuarine subtidal wetland that has an unconsolidated bottom and is permanently flooded (see **Figure 11-2**). Subtidal areas are continuously submerged substrates (below extreme low water). Unconsolidated bottoms have at least 25 percent cover of particles smaller than 2.5 or 2.8 inches, and less than 30 percent vegetative cover. The Hudson River within the study area does not contain wetland vegetation and would not fall under the definition of wetland under the Clean Water Act.

6/6/2017



Preliminary FEMA flood hazard data for NYC and Hudson County: Jan. 2015; Bergen County: August 2014

Project Site

Zone + EL *1% Annual Chance Flood Hazard (100-year floodplain)*

0.2% Annual Chance Flood Hazard (500-year floodplain)

0 2,000 FEET

HUDSON TUNNEL PROJECT

Flood Hazard Areas, Preliminary FIRM:
New York Study Area

Figure 11-7

Near the Project site, NYSDEC has mapped the waters of the Hudson River west of the Manhattan pierhead line as littoral zone tidal wetlands (see **Figure 11-8**). Littoral zone tidal wetlands are defined as permanently flooded lands under waters less than or equal to 6 feet of tidal waters at MLW that are not included in another tidal wetland category. Water depths at the pierhead line are deeper than 6 feet at MLW, ranging from 18 to 30 feet at MLLW. Therefore, NYSDEC would not regulate activities in this portion of the Project site under Article 25 of the NY ECL.

There are no NYSDEC-mapped freshwater wetlands or submerged aquatic vegetation (SAV) within the New York study area.

11.3.3.3 GROUNDWATER

Groundwater is not used as a potable water supply in New York City. Groundwater levels in the Manhattan study area, recorded during geotechnical surveys as part of the ARC Project, ranged from between 5 feet and 20 feet below ground surface. West of about Eleventh Avenue, groundwater levels are within 10 feet of the ground surface, and vary by about 4 feet with the tidal cycle of the Hudson River. Groundwater is expected to flow toward the Hudson River.

11.3.3.4 TERRESTRIAL RESOURCES

11.3.3.4.1 Ecological Communities

The study area is located within the urban landscape of Manhattan's Hudson Yards neighborhood, and the habitat primarily consists of roadways, railyards, buildings, and a few narrow bands of street trees. The study area is best described as having "terrestrial cultural" communities, which are defined as "communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformations of the substrate (e.g., soil, bedrock, etc.), or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence" (Edinger et al. 2014). The terrestrial cultural communities that are present within the study area include paved road/path[101], urban structure exterior[102], railroad[103], mowed lawn with trees[104], and flower/herb garden[105] (Edinger et al. 2014). The

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[101] Edinger et al. (2014) define this community as "a road or pathway that is paved with asphalt, concrete, brick, stone, etc. There may be sparse vegetation rooted in cracks in the paved surface."

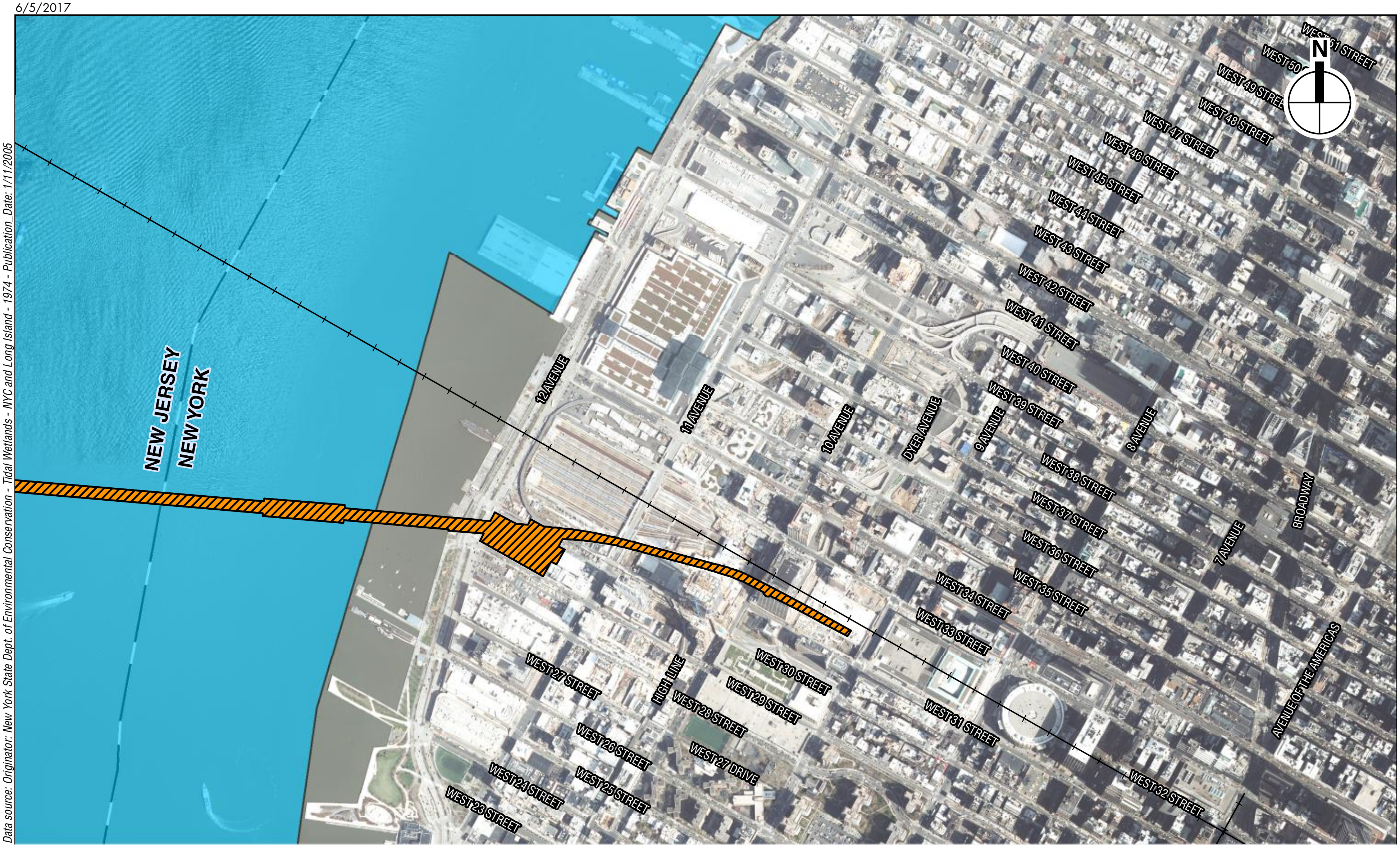
[102] Edinger et al. (2014) define this community as "the exterior surfaces of metal, wood, or concrete structures (such as commercial buildings, apartment buildings, houses, bridges) or any structural surface composed of inorganic materials (glass, plastics, etc.) in an urban or densely populated suburban area. These sites may be sparsely vegetated with lichens, mosses, and terrestrial algae; occasionally vascular plants may grow in cracks. Nooks and crannies may provide nesting habitat for birds and insects, and roosting sites for bats."

[103] Edinger et al. (2014) define this community as "a permanent road having a line of steel rails fixed to wood ties and laid on a gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate along regularly maintained railroads. The railroad right of way may be maintained by mowing or herbicide spraying."

[104] Edinger et al. (2014) define this community as "residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs, and is shaded by at least 30 percent of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing and broadleaf herbicide application."

[105] Edinger et al. (2014) define this community as "residential, commercial, or horticultural land cultivated for the production of ornamental herbs and shrubs. This community includes gardens cultivated for the production of culinary herbs."

6/5/2017



Data source: Originator: New York State Dept. of Environmental Conservation - Tidal Wetlands - NYC and Long Island - 1974 - Publication_Date: 1/11/2005

Project Site

Tidal Wetlands: Littoral Zone

Existing Northeast Corridor

0 1,000 FEET

HUDSON TUNNEL PROJECT

NYSDEC Littoral Zone Tidal Wetlands

Figure 11-8

paved road/path, railroad, and urban structure exterior communities are unvegetated and represent the surrounding streets, railyards, and residential/commercial buildings respectively. The mowed lawn with trees community is found in small portions of the study area as street trees between concrete sidewalks and paved roads. The most common street trees in New York City are London planetree (*Platanus acerfolia*), Norway maple (*Acer platanoides*), Callery pear (*Pyrus calleryana*), honey locust (*Gleditsia triacanthos*), and pin oak (*Quercus palustris*) (Peper et al. 2007). The flower/herb garden community is found planted along the High Line, a public park built on a converted former railroad trestle. Vegetation along the High Line consists of trees, shrubs, wildflower, and grasses that are generally selected for their vigor and benefit to wildlife, including pollinators (e.g., flat-topped aster (*Doellingeria umbellate)*, white sweet clover (*Melilotus albus*), butterfly milkweed (*Asclepias tuberosa)*, and seaside goldenrod (*Solidago sempervirens*)).

11.3.3.4.2 Wildlife

Natural habitats available to terrestrial wildlife within the study area are limited to small buffers between areas of urban residential/commercial land use and human disturbance. As a consequence, these habitats are of limited value to native wildlife. The study area is otherwise developed and covered by buildings, railyards, asphalt, and maintained lawns. As such, only the most urban-adapted, generalist species that can tolerate highly degraded environments and high levels of human activity currently have the potential to occur within the study area.

11.3.3.4.2.1 Birds

Birds species commonly found in the New York study area were identified using the *Breeding Bird Atlas,* a periodic census of the distribution of breeding birds across New York State. The most recent census was conducted from 2000-2005 and documented eight species as confirmed or probable/possible breeders in the survey block in which the study area is located (Block 5751D) (see **Table 11-7**). However, the 9-square-mile survey block spans natural areas where there is habitat to support these species, while the study area contains habitat that is suitable for only a few of the most urban-adapted birds. The bird species that are considered most likely to breed within the study area are the non-native European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock pigeon (*Columbia liva*). These are extremely disturbance-tolerant, generalist species that can thrive in heavily developed, urban environments.

Table 11-7
New York State
Breeding Bird Atlas 2000-2005
for Block 5751D

Common Name	Scientific Name
American Kestrel	*Falco sparverius*
Rock Pigeon	*Columba livia*
Mourning Dove	*Zenaida macroura*
Northern Mockingbird	*Mimus polyglottos*
European Starling	*Sturnus vulgaris*
Northern Cardinal	*Cardinalis cardinalis*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*

Source: 2000-2005 NYS Breeding Bird Atlas for Block 5751D

11.3.3.4.2.2 Mammals

Habitat for mammals is limited within the study area, and is likely to be used only by urban-adapted and synanthropic species (those that benefit from an association with humans). These include the raccoon (*Procyon lotor*), Norway rat (*Rattus norvegicus*), gray squirrel (*Sciurus carolinensis*), and domestic cat (*Felis catus*).

11.3.3.4.2.3 Reptiles and Amphibians

The study area in New York comprises lots covered by buildings, asphalt, and railyards in a heavily urbanized and residential/commercial setting and does not provide habitat for reptiles or amphibians.

11.3.3.5 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

No Federally listed species were indicated by the USFWS IPaC system as occurring within the study area.

NYNHP (2016) indicated that the state-listed endangered peregrine falcon (*Falco peregrinus*) and the yellow bumblebee (*Bombus (Thoracobombus) fervidus*) an unlisted species identified as of conservation concern, have the potential to occur within a half-mile of the Project site in New York. These species are described below.

11.3.3.5.1 Peregrine Falcon

The peregrine falcon is listed as endangered at the state level by NYNHP. It is globally widespread and common in many areas (White et al. 2002), and populations in New York State have grown dramatically since the 1980s. Peregrine falcons have become increasingly common in urban areas, demonstrating a tolerance of human disturbance and an ability to exploit resources in human-modified environments (Cade et al. 1996, White et al. 2002). It has been stated that peregrine falcons will tolerate almost any level of human activity taking place below their nest provided that the nest is inaccessible to humans (Ratcliffe 1972). Urban peregrine falcons appear to have particularly high tolerance thresholds compared with those in more remote areas (White et al. 2002). In several cities within New York State, including New York City, peregrine falcons nest in bridges and high-rise buildings among high levels of noise and human activity associated with the urban environment (Frank 1994, Cade et al. 1996, Loucks and Nadaraski 2005). NYNHP identified peregrine falcon as occurring within a half-mile of the Project site.

11.3.3.5.2 Yellow Bumblebee

The yellow bumblebee is an unlisted species that is considered to be critically imperiled at the state level by NYNHP. The primary threat to yellow bumble bees are exotic pathogens in addition to habitat loss, insecticides, and urbanization. Yellow bumblebees are generalist foragers that nest both above and below ground (NYNHP 2015). Within the study area, the yellow bumblebee would have the potential to occur along the High Line where there is ample vegetation and flowering plants for foraging and nesting.

11.4 AFFECTED ENVIRONMENT: FUTURE CONDITIONS

11.4.1 OVERVIEW

In the future, ongoing and proposed projects within the study area by the analysis year of 2030 may result in impacts or improvements to natural resources in the study area. This condition is the baseline against which the impacts of both the No Action and Preferred Alternatives are compared.

11.4.2 NEW JERSEY

In the New Jersey study area, by the analysis year of 2030 improvements to natural resources are anticipated to continue through the implementation of several initiatives, including the New Jersey Meadowlands Commission Master Plan and the Rebuild By Design project in Hoboken.

The New Jersey Meadowlands Commission (renamed the NJSEA in 2015) adopted a Master Plan in 2004 that set the planning framework for environmental protection and development in the Meadowlands District (NJSEA is currently the planning authority for the 30.4-square-mile district). The primary goal of the Master Plan is the protection of the district's valuable natural resources (particularly 8,400 acres of wetlands) while promoting economic growth through sustainable redevelopment practices, with an emphasis on limiting urban sprawl and improving mass transit.

In addition, the NJDEP has proposed the Rebuild By Design project, an initiative to reduce frequent flooding in Hoboken due to major storm surges and high tides, and heavy rainfall events. That project proposes numerous green infrastructure elements, such as landscaped berms and levees and bioretention basins, to resist and delay flooding. Within the study area, the Rebuild By Design project will include a resist feature: a flood barrier to be located along Park Avenue south of the HBLR and curving along the HBLR. This project has the potential to provide wildlife habitat for urban adapted wildlife species, and improve ecological communities along the waterfront.

11.4.3 HUDSON RIVER

In the future, water quality in the lower Hudson River will continue to gradually improve as a result of the ongoing implementation of several initiatives in New York and New Jersey. Examples of these initiatives include the HEP, Hudson Raritan Estuary (HRE) Ecosystem Restoration Project, New York City Citywide Long-Term Control Plan, and the New Jersey Environmental Infrastructure Financing Program (NJEIFP) to address CSO discharges, Vision 2020, the New York City Green Infrastructure Plan, and PlaNYC/OneNYC.

Elements of the HEP and other programs such as the HRE Ecosystem Restoration Project that are specifically directed at improving biological resources and habitats will result in improvements to natural resources over time. The HRE has identified the Hudson River Park Estuarine Sanctuary (located in the Hudson River eastward of the Manhattan pierhead line) as a restoration site. Restoration opportunities identified for the Sanctuary include creation, restoration, and enhancement of shallow water habitat and providing environmental interpretation (USACE and PANYNJ 2009, and Hudson River Park Trust 2002). Restoration opportunities pursued within the Sanctuary as part of the HRE would also occur under the Preferred Alternative.

The New York City Department of City Planning (NYCDCP) developed the *Vision 2020: New York City Comprehensive Waterfront Plan* to establish goals for the New York City waterfront, with the intention of promoting various ecological objectives and enhancing sustainability and climate resilience planning through the incorporation of climate change considerations, among other goals. The plan seeks to make improvements to water quality and aquatic resources through measures such as additional nitrogen reduction at the Bowery Bay, Tallman Island, Hunts Point, and Wards Island wastewater treatment plants (WWTPs) (NYCDCP 2011); additional reduction in CSOs with the increased capture of stormwater runoff through implementation of the New York City Green Infrastructure Plan (NYCDEP 2016); improved flushing of constrained water bodies; and optimization of existing sewer systems through improvements to drainage, interceptors, and tide gates (NYCDCP 2011). As of February 2016, the Green Infrastructure Plan reported about 4,470 green infrastructure assets (such as bioswales[106]) had been constructed, were in construction, or were in design (NYCDEP 2016). In addition to reducing nitrogen discharges from WWTPs, PlaNYC goals that would result in improvements to water quality and aquatic resources include construction of grey infrastructure projects to reduce the discharge of untreated water to waterways, and reintroduction of oysters and eel grass. OneNYC, an update to PlaNYC, focuses on growth, equity, sustainability, and resiliency, and includes similar initiatives to improve water quality through wastewater treatment and stormwater management, as well as initiatives focusing on the resiliency and adaptability of the New York City's infrastructure.

As required by EPA's CSO Control Policy, NYCDEP initiated the development of the Long-Term Control Plan (LTCP) project in 2004. The LTCP project, recently amended in 2012 through an agreement between NYCDEP and NYSDEC, integrates CSO Facility Planning projects and the Comprehensive City-Wide Floatables Abatement Plan, and incorporates ongoing Use and Standards Attainment Program (USA) project work. As part of the 2012 agreement, NYCDEP will develop 10 waterbody-specific LTCPs and a citywide LTCP (anticipated in 2017) with the goal of achieving waterbody-specific water quality standards consistent with the Federal CSO Policy and the water quality goals of the Clean Water Act.

These anticipated programs and initiatives should gradually improve living conditions for aquatic biota and potentially allow more pollution-intolerant species to occur in the Hudson River. Overall, however, communities of aquatic biota within the lower Hudson River are anticipated to be largely composed of the same species as at present.

In addition, efforts to characterize and understand sediment contamination are likely to lead to improvements in sediment quality over time. The Contamination Assessment and Reduction Project (CARP), sponsored by PANYNJ, focused on understanding the fate and transport of contaminants discharged to the estuary, and using this information to develop measures that may be necessary to reduce sediment contamination. The principal chemicals of concern include dioxins/furans, PCBs, PAHs, metals (mercury, cadmium, and methyl mercury), and organochlorine pesticides. Continued research and monitoring programs are anticipated to play a role in the development of future management strategies for Harbor sediments.[107]

11.4.4 NEW YORK

Natural resources in the New York study area are expected to remain essentially unchanged from the existing condition in the 2030 analysis year with the exception of landscaping added as a result of new open space areas. As discussed in detail in Chapter 6A, "Land Use, Zoning, and Public Policy," Section 6A.4.3, the New York study area is currently undergoing extensive redevelopment and many sites are currently under construction with high-density developments, and will be redeveloped with high density developments in the future under the No Action condition. These developments, including the Hudson Yards overbuild project (at the Western Rail Yard and Eastern Rail Yard), will result in new open space areas with landscaping that will benefit urban wildlife and ecological communities in the vicinity of the Project site. In addition, the Tenth Avenue spur of the High Line may be completed by 2030, which will provide additional wildlife habitat, particularly for insect pollinators.

[106] Bioswales are long, narrow depressions or channels designed with absorbent soils or other substrates, and planted with deep-rooted vegetation. They filter, retain, and route excess runoff and are particularly suitable along streets and parking lots.

[107] Landeck Miller et al. 2011.

11.5 IMPACTS OF NO ACTION ALTERNATIVE

The assessment of impacts under the No Action Alternative assumes no new passenger rail tunnel would be built across the Hudson River and no rehabilitation of the North River Tunnel would occur. Additionally, the No Action Alternative assumes that maintenance of the North River Tunnel would continue as necessary to address ongoing deterioration and maintain service. This alternative would have no effect on natural resources.

11.6 CONSTRUCTION IMPACTS OF THE PREFERRED ALTERNATIVE

11.6.1 OVERVIEW

This section considers potential impacts resulting from the approximately 10-year construction period of the Preferred Alternative. Construction of the various Project elements, including the proposed rail tunnel, tracks and embankment, structures such as retaining walls, buildings and viaduct foundation would result in both surface and subsurface disturbances and therefore would have the potential to affect natural resources. In addition, the in-water work at the low-cover area within the Hudson River and the rehabilitation of the North River Tunnel are also evaluated.

11.6.2 NEW JERSEY

11.6.2.1 FLOODPLAINS

The Project Sponsor would construct Project elements including fill, structures, and roadways (construction roads and permanent access roads), at or below the BFE in a number of areas. Accordingly, construction crews would handle equipment and materials as required by state and local regulations to ensure the safety of workers and protect adjacent uses. Because the source of floodwaters is tidal, the BFE would not be affected by displacement of floodplain storage or conveyance as a result of construction. Accordingly, the Preferred Alternative would not affect the floodplain or result in flooding of adjacent areas during construction.

11.6.2.2 WETLANDS

As discussed in Section 11.3, New Jersey wetlands within the study area include four delineated wetlands, two of which correspond to wetlands mapped by both NWI and NJDEP.

Installation of erosion and sediment control measures and security fencing would temporarily impact approximately 4.307 acres of emergent wetlands and associated open water areas within the emergent wetlands along the surface tracks of the Preferred Alternative in New Jersey (Delineated Wetlands A, B, and CD) (see **Table 11-8**).

Implementation of erosion and sediment control measures (e.g., hay bales. silt fences, and inlet protection) in accordance with the Stormwater Pollution Prevention Plan (SPPP) required under NJPDES General Permit NJ0088323 for Construction Activity Stormwater (General Permit 5G3) would minimize indirect impacts to wetlands due to deposition of soil and other material. During final design and construction of the Project, the future Project Sponsor would prepare the SPPP and site-specific soil erosion and sediment control plan in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, have it certified by the Hudson-Essex-Passaic Soil Conservation District, and would implement the SPPP as part of the Project's best management practices (BMPs) for construction. Following the completion of construction, where possible, wetlands temporarily affected during construction would be restored back to original topography and stabilized in accordance with the SPPP (e.g., seeding with seed mix as specified in Table

4-2, *The Standards for Soil Erosion and Sediment Control in New Jersey*, 7th Edition, January 2014, stabilized with mulch, straw, or hay).

Prior to other construction activities associated with the Preferred Alternative, existing culverts under the NEC surface tracks would be extended to maintain drainage and minimize indirect permanent impacts to wetlands. Construction of the new culverts and culvert extension would include the installation of a temporary cofferdam and sump pits to divert water flow around the work area to control infiltration of groundwater during placement and anchoring of culverts or extensions. Water removed during cofferdam dewatering would be treated with temporary sediment control measures before being discharged back to surface waters or wetlands.

A culvert would be installed for a construction access road to the Hoboken shaft site and staging area within the small 0.439 acre emergent wetland (Wetland F) (**Figure 11-4c**) to maintain drainage under the access road during construction.

Based on implementation of BMPs in accordance with the SPPP and wetland restoration/mitigation activities, construction of the Preferred Alternative would not result in adverse impacts to wetlands. All temporary impacts to wetlands and associated open water areas would require permits from the USACE under Section 404 of the Clean Water Act and from NJDEP under Section 401 of the Clean Water Act. **Appendix 11** includes a Section 404(b)(1) Evaluation and a Draft Conceptual Mitigation Plan.

Table 11-8
Summary of Temporary Impacts to Wetlands and Associated Open Waters

Wetlands and Associated Open Waters within the Limit of the Project	Temporary Impact due to construction activity (acres)
Wetland A	0.578
Wetland B	0.000
Wetland CD	3.729
Total Temporary Impact within Delineated Wetlands	**4.307**

11.6.2.2.1 NYSW Wetland Mitigation Site

The Preferred Alternative would result in approximately 0.28 acres of temporary impacts to the NYSW wetland mitigation site. Similar to the other portions of the surface alignment, temporary impacts would result from the installation of erosion and sediment control measures and security fencing, and culverts with associated riprap outlet protection. Following the completion of construction, the 0.28 acres impacted would be restored back to original topography and stabilized in accordance with the SPPP.

11.6.2.3 GROUNDWATER

Construction of various elements of the proposed surface alignment, including retaining walls, culverts, and bridge abutment foundations within the unconsolidated sediments to the west of the Palisades, may require construction dewatering. Groundwater recovered during dewatering for these elements, as well as groundwater diverted from the construction area, would be from the surficial aquifer and would not result in adverse impacts to groundwater resources of the deep bedrock aquifers comprising the water supply for most of the wells in the study area. Should construction dewatering exceed 100,000 gallons per day of water (70 gallons per minute pumping capacity), a dewatering permit from NJDEP would be required (NJAC 7:19). A Short Term Permit-by-Rule would be required if the duration of dewatering is less than 31 days. A

Dewatering Permit-by-Rule would be required if dewatering would occur for 31 days or longer and from within a cofferdam or similar confined space. The Project Sponsor would implement measures during construction (e.g., sheeting or similar methods) to minimize groundwater intrusion such that dewatering is minimized to the extent practicable. Groundwater contamination encountered during construction dewatering would be treated according to New Jersey surface water quality standards and discharged to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (a NJPDES permit may be required).

The rate of groundwater seepage in the Palisades portion of the new Hudson River Tunnel is expected to be very low. Groundwater that could seep into the Palisades portion of the tunnel would be highly alkaline, and could exceed New Jersey groundwater quality standards for volatile organic compounds and pesticides. Inflow water collection and disposal from excavations would include some combination of sumps, pumps, sediment settling tanks, and oil and water separation at the construction staging sites and access shaft sites. Water pumped from excavation sites would be tested and treated, if required, before disposal to a municipal sewer under applicable permits and in conformance with applicable discharge limits. Although construction dewatering is not expected to affect water supply wells near the tunnel alignment, prior to construction an assessment would be made of the potential impacts and mitigation measures would be implemented if required.

Water that infiltrates into the two tubes of the North River Tunnel is currently pumped to the sump in the Weehawken shaft where it is treated and discharged to the Hudson River through an existing permitted outfall in accordance with NJDEP (NJPDES) Permit Number NJ0164640. Amtrak is required to sample the discharge annually for contaminants in accordance with the NJPDES permit and submit the results to NJDEP. During rehabilitation, drainage would continue to be pumped to the Weehawken sump, where Amtrak would treat it as necessary prior to discharge to the Hudson River in accordance with the NJPDES permit. Therefore, the discharged water would not have the potential to result in adverse impacts to water quality or aquatic biota of the Hudson River.

The Hoboken fan plant and ventilation shaft in New Jersey east of the Palisades would extend well below the water table and therefore these construction sites would require construction dewatering. Where the groundwater is lowered beyond the seasonal/daily fluctuations, settlement of compressible soils would result from the reduction in pore pressures. Construction would therefore require that an impervious excavation support method such as slurry walls extending into rock to cut off groundwater inflow be utilized for excavation support at the New Jersey shaft. As an additional groundwater cutoff measure, a grouting program to fill cracks and other voids in the rock mass below and adjacent to the shaft may be required in order to minimize groundwater inflow.

Because of relatively high permeability rates in the Stockton Formation, a moderate amount of dewatering and seepage control would likely be required for construction of the new Hudson River Tunnel between the Palisades and the Hudson River. However, seepage rates would be limited through tunnel construction methods and there would not be any adverse impacts to surrounding wells, all of which are constructed in deeper rock formations. Dewatering would require a NJDEP construction dewatering permit (NJAC 7:19) should it exceed 100,000 gallons per day of water (70 gallons per minute pumping capacity). A Short Term Permit-by-Rule would be required if the duration of dewatering is less than 31 days. A Dewatering Permit-by-Rule would be required if dewatering would occur for 31 days or longer from within a confined space. Dewatering and seepage effluent[108] from this portion of the tunnel would be pumped to the Hoboken staging and fan plant site for treatment prior to discharge to a municipal sewer.

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[108] A discharge of water or wastewater.

It is anticipated that dewatering and seepage effluent from the Hudson River portion of the tunnel would also be pumped to the Hoboken staging and fan plant site for treatment prior to discharge to a municipal sewer.

For the reasons described above, construction of the Preferred Alternative would not result in adverse impacts to groundwater resources.

11.6.2.4 SURFACE AND NAVIGABLE WATERS

Construction activity in the surface tracks segment along approximately 6,785 linear feet of stream would result in temporary impacts to Penhorn Creek. As described previously, culverts that currently run underneath the existing surface tracks would be extended prior to placement of fill material to include the area beneath the new tracks, including in the vicinity of Penhorn Creek. The most important of these is the drainage swale located on the south side of the NEC that receives discharges from CSO 011A that have passed through the NYSW wetland mitigation site and discharges into Penhorn Creek near the Penhorn Creek pump station. The culverts beneath the NEC at the Penhorn Creek pump station are also critical drainage elements that would be carefully maintained during culvert extension and construction in order to minimize impacts to flow patterns within wetlands and discharges to Penhorn Creek.

11.6.2.4.1 Water Quality

Implementation of erosion and sediment control measures in accordance with the SPPP would minimize the potential for sedimentation into Penhorn Creek during extension of drainage culverts and other construction activities that have the potential to discharge sediment to waters that discharge to Penhorn Creek. The plan would include measures such as the construction of water quality and detention basins, installation of silt fence, hay bales and/or fabric filters at the construction periphery, and vegetative stabilization of soils to prevent sedimentation into surface waters. The SPPP and site-specific soil erosion and sediment control plan would be prepared in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, certified by the Hudson-Essex-Passaic Soil Conservation District, and would be implemented as part of the Preferred Alternative's BMPs for construction.

Installation of culvert extensions in Penhorn Creek would have the potential to result in temporary increases in suspended sediment during culvert construction. Construction of culvert extensions would include the installation of a temporary cofferdam and sump pits to divert Penhorn Creek water flow around the work area to control infiltration of groundwater during placement and anchoring of culverts or extensions. Water removed during cofferdam dewatering would be treated with temporary sediment control measures developed in consultation with NJDEP (e.g., sediment control basin) before being discharged back to Penhorn Creek.

11.6.2.4.2 Aquatic Biota

Implementing BMPs to minimize sediment resuspension during construction of culvert extensions and the maintenance of flow through existing culverts, and implementing erosion and sediment control measures in accordance with the SPPP would minimize water quality impacts to Penhorn Creek and emergent wetlands, and adverse effects to benthic invertebrates and fish. To protect anadromous species spawning run in Penhorn Creek, no in-water or sediment-generating activities and pile driving would occur between March 1 and June 30.

11.6.2.5 TERRESTRIAL RESOURCES

11.6.2.5.1 Ecological Communities

As discussed in Section 11.3, ecological communities within the study area are primarily unvegetated or dominated by ruderal species. Construction of the Preferred Alternative would result in disturbance to approximately 1.7 acres of the upland successional southern hardwoods community. All tree clearing associated with the Preferred Alternative would occur between October 1 and March 14 to minimize impacts to breeding birds protected under the MBTA, as discussed below. Implementation of erosion and sediment control measures in accordance with the Project's SPPP would minimize potential impacts to ecological communities adjacent to the Project site. Therefore, construction of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.6.2.5.2 Wildlife

Construction of the Preferred Alternative, including retaining walls, embankments, culverts, access roads, and a pile-supported viaduct, would result in the temporary loss of approximately 3.8 acres of wetlands and 0.51 acres of associated open water areas due to the installation of erosion and sediment control measures and security fencing. Approximately 1.7 acres of upland successional southern hardwoods community would also require clearing. Otherwise, all land-disturbing construction activities would occur within existing cleared areas or along roadside and rail track margins and other such degraded areas.

The proposed wetland and successional southern hardwoods community impact areas are widespread and common habitat types throughout the region and are of low overall quality to native wildlife, due to the prevalence of invasive species and the disturbed nature of the habitat. Portions of these habitats that would be lost during construction would represent a negligible reduction in the amount of such habitat available to wildlife in the vicinity of the Project area. Any reductions in the number of individuals inhabiting these communities would not impact the size or viability of their local populations and would not change the assemblage of wildlife species present.

To minimize any potential impacts to migratory birds protected under the MBTA with the potential to breed in the vicinity of the Project site, vegetation clearing and/or initial placement of fill material would not occur during the primary breeding period for most bird species (April through July) and would instead occur between October 1 and March 14 (i.e., prior to or after the breeding season), to prevent birds from attempting to breed where additional construction activity would later occur. These measures would further avoid any potential direct impacts to birds, particularly threatened species and wading birds species of special concern identified on the state level that could nest or forage within the wetlands around Penhorn Creek. Overall, land disturbance in New Jersey required to construct the Preferred Alternative would not have adverse effects to wildlife species.

Noises generated during construction of the Preferred Alternative would not be likely to have long-lasting or adverse effects to wildlife in the area due to high existing levels of noise and other human disturbance from the surrounding urban and industrial land uses. As discussed in Section 11.3 above, wildlife communities in the Project area have been established under noisy existing conditions associated with the urban environment, and as such, are largely composed of disturbance-tolerant species. Visual and auditory disturbances during construction would have the potential to temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but the construction activities would not be expected to increase levels of disturbance to the extent that there would be alterations in species assemblages or otherwise negative changes to wildlife communities in the surrounding area relative to the present state. Individuals that would potentially briefly relocate in response to the construction noise would be expected to easily distance themselves from the activity and acquire suitable alternative habitat nearby. Any such temporary relocation away from the area of disturbance would not be expected to adversely affect these individuals in the long term (*sensu* Gill et al. 2001). Overall, noises generated during construction of the Preferred Alternative would not have adverse effects to wildlife within the Project area.

11.6.2.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

According to the USFWS's IPaC database (see **Appendix 11**), there are no Federal threatened or endangered species or critical habitats (including wildlife refuges or fish hatcheries) within the New Jersey portion of the study area. Therefore, construction of the Preferred Alternative does not have the potential to adversely affect Federally listed species under the responsibility of the USFWS. The Preferred Alternative would result in the relocation of a drainage swale connected to Penhorn Creek, which contains a documented population of the state-listed endangered floating marsh-pennywort. A transplantation plan for the floating marsh-pennywort population would be developed in consultation with NJDEP for implementation prior to initiating construction activities. Floating marsh-pennywort thrives in stagnant and slow-moving waters, such as those within a stormwater drainage swale. A possible transplantation site would be near the proposed culvert and replacement stormwater drainage swale. With the implementation of a mitigation and transplantation plan in coordination with NJDEP, no adverse impacts to floating marsh-pennywort are expected as a result of the Preferred Alternative.

Construction of the Preferred Alternative would occur within wetlands that serve as potential nesting and/or foraging habitat for state-listed birds, including glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, and black-crowned night heron. The barn owl is also considered to have the potential to occur in the wetlands around Penhorn Creek at any time of year. As discussed above in Section 11.6.2.5.2, the 4.3 acres of wetland and associated open water areas temporarily lost during Preferred Alternative construction would represent a negligible reduction in the amount of such habitat available to these species in the vicinity of the Project area and would not impact the size or viability of their local populations. An abundance of interior wetland habitat surrounding Penhorn Creek would remain when the Preferred Alternative is complete, and glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, black-crowned night heron, and barn owl would all have the same potential to occur in this area as at present.

To minimize the potential for impacts to birds potentially using this wetland habitat, vegetation clearing and/or initial placement of fill material would not occur in the primary breeding period for most bird species (April through July) and would instead occur between October and March (i.e., prior to or after the breeding season), to prevent birds from attempting to breed where additional construction activity would later occur. These measures would further avoid any potential direct impacts to threatened species and species of special concern birds that could nest or forage within the wetlands around Penhorn Creek. Measures to be implemented to minimize potential impacts to breeding birds and endangered, threatened, or special concern on the state level would be developed in consultation with NJDEP and USFWS.

Noises generated during construction of the Preferred Alternative would likely not have long-lasting or adverse effects to threatened and species of special concern birds potentially occurring in the area. As discussed in Section 11.3, the wildlife communities in the Project area have been established under noisy existing conditions associated with the urban environment. Visual and auditory disturbances during construction would have the potential to temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but the construction activities would not be expected to increase levels of disturbance to the extent that these species would altogether abandon the area. Impacts would be limited to the periphery of the habitat, where conditions are already degraded by edge effects and the habitat is subjected to the greatest levels of human disturbance. More interior portions of the wetland complex would be unaffected, and any individuals that would potentially be displaced by the disturbances occurring on the edges would be expected to easily distance themselves from the activity and acquire suitable alternative habitat nearby. Any such temporary relocation away from the area of disturbance would not be expected to adversely affect these individuals in the long term (*sensu* Gill et al. 2001). Overall, noises generated during construction of the Preferred Alternative would not have adverse effects to endangered, threatened, or special concern species within the Project area.

11.6.3 HUDSON RIVER

11.6.3.1 AQUATIC RESOURCES

Components of the Preferred Alternative that have the potential to impact aquatic resources include installation and removal of the sheet pile cofferdams, increased vessel activity, and ground stabilization through jet grouting in the 1.5-acre low-cover area (as described in detail in Chapter 3, “Construction Methods and Activities,” Section 3.3.5). Potential impacts would be associated with sediment resuspension, underwater noise, and alteration of sediment characteristics, as described below.

11.6.3.1.1 Water Quality

As discussed in Chapter 3, “Construction Methods and Activities,” Section 3.3.5, the Preferred Alternative would have in-water construction work where the tunnel alignment would be relatively shallow below the river bottom, referred to as the low-cover area. As described there, for a small segment of the tunnel alignment beneath the Hudson River, the shallow alignment could cause difficulties during tunnel boring. Generally, tunnels that are bored through soft soils like that of the Hudson River bed should have a depth of soil above the tunnel equivalent to half the diameter of the tunnel or greater to avoid these challenges. The two tubes of the new Hudson River Tunnel would each have an outer diameter of approximately 28 feet, so that at least 14 feet of cover should be above the top of the tunnel as the soft-soil tunnel boring machine excavates the tunnel. A short segment of the tunnel would be shallower than that. In that area. to ensure that the new Hudson River Tunnel has a minimum cover of 11 feet above the tunnel below the river bottom, a 1.5-acre area of river bottom in New York waters within the Hudson River would be strengthened using jet grout, involving a mix of cement grout, water, and compressed air at high pressure that will mix with and partially replace the soil. This would result in a stronger, solidified cemented soil with a consistency equivalent to a hard clay, i.e., a moderate-strength “soilcrete.”

Soil improvement through jet grouting within the 1.5-acre low-cover area would be conducted within cofferdams, minimizing potential increases in suspended sediment and adverse impacts to water quality. In this area, soil improvement would be made within an area enclosed by temporary cofferdams used to protect the water quality of the surrounding area. Therefore, the only potential impacts to water quality would result from the installation and removal of cofferdams. In general, installation of sheet pile cofferdams, like pile driving, generally does not result in significant levels of sediment disturbance. The greatest potential for increased turbidity typically occurs when the sheet pile is removed (MPCA 2017). Sediment disturbance associated with installation and removal of the cofferdams would result in minor, short-term increases in suspended sediment and re-deposition of sediments and associated contaminants. The Project Sponsor would implement a Pollution Prevention Plan, which may include measures such as use of a containment boom and spill socks, developed for the in-water construction activities to minimize the potential for discharge of materials to the Hudson River during sheet pile installation and jet grouting activities conducted from construction barges.

Increases in suspended sediment associated with installation and removal of the cofferdams would be temporary and localized to the immediate vicinity of construction activities. The average tidal current in the Hudson River is 1.4 knots (Geyer and Chant 2006); therefore, any sediment re-suspended during sediment-disturbing activities would move away from the area of in-water construction, either a short distance upstream or downstream depending on the tidal direction, and would dissipate quickly after the completion of the activity. Similarly, any contaminants released to the water column as a result of sediment disturbance would dissipate quickly and would not result in adverse long-term impacts to water quality.

During rehabilitation of the existing North River Tunnel, water in the tunnel would continue to be discharged to the north and south tube mid-river sump pumps, which empty into the Weehawken sump, and finally discharge to the Hudson River. This water is and would continue to be monitored and discharged in accordance with Amtrak's active discharge permit NJPDES Permit No. NJ0164640, and would therefore not result in adverse impacts to water quality.

As described in Chapter 3, "Construction Methods and Activities," Section 3.3.6.3, a concrete-type grout would first be injected into the voids of the Manhattan Hudson River bulkhead (permeation) and then followed with an application of ground freezing in preparation for tunnel boring through the foundation of the bulkhead. The jet grouting procedure (using combinations of primarily cementitious materials mixed with additives) would be conducted at a pressure high enough to travel horizontally through the riprap voids, but low enough not to exceed the resistance of the overlying ground weight. In this manner, it is unlikely that any grout would be introduced to the Hudson River or have potential adverse effects on water quality as a result of the injection of jet grout into the bulkhead.

Soil improvement within the low-cover area would require permits from the USACE under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, from the NYSDEC under Article 15 of the ECL, and consultation with NMFS under Section 7 of the Endangered Species Act and with the NYSDEC under Article 11 of the ECL.

11.6.3.1.2 Sediment Quality

Installation and removal of cofferdams may result in temporary increases in suspended sediment containing low to moderate levels of contamination. Any sediments and associated contaminants resuspended during installation and removal of the cofferdams would be expected to be localized and would dissipate quickly with the tidal currents. Resuspended sediment would be expected to settle out over sediment with similar levels of contamination, and thus would not result in adverse impacts to sediment quality. Ground stabilization through jet grouting would be contained within the cofferdams and would not result in increased turbidity or contaminant resuspension in the river. The jet grouting would result in alteration of the sediment characteristics from soft bottom to soilcrete within the 1.5-acre low-cover area.

During rehabilitation of the North River Tunnel, discharges to surface water would be in accordance with the existing NJPDES permit and would not result in the introduction of contaminants that could impact sediment quality.

11.6.3.1.3 Aquatic Biota

The in-water construction activities described above would have potential temporary adverse impacts to fishes and benthic macroinvertebrates in a localized area surrounding the construction due to: temporary increases in suspended sediment, underwater noise, and shading during cofferdam installation/removal and ground stabilization via jet grouting (approximately 12 to 13 months; see Figure 3-8 in Chapter 3, "Construction Methods and Activities"). Shading impacts would be minimal from the barges associated with this work, as each barge would be small (approximately 30 feet wide by 90 feet long) in comparison to the area of the river left unshaded and moored-in-place in relatively deep waters at any given time.

11.6.3.1.3.1 Suspended Sediment

Life stages of estuarine and anadromous fish and macroinvertebrate species are generally tolerant of elevated suspended sediment concentrations and have evolved behavioral and physiological mechanisms for dealing with variable and potentially high concentrations of suspended sediment (Birtwell et al. 1987, Dunford 1975, LaSalle et al. 1991, Nightingale and Simenstad 2001). Any sediment re-suspension that could occur during in-water work would be temporary, minimal, and localized, and would be well below physiological impact thresholds of larval and adult fish and benthic macroinvertebrates. Additionally, because fish are mobile and generally avoid unsuitable conditions such as high suspended sediment concentrations (Clarke and Wilber 2000), the effects of habitat avoidance would not significantly affect their condition, fitness, or survival. Most shellfish are adapted to naturally turbid estuarine conditions and can tolerate short-term exposures by closing valves or reducing pumping activity.

Sheet pile cofferdams in the low-cover area would be installed in three sections, each approximately 200 feet long by 120 feet wide, in order to minimize the area of riverbed that is disturbed at any one time; as each stage is completed, the sheet piles would be removed. There would be minimal sediment resuspension associated with the installation and removal of each cofferdam. As discussed above in Section 11.3.2.1.1, the Project site in the Hudson River is strongly influenced by the tidal and riverine currents of the Hudson River, and therefore, any temporary increase in suspended sediment associated with in-water construction activities would be localized and would dissipate shortly following cessation of the sediment disturbing activity. Installation and removal of the cofferdams would be an intermittent disturbance (installation over 3 to 4 weeks and removal over 1 to 2 weeks per cofferdam, assuming 8 working hours per day and 5 working days per week), and would therefore have a limited effect on suspended sediment concentrations within any given location during the course of construction. Tidal currents would dissipate any resuspended sediments such that redeposition within or outside the Project area would not adversely affect benthic macroinvertebrates or bottom-dwelling finfish. Ground stabilization through jet grouting would be contained within the cofferdams and would not result in additional sediment resuspension that could affect aquatic biota.

11.6.3.1.3.2 Underwater Noise

In-water construction would result in temporary increases in underwater noise from vessel activity and driving the sheet pile into the sediment for the cofferdams. During construction, there would be up to four barges moored in-place in the work area from which cofferdam installation and removal and jet grouting activities would be conducted; two smaller vessels would be used periodically to deliver materials and carry personnel to and from the site. Personnel would travel to the barges from an existing pier to the work area via tugboat or dingy, and construction materials would be delivered by a second small vessel. The temporary increase in vessel activity over the approximately 12 to 13 months of in-water work would result in an incremental increase in underwater noise levels in the vicinity of the Project site, which could lead to habitat avoidance by fish and some macroinvertebrates in the immediate vicinity of the Project site. This minimal increase in the number of vessels present in the area, and the associated underwater noise, would be well within the typical range of vessel activity in the lower Hudson River, which is an area of heavy commercial vessel traffic. As such, aquatic organisms in the area are likely acclimated to ambient noise levels and would not be adversely affected by the minimal increase in vessel noise.

Installation and removal of steel sheet pile with a vibratory hammer would result in a temporary increase in underwater noise during installation of each sheet pile section. Elevated underwater noise would be temporary, as the cofferdams would be installed in sections, with each section being completed within 3 to 4 weeks (8 hours of pile driving per day, for 5 days per week for each cofferdam; total of 15 weeks for all three cofferdams including time required for removal). Installation of the sheet pile for the cofferdam structures would result in temporary increased underwater noise levels that would not be expected to exceed the threshold for physiological injury to fishes.[109] Fish would likely avoid portions of the Hudson River in the vicinity of sheet pile installation above the behavioral threshold (150 dB SPLrms) that would occur within about 100 feet of the pile-driving activity. Most of the river would be non-ensonified[110] (<150 dB SPLrms) at any given time during sheet pile installation. Even when the deepest sheet piles are installed closest to the navigation channel, about 80 percent of the distance across the channel would likely be non-ensonified, leaving room for fish to avoid portions of the Hudson River in proximity to the cofferdam while the sheet pile is driven. Avoidance of the ensonified area by fish would constitute a temporary loss of foraging habitat within the avoided section of the river. The temporary loss of foraging habitat within and in the vicinity of the soil improvement area, when compared with the available suitable habitat that would still be available within the lower Hudson River, would not result in an adverse impact to aquatic biota. Consultation with NMFS is ongoing with respect to measures to minimize potential impacts to anadromous fish during migration. For these reasons discussed above, the temporary increase in underwater noise during construction of the Preferred Alternative would not have adverse effects on aquatic biota.

11.6.3.2 ESSENTIAL FISH HABITAT

For the reasons identified above, and described in detail in the EFH assessment included in **Appendix 11**, construction of the Preferred Alternative would not result in adverse impacts to water quality, aquatic habitat, or aquatic biota of the Hudson River. Consultation with NMFS is ongoing with respect to measures to minimize impacts to EFH during construction. Therefore, the Preferred Alternative would not result in adverse impacts to the suitability of the Project site for fish species identified by NMFS as having EFH in the Lower Hudson River Estuary.

11.6.3.3 WILDLIFE

The temporary loss of open water habitat during the 12 to 13 months needed to conduct the soil improvement within the 1.5-acre low-cover area would not adversely affect waterbirds foraging within this portion of the Hudson River due to the availability of similar foraging habitat within the immediate vicinity of the Project site. Any individuals affected by any temporary increase in boat activity or other human activity would be expected to avoid the area and use suitable available habitat nearby. Therefore, construction of the Preferred Alternative would not result in adverse impacts to wildlife using the Hudson River.

11.6.3.4 THREATENED, ENDANGERED OR SPECIAL CONCERN SPECIES

Because the Lower Hudson River Estuary is used by shortnose and Atlantic sturgeon primarily for migration rather than extended occupation for feeding or reproduction, it is unlikely that construction would significantly affect these species. Although shortnose sturgeon were found in the Hudson River channel south of the George Washington Bridge (Bain et al. 2006), the number collected was relatively low. Atlantic sturgeon are more likely to occur in deep water habitat of the Hudson River in the vicinity of the Project site during migration to and from upriver foraging, overwintering, and/or spawning grounds. It is unlikely that individuals of either species would occur in the vicinity of the Project site except perhaps as occasional transients. The potential for Project vessel interaction with sturgeon is extremely minimal, as barges would be moored-in-place in relatively deep water during in-water work, and two small vessels would be used periodically to transport personnel and materials to the site.

[109] For vibratory driving of steel sheet piles, typical noise levels at a distance of 33 feet from the pile have been reported as 175 dB SPLpeak, 160 dB SPLrms, and 160 dB for the 1-second SEL. These sound levels are continuous rather than percussive and would not exceed the threshold of 206 dB SPLpeak that is associated with the onset of recoverable physiological injury to fishes.

[110] Without incremental underwater noise due to the Preferred Alternative.

Because any impacts to water or sediment quality associated with the Preferred Alternative's in-water construction activities in the low-cover area would be localized and temporary, the deep channel habitat typically used by shortnose and Atlantic sturgeon is unlikely to be adversely affected during construction. Increased underwater noise during installation and removal of each cofferdam would likely lead to avoidance of the work area by shortnose and Atlantic sturgeon, but would not reach the thresholds of underwater noise associated with the onset of physiological injury or mortality. For sturgeon, noise levels that may cause recoverable physiological injury are 206 dB SPLpeak and 187 dB cumulative sound exposure level (SEL); the noise threshold that causes behavioral modification is 150 dB SPLrms (NMFS 2016). Noise levels consistent with vibratory sheet pile installation,[111] would likely cause sturgeon to avoid the area but would not reach the thresholds associated with physical injury.

While sheet pile cofferdams would be installed in deeper waters of the river along the margins of the deep navigation channel, about 80 percent of the distance across the channel would likely be non-ensonified, and sturgeon would be able to avoid the portion of the river in proximity to the cofferdams in favor of suitable habitat in the vicinity. In order to minimize potential behavioral impacts to migrating subadult and adult Atlantic sturgeon, which could occur in the soil improvement area, cofferdam installation would commence in May in the section closest to the shore and move outward toward the channel. Jet grouting activities would be contained within the cofferdams, in accordance with BMPs for minimizing silt and as recommended by NMFS (2016) for the protection of sturgeon. Sturgeon feed on the river bottom (i.e., they are benthic feeders), and soil improvement through jet grouting in the 1.5-acre low-cover area would temporarily disturb foraging habitat within this area. However, when compared to the available suitable habitat that would still be available within the lower Hudson River, this temporary loss of foraging habitat would not result in an adverse impact to sturgeon.

Sturgeon would be expected to return to the low-cover area following the cessation of in-water construction activities. While the 1.5-acre low-cover area would initially be unsuitable for burrowing organisms, over time sediments would be expected to be deposited on top of the soil and grout mixture. These sediments could provide habitat for soft bottom organisms that would provide forage for sturgeon.

As discussed above (see Section 11.6.3.1.1), the soil improvement activities within the low-cover area would require consultation with NMFS under Section 7 of the Endangered Species Act and with NYSDEC under Article 11 of the ECL.

11.6.3.4.1 Critical Habitat

Given the location of the Project, in-water construction activities would not occur in the vicinity of hard bottom substrate in low salinity waters, and the installation of the cofferdams would not remove any soft substrate used for juvenile foraging and physiological development. As the in-water construction activities would only produce minimal increases in suspended sediment, it would have insignificant effects on water depth, water flow, dissolved oxygen levels, salinity, temperature, or the ability for Atlantic sturgeon to migrate in the vicinity of the Project. Given the width of the Hudson River in the study area (approximately 4,350 feet), the temporary addition of the cofferdams would not add a physical barrier to passage between the river mouth and spawning sites necessary to support unimpeded movement of adults to and from spawning sites, seasonal movement of juveniles, and staging, resting, or holding of subadults or spawning condition adults.

[111] 175 dB SPLpeak, 160 dB SPLrms.

11.6.3.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The Preferred Alternative would result in the modification of 1.5 acres of bottom habitat within the Lower Hudson Reach due to the soil improvement through jet grouting. This portion of the river is a designated Significant Coastal Fish and Wildlife Habitat largely based on its importance in providing wintering habitat for young-of-the-year and yearling-or-older striped bass. Since striped bass spawning and larval habitat occur in freshwaters well upriver of the low-cover area, and striped bass juveniles and adults are widely distributed throughout the estuary, these life stages would not be adversely affected by construction of the Preferred Alternative. Likewise, the Preferred Alternative would not have adverse effects on aquatic habitat for other fish and invertebrate species, or on migratory birds that use the region. In-water construction activities in the 1.5-acre soil improvement area would have the potential to result in temporary increases in suspended sediment that would be localized and expected to dissipate quickly and would not result in adverse impacts to aquatic biota. Installation of the sheet pile for the cofferdam structures used for the three phases of soil improvement would result in temporary increases in underwater noise levels that would not be expected to exceed the threshold for physiological injury to fishes. Fish would likely avoid portions of the river in proximity to the cofferdam while the sheet pile is driven. Pile driving restrictions between November 1 and April 30 required for pile driving within Hudson River Park would minimize the potential of increased underwater noise to adversely impact fishes. The temporary loss of foraging habitat within and in the vicinity of the soil improvement area, when compared to the available suitable habitat that would still be available within the lower Hudson River, would not result in adverse impacts to striped bass or other aquatic biota. Consultation with NMFS with respect to additional measures to minimize impacts to EFH associated with the temporary loss of prey species, and anadromous fish species during migration, is ongoing.

Due to the limited potential for in-water construction activities of the Preferred Alternative to affect water quality, and the limited potential for sheet pile driving to result in adverse impacts to fish, the Preferred Alternative would not result in adverse impacts to fish including the striped bass, and wildlife species, or adversely affect the designation of this portion of the Hudson River as a Significant Coastal Fish and Wildlife Habitat.

11.6.4 NEW YORK

11.6.4.1 FLOODPLAINS

In New York, the tunnel portal near Tenth Avenue and the ventilation shaft and fan plant at Twelfth Avenue (which would be an open shaft for much of the construction period) and A Yard, where track connections would be made, are located within the 100-year floodplain (Zone AE with a BFE of +12 feet NAVD88 and +10 feet NAVD88 at A Yard). Small portions of the Project site are located in the 500-year floodplain (**Figure 11-7**). The floodplain within and adjacent to the study area is affected by coastal flooding and would not be affected by construction or regrading/filling of the floodplain as would occur within a riverine floodplain. Coastal floodplains are influenced by astronomic tide and meteorological forces (e.g., nor'easters and hurricanes) rather than local flooding caused by precipitation (FEMA 2013). Therefore, the occupancy of the floodplain during construction would not affect the flood elevation or increased risks due to flooding adjacent to the study area.

Additionally, the only construction associated with the rehabilitation of the North River Tunnel that would take place within the New York study area would be within the tunnels and would not affect surrounding floodplains. Therefore, no adverse impacts on floodplain are anticipated as a result of construction of the Preferred Alternative, including the rehabilitation of the North River Tunnel.

11.6.4.2 WETLANDS

As discussed in Section 11.3, the only NWI wetlands in New York within the Project site consist of NWI estuarine wetlands with unconsolidated bottoms (E1UBL). These NWI mapped wetlands within the Hudson River are not vegetated and would not be regulated as wetlands under the Clean Water Act. No NYSDEC littoral zone tidal wetlands occur within the Project site within the Hudson River. Therefore, construction of the Preferred Alternative in New York would not result in adverse impacts to wetlands.

11.6.4.3 GROUNDWATER

Ground freezing along the Preferred Alternative's tunnel alignment from the Twelfth Avenue shaft site to the Hudson River bulkhead would temporarily obstruct groundwater flow through the area within a closed system of pipes, avoiding any adverse impact from construction of the tunnel on the surrounding groundwater regime (McCann et al. 2009). Groundwater would be restricted from entering the construction area in the location treated with ground freezing. Because ground freezing occurs within a closed, sealed system of pipes, there would be no release of chemicals to groundwater. Potential groundwater drawdown during ground freezing would be limited to no more than 2 feet in this highly compressible area to avoid issues of settlement. Permeation grouting, which would be used to further stabilize the bulkhead by filling the void spaces of the riprap, would also divert groundwater flow within the vicinity of the grout. Slurry walls would be used in the cut-and-cover sections of tunnel construction to stabilize the ground and to control leakage and limit groundwater drawdown outside of the excavation site. Groundwater monitoring wells or piezometers may be used at certain locations to track the extent of groundwater level lowering.

Groundwater infiltration during construction of the Preferred Alternative in the New York portion of the Project site is expected to be low. Some combination of sumps, pumps, and sediment settling tanks and oil and water separators would be used for groundwater collection, as external dewatering is not an option given the highly compressible soils. It is anticipated that no major dewatering equipment (e.g., deep wells, ejectors, vacuum wellpoints) would be required or allowed outside the limits of excavations; therefore, any groundwater requiring handling would come exclusively from within the excavations. Any groundwater collected in excavation shafts or from the excavated materials from the tunnel boring process would be pumped, tested, and treated before disposal to the New York City sewer system under applicable permits and in conformance with applicable discharge limits and would not be discharged to the Hudson River.

Prior to construction, groundwater testing would be conducted to determine the quality of the groundwater that would be encountered. Should any significantly contaminated groundwater (e.g., volatile organic compounds, petroleum contamination, or other visual evidence) be encountered, it would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it. Handling of potential groundwater contamination issues is discussed in greater detail in Chapter 16, "Contaminated Materials."

In summary, with the measures described above in place, construction of the Preferred Alternative would not result in an adverse effect to groundwater.

11.6.4.4 SURFACE AND NAVIGABLE WATERS

During construction, stormwater on the Project's construction sites in New York City would be discharged to the New York City sewer system, and from there directed to municipal wastewater treatment facilities for treatment before discharge to the Hudson River. Therefore, there would be no adverse effect to waters of the Hudson River from construction activities associated with the Preferred Alternative in New York.

11.6.4.5 TERRESTRIAL RESOURCES

11.6.4.5.1 Ecological Communities

As discussed under Section 11.3, ecological communities within the New York study area are primarily unvegetated terrestrial cultural communities. Most construction activities would occur below ground. Construction of the Preferred Alternative's ventilation shaft, fan plant, and cut-and-cover elements across 30th Street and Tenth Avenue, and use of the ventilation shaft site for construction staging, would involve conversion of areas of paved road/path community to urban structure exterior community.

Construction of the new alignment would result in the removal of approximately 15 street trees within the median of Twelfth Avenue. However, all work would be performed in compliance with Local Law 3 of 2010 and the New York City Department of Parks and Recreation's (NYC Parks) Tree Protection Protocol to minimize potential adverse impacts. In addition, all required replacement and/or restitution for removed trees would be provided in compliance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York (the Project Sponsor would choose to either plant the required number of replacement trees, as directed by NYC Parks, or to pay for the cost of tree replacement to be conducted by NYC Parks). All tree work would be carried out under the supervision of a certified arborist, following a tree protection plan approved by New York City Parks' Manhattan Borough Forester. Construction of the new alignment would not disturb vegetated communities with high ecological value. Therefore, construction of the Preferred Alternative would not result in adverse impacts to ecological communities. Similarly, rehabilitation of the existing tunnel would occur exclusively subsurface within the existing tunnel. Therefore, rehabilitation of the existing tunnel would not result in adverse impacts to ecological communities.

11.6.4.5.2 Wildlife

As discussed in Section 11.3, habitat within the New York study area is primarily limited to buildings, streets, and other impervious surfaces. Existing levels of human disturbance are extremely high. As such, wildlife in the area is limited to the most urban-adapted, synanthropic species, most of which are non-native (e.g., house sparrow, European starling, rock dove, Norway rat). Visual and auditory disturbances during construction would potentially temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but these individuals would easily relocate to areas nearby given the extensive availability and continuity of the same habitat. Construction activities would increase levels of disturbance to the extent that there would be temporary alterations in species assemblages or otherwise temporary changes to wildlife communities in the surrounding area. The same depauperate[112] community of generalist species of wildlife would occur as at present. Overall, construction of the Preferred Alternative would not have adverse impacts to wildlife in the New York study area.

11.6.4.5.3 Threatened, Endangered, or Special Concern Species

Construction activities for the Preferred Alternative would occur primarily subsurface, although there would be above-ground construction at the Twelfth Avenue staging area. Construction activities would not adversely affect existing habitats on the High Line. Therefore, there would be no loss of habitat for the yellow bumblebee. There would also be no potential impact to peregrine falcon nesting sites, which in New York City are limited to bridges and the rooftops of tall buildings. Urban peregrine falcons have a particularly high tolerance for noise and indirect human disturbance (White et al. 2002), and would not be affected by any construction activities of the Preferred Alternative. Urban peregrine falcons primarily prey upon rock doves (DeMent et

[112] Lacking in numbers or variety of species.

al. 1986, Rejt 2001), whose abundance would not change as a result of the Preferred Alternative. Prey availability and foraging habitat therefore would not be affected. Overall, peregrine falcons would not be adversely impacted by the Preferred Alternative and would have the same potential to occur in the Project area as at present.

11.7 PERMANENT IMPACTS OF THE PREFERRED ALTERNATIVE

11.7.1 OVERVIEW

This section considers the permanent impacts on natural resources as a result of the Preferred Alternative once it is complete when both the North River Tunnel and the new Hudson River Tunnel are in operation in the year 2030. Mitigation for the Project's adverse impacts, such as wetland impacts within the New Jersey portion of the Project site, would be developed and implemented in consultation with the NJDEP and USACE.

11.7.2 NEW JERSEY

11.7.2.1 FLOODPLAINS

As described in Chapter 2, "Project Alternatives and Description of the Preferred Alternative," the Preferred Alternative is being designed with a Design Flood Elevation (DFE) of BFE plus 5 feet, meaning that all Project elements would be either above the DFE or would be floodproofed appropriately (i.e., entrances and openings would be raised above the DFE, or any entrances below the DFE would be watertight). The DFE for the Project would therefore be at least elevation 14 feet NAVD88 west of Palisades and elevation 16 feet NAVD88 for the Hoboken fan plant. The DFE west of the Palisades is above the conservative estimate of the 500-year floodplain elevation of 11.7 feet NAVD88; therefore, the Project elements would be above the 500-year floodplain. The Preferred Alternative's surface alignment would be at least 10 feet above the BFE. The New Jersey portal for the new tunnel at Tonnelle Avenue would be slightly below the DFE, but the adjacent approach tracks and surrounding areas would be above the DFE. Soil berms and other design features would be included in the Project at this location to prevent floodwater from entering the tunnel. Additional information on flooding and resilience is provided in Chapter 14, "Greenhouse Gas Emissions and Resilience," Section 14.3.

Because the source of floodwaters is tidal, there would be no increase in flooding due to displacement of floodplain storage or conveyance as a result of permanent structures or fill proposed for the Preferred Alternative. Accordingly, the Preferred Alternative would have no adverse floodplain impacts on adjacent uses.

11.7.2.2 WETLANDS

The surface alignment would result in the unavoidable permanent loss of approximately 8.005 acres of emergent wetlands and associated open water areas within the footprint of the expanded embankment, permanent access roads, culverts, retaining walls, new embankment and bridge abutment over the freight railroad right-of-way in and near the Meadowlands and within the footprint of a construction access road in Hoboken (see **Figures 11-4a and 11-4b** and **Table 11-9)**.

Additionally, these same elements have the potential to result in indirect impacts to wetlands due to changes in hydrology within the study area, or shading due to the viaduct. The drainage ditch that parallels the NEC embankment, located east of Secaucus Road, would be relocated to a 300-foot-long box culvert adjacent to the proposed retaining wall. In addition, four 24-inch diameter culverts would cross beneath the embankment of the new alignment and the adjacent access road. The embankment and access road would limit the flow of water between the drainage ditch that parallels the NEC embankment and the wetlands to the south. Altering the hydrology of wetlands within the study area (e.g., flooding, draining) would disturb the ecology of the wetlands and their distribution. A culvert would be installed for the construction access road to the Hoboken shaft site and staging area within the small 0.439 acre emergent wetland (Wetland F) (**Figure 11-4c**) to maintain drainage under the access road. Once construction of the Project in this area is complete, the construction access road would either be removed and soils stabilized, or the access road and culvert would remain in place to be used as maintenance access for the HBLR.

Of the approximately 43,100 square feet (0.99 acres) occupied by the proposed viaduct, only approximately 12,300 square feet (0.28 acres) along the southern edge of the viaduct would be located above wetlands. The viaduct would be a solid structure positioned between 18 and 19 feet above the surface of the wetlands and located immediately south of the NEC tracks. This elevation above the emergent wetland combined with the southern exposure would allow sufficient sunlight to reach the wetland during periods of the day to support the existing plant community. Therefore, shading of wetlands due to the viaduct would not result in significant adverse impacts to wetlands.

Mitigation for direct and indirect wetland impacts would be determined in consultation with NJDEP and USACE under Sections 404 and 401 of the Clean Water Act, and would likely include the purchase of mitigation credits from an approved mitigation bank within the same watershed unit(s) as the Project site.

Table 11-9
Summary of Permanent Impacts
to Wetlands and Associated Open Waters

Wetlands and Associated Open Waters within the Limit of the Project	Permanent Impact Due to Construction Activity (Acres)
Wetland A	0.670
Wetland B	0.010
Wetland CD	6.886
Wetland F	0.439
Total Impact within Delineated Wetlands	**8.005**

11.7.2.2.1 NYSW Wetland Mitigation Site

The Preferred Alternative would result in 0.47 acres (0.3 acres within wetland areas and 0.17 acres within upland areas) of permanent impacts to the NYSW wetland mitigation site. Similar to the other portions of the surface alignment, permanent impacts would result from placement of fill for the new track embankment and gravel access road and drainage structures with riprap outlet protection. The Preferred Alternative has the potential to result in indirect impacts to the wetland mitigation site and adjacent wetlands due to changes in hydrology and hydraulics associated with the loss of wetland area and change in the discharge point from the wetland mitigation site to the adjacent wetland. The Project Sponsor would conduct additional evaluations to confirm that the outlet structure for the wetland mitigation site is designed to minimize hydraulic impacts to the wetland mitigation site and the North Bergen CSO outfall 011A, and the functioning of the wetland with respect to water quality and minimizes impacts to the wetland receiving the discharge from the mitigation site. The 0.47 acres of permanent impacts would be appropriately mitigated for through the purchase of wetland mitigation credits (see the Draft Conceptual Mitigation Plan provided in **Appendix 11**).

11.7.2.3 GROUNDWATER

The Preferred Alternative would not result in permanent groundwater impacts for any Project elements west of the Palisades. The rate of groundwater seepage in the Palisades portion of the tunnel would be very low. Although long-term seepage control is not likely to impact water supply wells adjacent to the tunnel alignment, prior to construction an assessment would be made of the potential impacts and mitigation measures would be implemented as necessary.

No permanent groundwater impacts are anticipated in New Jersey for either the fan plant and ventilation shaft or the Hudson River portion of the tunnel east of the Palisades.

11.7.2.4 SURFACE AND NAVIGABLE WATERS

11.7.2.4.1 Surface Water Drainage

The Preferred Alternative would maintain the long-term function and conveyance of all crossing and adjacent watercourses. The drainage swale located on the south side of the NEC between CSO 011A and Penhorn Creek pump station would be reconstructed and partially culverted with equal or greater than its present capacity. Existing culverts beneath the NEC at the Penhorn Creek pump station would be extended to accommodate the Preferred Alternative, and would maintain or exceed their existing capacity.

West of the Palisades tunnel portal, the Preferred Alternative would include surfaces that are vegetated or ballasted which mimic or reduce existing stormwater runoff rates and volumes. Runoff from the new surface tracks and adjacent access roads would discharge directly to tidal waterbodies and in accordance with State of New Jersey requirements, management of runoff rate and volume is not required. The exception to the volume concern is approximately 700 feet of proposed rail line immediately to the west of the Palisades tunnel portal. It is anticipated that the ballasted and vegetated rail corridor over this 700-foot portion would result in less runoff than what presently discharges from the existing largely impervious conditions in that area and therefore management of runoff rate and volume would not be required.

The construction of the new Hoboken fan plant would potentially (depending upon its final configuration) require groundwater recharge and management of stormwater. The construction would be implemented in accordance with stormwater BMPs and in accordance with New Jersey stormwater requirements.

11.7.2.4.2 Water Quality

The proposed rail line, its associated structures (e.g., retaining walls, abutments) and new service roadways have the potential to accumulate pollutants on surfaces that could then be entrained in runoff and degrade the water quality of receiving surface water bodies. These potential water quality impacts are expected to be a result of distributed pollutants, mainly from trains and service vehicles. Post-construction stormwater management measures would be implemented as required to treat runoff from the Preferred Alternative and meet all local and NJDEP requirements prior to discharge to existing drainage systems. Stormwater quality for the Hoboken fan plant would be managed as part of the stormwater BMPs implemented for that site in accordance with NJDEP requirements.

Drainage from the new tunnel would be treated as required by the local municipality before discharge to the public sewer system.

11.7.2.4.3 Aquatic Biota

With the installation of culverts designed to minimize adverse impacts to the hydrology of wetlands within the study area and Penhorn Creek, the Preferred Alternative would not result in permanent adverse impacts to macroinvertebrates and fish of Penhorn Creek and associated wetlands.

11.7.2.5 TERRESTRIAL RESOURCES

11.7.2.5.1 Ecological Communities

The Preferred Alternative would result in the permanent establishment of railroad and roadway ecological communities within the surface track portion of the Project site. Operation of the Preferred Alternative would require maintenance of vegetation within the right-of-way of the new alignment, similar to rail right-of-way elsewhere along the NEC. Standard Amtrak right-of-way maintenance includes herbicide application and/or pruning and cutting and measures to minimize indirect impacts to adjacent ecological communities (e.g., minimizing any discharge of herbicides to the adjacent wetlands and only using those approved for application near surface waters). On the basis of these standard maintenance measures, operation of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.7.2.5.2 Wildlife

As discussed above, the Preferred Alternative would permanently affect 8.005 acres of wetland habitat and associated open water habitats associated with Penhorn Creek and a small wetland in Hoboken due to the surface tracks, access road, retaining walls, culverts, and potential indirect impacts to wetland habitats due to changes in hydrology. The permanent loss of 8.005 acres of wetland and open water habitat would not result in adverse impacts to wildlife given the availability of similar habitat adjacent to the Project site within the Meadowlands. Potential indirect effects due to changes in wetland hydrology would be offset to the extent feasible through the design of culvert structures sufficient to maintain the hydrology of wetlands within the study area. The Project Sponsor would conduct additional evaluations to confirm that the culverts are designed to minimize secondary wetland impacts due to changes in hydrology. With the minimization of indirect impacts to wetland habitats, the Preferred Alternative would not result in adverse impacts to wildlife habitat and wildlife.

Operation of the Hoboken fan plant would not likely result in a noticeable incremental increase in noise levels to the point that wildlife would avoid the area or experience any other negative impacts at either the individual or population levels. Natural resources at the potential fan plant site are extremely limited, and wildlife inhabiting this area is limited to urban-adapted, generalist species that are highly tolerant of anthropogenic noise, such as the house sparrow, European starling, and Norway rat.

Operation of trains along the new surface tracks, and any increases in motor vehicle usage or other human activities in the area during operation of the Preferred Alternative, would also not be expected to increase noise levels above existing conditions to an extent that would displace or otherwise negatively affect wildlife in the surrounding area. The wildlife community currently in this area was established under noisy existing conditions created by regional transportation activity, including operating railroads and highways, and other industrial activities near the Project site. As such, these species and individuals are inherently tolerant of high levels of disturbance and would not be expected to experience negative effects from the incremental increase in noise during operation of the new surface tracks. Operation of the North River Tunnel after rehabilitation would not increase train traffic or otherwise change operation from the existing conditions, and therefore, would not have the potential to affect wildlife. Overall, operation of the Preferred Alternative would not have adverse impacts to wildlife.

11.7.2.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

The Preferred Alternative would result in permanent impacts to 8.005 acres of wetlands and associated open water habitat associated with Penhorn Creek and the small wetland in Hoboken, and there would be some potential changes in hydrology that would be minimized through the design of culvert structures that would maintain water flow. As discussed above in Section 11.6, the permanent loss of wetland areas would represent a negligible reduction in the amount of such habitat available to the state-listed birds potentially in the area and would not impact the size or viability of their local populations. An abundance of interior wetland habitat surrounding Penhorn Creek would remain once the Preferred Alternative is in place, and glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, black-crowned night heron, and barn owl would all have the same potential to occur in this area as at present. A transplant plan would be developed in coordination with NJDEP to minimize potential impacts to the floating marsh-pennywort population impacted due to construction. With the implementation of a mitigation and transplantation plan, no adverse operational impacts to floating marsh-pennywort are expected as a result of the Preferred Alternative.

No listed wildlife species are considered to have the potential to occur near the Hoboken fan plant or Palisades tunnel portal, and therefore, operation of these elements of the Preferred Alternative would not have any impacts to such species. Operation of trains along the new surface tracks, and any increases in motor vehicle usage or other human activities in the area during operation of the Preferred Alternative, would also not be expected to increase noise levels above existing conditions to an extent that would displace or otherwise negatively affect any listed bird species from the surrounding area. The bird community currently in this area was established under noisy existing conditions created by regional transportation activity, including operating railroads and highways, and other industrial activities near the Project site. As such, these species and individuals are inherently tolerant of high levels of disturbance and would not be expected to experience negative effects from the incremental increase in noise during operation of the new surface tracks. Operation of the North River Tunnel after rehabilitation would not increase train traffic or otherwise change operation from the existing conditions, and therefore, would not have the potential to significantly affect endangered, threatened, or special concern species.

11.7.3 HUDSON RIVER

11.7.3.1 AQUATIC RESOURCES

11.7.3.1.1 Water Quality

The Preferred Alternative would not result in an adverse impact to the movement of tidal waters or the NYSDEC-designated use classification of the Hudson River within the Project site. Excess grout material and native soil that accumulates during jet grouting would be removed for off-site transport and would not affect water quality once the cofferdams are removed. The introduced soilcrete in the low-cover area would be composed of a mixture of cement and native soil, and would not result in leaching of contaminants into the water column. Therefore, operation of the Preferred Alternative would not result in adverse effects to water quality.

11.7.3.1.2 Sediment Quality

The Preferred Alternative would result in alteration of the sediment characteristics within the 1.5-acre low-cover area, where fine-grained silt/clay sediments would be mixed with cement grout. The resulting soilcrete would be similar to a firm or dense soil substrate and would not lead to leaching or resuspension that could adversely affect sediment quality. Beyond the limited low-cover area, the Preferred Alternative would not result in adverse effects to sediment quality.

11.7.3.1.3 Aquatic Biota

As discussed above, the operation of the Preferred Alternative would not result in adverse impacts to water or sediment quality that would have the potential to result in adverse impacts to aquatic biota. In the approximately 1.5-acre low-cover area where jet grout would be injected to form a hard soilcrete (see discussion in Section 11.6.3.1.1), the approximately 1.5-acre low-cover area of fine-grained silt/clay sediments would no longer provide habitat for infaunal macroinvertebrates, or those that live within the sediment, resulting in a loss of forage for fish. In this area, when construction is complete the 1.5 acres of soilcrete would initially be available as hard bottom habitat for encrusting organisms tolerant of soilcrete, which would provide some foraging habitat for benthic feeders. About 0.8 acres of the soilcrete would be approximately level with the surrounding riverbed, and over time, sediments would be deposited over the soilcrete in this lower profile area at sedimentation rates typical of the lower Hudson River, possibly providing some soft bottom habitat for benthic invertebrates. Therefore, within this 0.8-acre portion of the low-cover area, the modification of the river bottom to achieve the soil improvement necessary to protect the Preferred Alternative would not result in adverse impacts to aquatic biota.

Approximately 0.7 acres of soilcrete area (approximately 120 feet wide and 270 feet long) would be between 1 and 2 feet above the existing mudline (i.e., river bottom). This elevated portion of the soilcrete would provide habitat for encrusting organisms, which would provide some foraging habitat for fish. However, because it would be higher than the surrounding river bottom, this area may have a lower potential to accumulate sediment that would provide soft-bottom habitat for benthic invertebrates and would not, therefore, provide forage habitat to soft-bottom feeding fish species such as windowpane, skates, and summer and winter flounder. As compensation for the change in the nature and elevation of bottom habitat within the 0.74 acres, the Project Sponsor will monitor this area, in coordination with the USACE, NMFS and the NYSDEC, for five years to assess its recovery as fish foraging habitat. The Project Sponsor will also monitor the recovery of the remaining 0.77 acres of soilcrete for five years post-construction. The loss of soft-bottom habitat within the 0.7-acre elevated portion of the soilcrete represents a small loss of this type of habitat within the harbor estuary in the context of the thousands of acres of such habitat available, and would not adversely affect populations of benthic invertebrates. With these measures in place, the Preferred Alternative would not adversely impact aquatic biota or commercial or recreational fishing activity within the study area.

11.7.3.2 ESSENTIAL FISH HABITAT

For the reasons identified above, and described in detail in the EFH assessment included in **Appendix 11**, the Preferred Alternative would not result in adverse impacts to water quality, but would permanently modify 0.7 acres of river bottom due to the establishment of an area hardened with soilcrete that would be between 1 and 2 feet above the mudline of the Hudson River. While this elevated portion of the soilcrete would provide suitable habitat for encrusting organisms that provide forage for some fish species, it would not provide forage habitat for those fish species that prefer soft-bottom habitat such as windowpane, skates, and summer and winter flounder. The addition of 0.7 acres of artificial hard-bottom structure may provide habitat for at least one species known to have EFH in the study area, black sea bass. The introduction of structural complexity in an area characterized as shallow soft-bottom habitat, could provide an "essential component of juvenile black sea bass habitat" (Drohan et al. 2007). Despite the potential benefit for some EFH species, because it would not provide forage habitat for other fish species the Preferred Alternative would result in an adverse effect on EFH that would not be substantial. As compensation for the change in the nature and elevation of bottom habitat within the 0.74 acres, the Project Sponsor will monitor this area, in coordination with the USACE, NMFS and the NYSDEC, for five years to assess its recovery as fish foraging habitat. The

Project Sponsors will also monitor the recovery of the remaining 0.77 acres of soilcrete for five years post-construction.

11.7.3.3 WILDLIFE

Upon completion of construction activities, typical wildlife use of the Hudson River would continue. The Preferred Alternative would result in changes under the water's surface in the low cover area, but would not adversely impact waterfowl or shorebirds using the lower Hudson River.

11.7.3.4 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

For the reasons identified above in Section 11.7.3.1.3, the operation of the Preferred Alternative would not result in adverse impacts to water or sediment quality, and therefore, would not result in adverse impacts to threatened, endangered, or special concern species in the Hudson River. The 0.8-acre portion of the low-cover area in which the soilcrete area would not extend above the mudline would initially be unsuitable for burrowing organisms because of its relatively hard surface, but over time natural river currents would deposit sediments on top of the soil and grout mixture. These sediments could provide habitat for soft-bottom organisms that would provide forage for sturgeon. The 0.7-acre portion of the soilcrete that would extend between 1 and 2 feet above the mudline is not likely to be suitable foraging habitat for Atlantic sturgeon or shortnose sturgeon. This area is outside the 45-foot-deep Federal navigation channel but within an area of the river that is approximately 50 feet deep. Juvenile and adult Atlantic sturgeon in this part of the Hudson River typically occur in deeper waters and may occur in this area as transients, in the case of migrating adults, or for foraging, in the case of juveniles and subadults. Despite the conversion of soft-bottom habitat to hard-bottom habitat, the loss of this area as foraging habitat for Atlantic sturgeon is small relative to the unaffected soft-bottom habitat in the lower Hudson River. Therefore, the loss of this area as foraging habitat for Atlantic sturgeon may affect but is unlikely to adversely affect this species.

Shortnose sturgeon do have the potential to use the 0.7-acre portion of the Hudson River affected by the elevated soilcrete as foraging habitat. However, considering the thousands of acres[113] of suitable foraging habitat in the lower Hudson River that would be unaffected by the Preferred Alternative, the loss of this 0.7-acre area of foraging habitat for shortnose sturgeon in the lower Hudson River is not likely to adversely affect this species.

The slight increase in the elevation of the river bottom in this location would not cause any obstruction of passage for either species of sturgeon. Consultation with NMFS regarding potential effects to Atlantic and shortnose sturgeon is ongoing. After construction is complete, the Project Sponsor will monitor the recovery of the 0.7 acres of elevated soilcrete and the remaining 0.8 acres of soilcrete for five years as foraging habitat. Monitoring of this area will be conducted in consultation with USACE, NMFS, and NYSDEC.

11.7.3.4.1 Critical Habitat

Given the location of the Project in saline waters near the mouth of the Hudson River, the permanent features of the Hudson River Tunnel beneath the river (i.e., the area of permanent soilcrete) would not impact hard-bottom substrate in low salinity waters where Atlantic sturgeon spawn and where eggs and larvae are found. The proposed addition of soilcrete in the low cover in a small area of the Project alignment where ground hardening is proposed would convert soft substrate along the salinity gradient, which is used for juvenile foraging and physiological development, to artificial hard bottom in an area encompassing 0.7 acres. The addition of this

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[113] The lower Hudson River Estuary has an estimated 78,322 acres (www.dec.ny.gov/lands/4836.html).

hard-bottom area in place of this soft-bottom substrate would adversely modify proposed critical habitat for Atlantic sturgeon but represents a small area relative to the thousands of acres of available foraging habitat suitable for Atlantic sturgeon in the Hudson River. The addition of soilcrete would also result in an increased elevation of approximately 2 feet above the river bottom at a water depth of approximately 45 to 50 feet. Given the width of the Hudson River in the study area (approximately 4,350 feet), the permanent impact to 0.7 acres of deep-water, soft-bottom habitat would not create a physical barrier to passage between the river mouth and spawning sites necessary to support unimpeded movement of adults to and from spawning sites, seasonal movement of juveniles, and staging, resting, or holding of subadults or spawning condition adults. The conversion of 0.7 acres of soft-bottom habitat to artificial hard-bottom habitat would not be likely to have significant effects on water flow, dissolved oxygen levels, salinity, or water temperature. Therefore, this aspect of the proposed critical habitat for Atlantic sturgeon would not be adversely modified. Following the issuance of the final critical habitat rule by NMFS, which is expected in August 2017, FRA will initiate consultation with NMFS regarding the potential impacts to critical habitat.

11.7.3.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The Lower Hudson Reach has been identified as a Significant Coastal Fish and Wildlife Habitat primarily because of its use by large numbers of juvenile striped bass as wintering habitat. Adult striped bass enter the Hudson River to spawn during spring and summer but spend most of their time in coastal waters, not within the study area. Spawning occurs in freshwaters far upstream of the study area and would not be adversely affected by the operation of the Preferred Alternative. Because striped bass spawning occurs well upriver of the Project site, the majority of the larval striped bass are also located upstream of the study area. Furthermore, the highest abundance of juvenile striped bass is also upstream of the study area, nearly 90 miles north. The 0.7-acre low-cover area of fine-grained silt/clay sediments that would be permanently modified would not result in an adverse impact to striped bass given the ubiquity of this bottom habitat elsewhere in the lower Hudson River. After construction is complete, the Project Sponsor will monitor the recovery of the 0.7 acres of elevated soilcrete and the remaining 0.8 acres of soilcrete for five years to assess the habitat use and re-sedimentation of the modified river bottom. Monitoring of this area will be conducted in consultation with USACE, NMFS, and NYSDEC. With implementation of measures recommended through these consultations, the permanent operation of the Preferred Alternative would not adversely affect the designation of this portion of the Hudson River as a Significant Coastal Fish and Wildlife Habitat.

11.7.4 NEW YORK

11.7.4.1 FLOODPLAINS

Within New York City, tidal flooding is the primary cause of flood damage. While the Preferred Alternative would result in the placement of additional structure within the 100-year floodplain, the floodplain within and adjacent to the study area is affected by coastal flooding and would not be affected by any additional structures as would occur within a riverine floodplain. Coastal floodplains are influenced by astronomical tide and meteorological forces (e.g., northeasters and hurricanes) and not by fluvial flooding (FEMA 2013). Additionally, the DFE criterion for the Preferred Alternative was established at the BFE plus 5 feet, which accounts for a conservative estimate related to future sea level rise plus a factor of uncertainty.

In New York, the tunnel portal and the new Twelfth Avenue fan plant site are located within the 100-year floodplain (Zone AE), with an elevation of +12 feet NAVD88. The Tenth Avenue fan plant would be located beneath the Lerner Building at approximately -18.3 feet NAVD88, which is 12 feet below the BFE and 17 feet below the DFE. The Tenth Avenue fan plant would be protected by the Long Island Rail Road perimeter wall that will be constructed around the West

Side Yard as part of the West Side Yard Perimeter Protection Project and would not alter the floodplain. The elevation of all building openings that may permit the entry of water in a flood event would be located above the DFE. Any openings that cannot be raised above the DFE would be protected by waterproof closures designed to withstand the anticipated pressure of water at the DFE (see Chapter 14, "Greenhouse Gas Emissions and Resilience," Section 14.3, for a more detailed assessment of impacts related to flooding). Additionally, above-grade structures would utilize existing impervious footprints and/or foundations and would result in minimal, if any, change in the floodplain. Below-grade structures, such as the tunnel and railroad systems, would not have the potential to alter the floodplain.

There would be no change in the footprint of the existing North River Tunnel within the New York study area and its long-term operation would be similar to that of the existing condition. Therefore, the permanent operation of the Preferred Alternative, including the rehabilitated North River Tunnel, would not have the potential to result in adverse impacts to the 100-year floodplain or 500-year floodplain in the New York study area, or result in additional flooding adjacent to the Project site.

11.7.4.2 WETLANDS

There are no NYSDEC littoral zone tidal wetlands or wetlands as defined by the Clean Water Act within the Project site. Therefore, the Preferred Alternative would not have the potential to result in adverse impacts to wetlands.

11.7.4.3 GROUNDWATER

No adverse permanent impacts on groundwater are anticipated as a result of the Preferred Alternative. Although the below-grade structures would have the potential to modify groundwater flow patterns, groundwater would be expected to flow around these structures and continue to flow toward the Hudson River.

11.7.4.4 TERRESTRIAL RESOURCES

11.7.4.4.1 Ecological Communities

As discussed in Section 11.6, all Project structures with the exception of the Twelfth Avenue fan plant would be located subsurface. Therefore, operation of the Preferred Alternative would not result in adverse impacts to ecological communities. Similarly, rehabilitation of the North River Tunnel would occur exclusively subsurface within the existing tunnel, and operation of the existing tunnel would remain unchanged. The Preferred Alternative would not adversely affect existing or future ecological communities and the habitat provided to wildlife within the High Line, or habitat that would be located within the Hudson Yards development. Therefore, operation of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.7.4.4.2 Wildlife

Existing levels of human disturbance in the New York study area are extremely high and the wildlife in the area is therefore limited to the most urban-adapted, synanthropic species (e.g., house sparrow, European starling, rock dove, Norway rat). Operation of the Twelfth Avenue fan plant would not increase levels of disturbance to the extent that there would be alterations in species assemblages or otherwise negative changes to wildlife communities in the surrounding area. The same depauperate community of generalist species of wildlife would occur as at present. All other operations would occur underground where no impacts to wildlife could occur. Overall, there would be no permanent impacts to wildlife in the New York study area from the operation of the Preferred Alternative.

11.7.4.4.3 Threatened, Endangered, or Special Concern Species

Operation of the Twelfth Avenue fan plant would not adversely impact any yellow bumblebees potentially occurring on the High Line, or any peregrine falcons occurring anywhere in the New York study area. Urban peregrine falcons have a particularly high tolerance for noise and indirect human disturbance (White et al. 2002), and any minor incremental increases in noise above the high existing noise levels of the New York study area would not displace or otherwise affect peregrine falcons. All other operations would occur underground where no impacts to yellow bumblebees or peregrine falcons could occur. Therefore, no permanent adverse impacts to endangered, threatened, or special concern species in the New York study area would result from the operation of the Preferred Alternative.

11.8 SUMMARY OF IMPACTS AND ASSOCIATED MITIGATION AND MINIMIZATION MEASURES

Table 11-10 summarizes the temporary and permanent natural resource impacts of the Preferred Alternative within the New Jersey, Hudson River, and New York Project areas. Section 11.9 lists the measures that would be employed for the Preferred Alternative to avoid, minimize, or mitigate adverse impacts to natural resources during and following construction.

Table 11-10
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
New Jersey				
Floodplains	No adverse impacts anticipated.	N/A	No potential adverse impacts.	N/A
Wetlands	• Approximately 4.307 acres of emergent wetlands and associated open water areas (of which 0.28 acres would fall within the existing NYSW wetland mitigation site) within the emergent wetlands along the surface tracks (Delineated Wetlands A, B, and CD).	• Implementation of measures that minimize impacts to wetlands in the vicinity of construction activities in the Meadowlands, such as the use of low-ground-pressure vehicles and marsh matting. • Implementation of erosion and sediment control measures (e.g., hay bales and silt fences, seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan, which would be prepared in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, and would be implemented as part of the Project's BMPs. • Restoration of disturbed wetlands back to original topography following the completion of construction. • Inclusion of a culvert within the construction access road in Hoboken to maintain drainage under the haul route.	• Approximately 8.005 acres of emergent wetlands and associated open water areas (of which 0.3 acres would fall within wetlands within the existing NYSW mitigation site) and 0.17 acres within uplands of the existing NYSW mitigation site within the footprint of the expanded embankment, permanent access roads, culverts, retaining walls, new embankment and bridge abutment over the freight railroad right-of-way in and near the Meadowlands. • Alteration of stormwater flow into wetlands as a result of permanent Project elements • Alteration of wetland hydrology due to changes in flooding and draining resulting from the access road and embankment.	• Development and implementation of mitigation for wetland impacts in consultation with NJDEP and USACE, likely including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site. • Track ballast and gravel in access roads would reduce stormwater runoff rates and volumes. • Implementation of post-construction stormwater management measures as required to treat runoff. • Design culverts to minimize secondary wetland impacts due to changes in hydrology.

Table 11-10 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Groundwater	• Possible construction dewatering, during which a potential encounter with contaminated groundwater may occur.	• Control seepage using sheeting, using grout to fill cracks and other voids in rock or similar methods. • Treatment of any groundwater contamination encountered during construction dewatering in New Jersey to state surface water quality standards, with discharge to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (a NJPDES permit may be required).	No potential adverse impacts.	N/A
Surface and Navigable Waters	• Potential increases in suspended sediments and discharge of sediments to Penhorn Creek may temporarily impact water quality and aquatic biota.	• Implementation of erosion and sediment control measures (e.g., hay bales and silt fences, seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan in order to minimize the potential for sedimentation into Penhorn Creek. • During installation of culvert extensions in Penhorn Creek, use of best management measures developed in consultation with NJDEP to minimize sediment resuspension (e.g., cofferdam or turbidity curtain) while at the same time maintaining flow within Penhorn Creek.	• Permanent alteration of the Penhorn Creek channel where culverts would be extended. • Alteration of stormwater flow throughout as a result of Project elements in New Jersey.	• Design culverts within the surface alignment to avoid changes in hydrology. • Track ballast and gravel in access roads would reduce stormwater runoff rates and volumes. • Implementation of post-construction stormwater management measures as required to treat runoff from access road and surface alignment. • Implement stormwater BMPs at the Hoboken fan plant and shaft site.
Aquatic Biota	• Potential increases in suspended sediments in Penhorn Creek and in-water construction activities may temporarily impact aquatic biota and affect anadromous fish spawning.	• Limit any in-water or sediment generating activities and pile driving so that these activities do not occur from March 1 through June 30 to protect anadromous species spawning in Penhorn Creek.	No potential adverse impacts.	N/A

Table 11-10 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Terrestrial Resources	• Disturbance to approximately 1.7 acres of the upland successional southern hardwoods community. • Approximately 4.3 acres of wetland associated open water areas lost as available habitat to wildlife in the area.	• All tree clearing associated with the Preferred Alternative would occur between October 1 and March 14 to minimize impacts to breeding birds protected under the MBTA. • Restoration of disturbed wetlands back to original topography following the completion of construction.	• Approximately 8.005 acres of emergent wetlands and associated open water areas lost as available habitat to wildlife in the area.	• Development and implementation of mitigation for wetland impacts in consultation with NJDEP and USACE, likely including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site.
Threatened, Endangered, or Special Concern Species	• Potential temporary disturbance to state-listed birds as a result of construction activities. •Impact to marsh-pennywort located within a drainage swale connected to Penhorn Creek that would be relocated during construction.	• Vegetation clearing and/or initial placement of fill material would occur between October 1 and March 14 to avoid impacts to breeding birds. •Development and implementation of a transplantation plan for the floating marsh-pennywort population in consultation with NJDEP for implement-tation prior to initiating construction activities affecting Penhorn Creek.	No potential adverse impacts.	N/A
Hudson River				
Aquatic Resources, including Essential Fish Habitat and Significant Coastal Fish and Wildlife Habitat	• Temporary loss of 0.8 acres of bottom habitat as a result of jet grouting. • Temporary impacts to aquatic biota as a result of increased suspended sedi-ment, underwater noise, and shading associated with the installation and removal of cofferdams.	• Installation and removal of steel sheet pile in the Hudson River low-cover area with a vibratory hammer. • Limiting sheet pile installation so that no installation occurs between November 1 through April 30, to protect over-wintering striped bass and winter flounder spawning. •Consultation with NMFS with respect to additional measures to minimize impacts to EFH and anadromous fish species is ongoing.	• Permanent fill within 0.7 acres of bottom habitat as a result of jet grouting that would result in soilcrete 1 to 2 feet above the existing mudline.	• Monitoring of the recovery of the 0.7 acres for five years, in consultation with USACE, NMFS, and NYSDEC, as fish foraging habitat. • Also monitor the recovery of the remaining 0.8 acres of soilcrete for five years post-construction.
Wildlife	No potential adverse impacts.	N/A	No potential adverse impacts.	N/A

Table 11-10 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Threatened, Endangered, or Special Concern Species	• Temporary loss of 0.8 acres of sturgeon foraging habitat as a result of jet grouting. • Temporary impacts to sturgeon as a result of increased suspended sediment, under-water noise, and shading associated with vessels used during the installation and removal of cofferdams for the 1.5-acre low cover area.	•Use of cofferdams in the low-cover area to contain jet grouting activities, in accordance with BMPs for minimizing silt and as recommended by NMFS for the protection of sturgeon. • To minimize potential behavioral impacts to migrating subadult and adult Atlantic sturgeon, sequencing cofferdam installation so that it commences in May in the section closest to the shore and moves outward toward the channel.	Unlikely to adversely impact.	Consultation with NMFS is ongoing.
New York				
Floodplains	No adverse impacts anticipated.	N/A	• The tunnel portal and the new Twelfth Avenue fan plant site are located within the 100-year floodplain (Zone AE), with an elevation of +12 feet NAVD88. • The Tenth Avenue fan plant would be located beneath the Lerner Building at approxi-mately -18.3 feet NAVD88, which is 12 feet below the BFE and 17 feet below the DFE.	• The elevation of all building openings that may permit the entry of water in a flood event would be located above the DFE. Any openings that cannot be raised above the DFE would be protected by waterproof closures designed to withstand the anticipated pressure of water at the DFE.
Wetlands	No wetlands present.	N/A	No wetlands present.	N/A
Groundwater	• Potential for encounter with contaminated groundwater during construction.	• Any contaminated groundwater encountered would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it.	No potential adverse impacts.	N/A
Surface and Navigable Waters	No potential adverse impacts.	N/A	No potential adverse impacts.	N/A

Table 11-10 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Terrestrial Resources	• Removal of approximately 15 street trees within the median of Twelfth Avenue.	• Replacement and/or restitution for tree removal in accordance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York. • All tree work would be carried out under the supervision of a certified arborist, following a tree protection plan approved by New York City Parks' Manhattan Borough Forester.	No potential adverse impacts.	N/A
Threatened, Endangered, or Special Concern Species	No potential adverse impacts.	N/A		

11.9 MEASURES TO AVOID, MINIMIZE, AND MITIGATE IMPACTS

As identified in **Table 11-10**, the following measures will be employed during and following construction of the Preferred Alternative to avoid, minimize, or mitigate adverse impacts to natural resources**.**

11.9.1 NEW JERSEY

- Design of culverts within the surface alignment to avoid changes in hydrology, and therefore to minimize secondary wetland impacts due to changes in hydrology.
- Development and implementation of mitigation for direct and indirect wetland impacts in consultation with NJDEP and USACE, likely including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site.
- Implementation of measures that minimize impacts to wetlands in the vicinity of construction activities in the Meadowlands, such as the use of low-ground-pressure vehicles and marsh matting.
- Implementation of erosion and sediment control measures (e.g., hay bales, silt fences, and post-construction stabilization with seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan, which would be prepared in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, and would be implemented as part of the Project's BMPs for construction to minimize discharge of sediment to Penhorn Creek and wetlands.
- Restoration of disturbed wetlands back to original topography following the completion of construction.

- Inclusion of a culvert within the construction access road in Hoboken to maintain drainage under the haul route.
- If necessary, elimination of adverse effects to nearby wells and wetlands by controlling seepage using sheeting or similar methods.
- Treatment of any groundwater contamination encountered during construction dewatering in New Jersey to state surface water quality standards with discharge to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (a New Jersey Pollutant Discharge Elimination System permit may be required).
- Implement measures during construction (e.g., sheeting or similar methods, and a grouting program to fill cracks and other voids in the rock mass) to minimize groundwater intrusion such that dewatering is minimized to the extent practicable.
- During installation of culvert extensions in Penhorn Creek, use of cofferdams and other best management measures developed in consultation with NJDEP to minimize sediment resuspension (e.g., cofferdam or turbidity curtain) while at the same time maintaining flow within Penhorn Creek.
- In the Meadowlands portion of the Project alignment (west of the Conrail and NYSW freight right-of-way), limit vegetation clearing and/or initial placement of fill material to the period between October and March (i.e., prior to or after the breeding season, which is April through July), to prevent birds from attempting to breed where additional construction activity would later occur.
- Limit any in-water or sediment-generating activities and pile driving so that these activities do not occur from March 1 through June 30 to protect anadromous species spawning in Penhorn Creek.
- Development and implementation of a transplantation plan for the floating marsh-pennywort population in consultation with NJDEP for implementation prior to initiating construction activities affecting Penhorn Creek.
- Implementation of stormwater BMPs for construction of the Hoboken fan plant.
- Use of a comprehensive stormwater management system to treat Project runoff and meet all local and state requirements prior to discharge to existing drainage systems.
- Treatment, if appropriate, for drainage from the new Hudson River Tunnel to meet local requirements prior to discharge (under permit) to a public sewer.

11.9.2 HUDSON RIVER

- Use of cofferdams in the low-cover area to contain jet grouting activities, in accordance with BMPs for minimizing silt and as recommended by NMFS for the protection of sturgeon.
- Installation and removal of steel sheet pile in the Hudson River low-cover area with a vibratory hammer.
- Limiting sheet pile installation so that no installation occurs between November 1 through April 30, to protect overwintering striped bass and winter flounder spawning. Consultation with NMFS with respect to additional measures to minimize impacts to EFH and anadromous fish species is ongoing.
- In order to minimize potential behavioral impacts to migrating subadult and adult Atlantic sturgeon, sequencing cofferdam installation so that it commences in May in the section closest to the shore and moves outward toward the channel.
- In the 0.7-acre area of the river bottom where the soilcrete would extend above the existing mudline, implementation of a five-year monitoring program following completion of construction, in consultation with USACE, NMFS, and NYSDEC, to assess recovery as fish

foraging habitat. Also monitor the recovery of the remaining 0.8 acres of soilcrete for five years post-construction.

11.9.3 NEW YORK

- Conducting groundwater testing prior to construction to determine the quality of the groundwater that would be encountered. Should any significantly contaminated groundwater (volatile organic compounds, petroleum contamination, or other visual evidence) be encountered, it would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it.
- Performing all tree clearing work in compliance with New York City Local Law 3 of 2010 and NYC Parks' Tree Protection Protocol. In addition, all required replacement and/or restitution for removed trees would be provided in compliance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York.

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