Chapter 16: Ecology

16-1 INTRODUCTION

This chapter describes existing terrestrial resources including vegetation and wildlife, aquatic resources including wetlands and aquatic biota, and threatened and endangered species in the study area; presents potential adverse impacts of the No Build and Replacement Bridge Alternatives on those resources during operation of the project; and proposes measures to minimize and mitigate potential impacts. Temporary impacts associated with construction activities, and measures for mitigating adverse construction impacts are discussed in Chapter 18, "Construction Impacts."

16-2 REGULATORY CONTEXT

Operation of the project has the potential to affect the ecological resources described above from the loss of habitat, including wetlands, terrestrial, and aquatic habitats; noise; changes in the height of the bridge structure; and discharge of stormwater runoff. Activities within wetlands, special habitats, or activities with the potential to affect threatened and endangered species must comply with the federal and state legislation and regulatory programs as described below.

16-2-1 FEDERAL

Endangered Species Act of 1973. The Endangered Species Act (ESA) of 1973 prohibits the importation, exportation, taking, possession, and other activities involving illegally taken species covered under the Act, and interstate or foreign commercial activities. The Act also provides for the protection of designated critical habitats on which endangered or threatened species depend for survival.

Bald and Golden Eagle Protection Act. The Bald and Golden Eagle Protection Act prohibits anyone without a permit issued by the Secretary of the Interior 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."

Clean Water Act. The objective of the Clean Water Act, also known as the Federal Water Pollution Control Act, is to restore and maintain the chemical, physical, and biological integrity of waters of the United States. Waters of the United States include streams, rivers, wetlands, mudflats, and sandflats that meet the specified requirements defined in 33 CFR 328.3. The Clean Water Act regulates point sources of water pollution (such as discharges of municipal sewage and industrial wastewater and discharges of dredged or fill material into navigable waters and other waters of the United States) and non-point source pollution (such as runoff from streets, agricultural fields, construction sites, and mining).

- Under Section 401 of the Act, any applicant for a federal permit or license for an activity that may result in a discharge to navigable waters must provide to the federal agency issuing a certificate (either from the state where the discharge would occur or from an interstate water pollution control agency) that the discharge would comply with Sections 301, 302, 303, 306, 307, and 316 (b) of the Clean Water Act.

- Section 404 of the Act requires authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the discharge of dredged or fill material into waters of the United States. Activities authorized under Section 404 must comply with Section 401 of the Act.

Rivers and Harbors Act of 1899. Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army acting through USACE for the construction of any structure in or over any navigable waters of the United States; 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. Any structures placed in navigable waters—such as pilings, piers, or bridge abutments up to the mean-high-water line—are regulated pursuant to this Act. USACE must evaluate, in the public interest, the benefits of the proposed activity versus potential detriments.

Executive Order 11990, "Protection of Wetlands." In accordance with Executive Order 11990, "Protection of Wetlands," 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.

Executive Order 13112, "Invasive Species." In accordance with Executive Order 13112, "Invasive Species," federal agencies must prevent, to the extent practicable and permitted by law, the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act entrusts the Secretary of the Interior 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 (dam) of a body of water.

Migratory Bird Treaty Act. The Migratory Bird Treaty Act (MBTA) of 1918 was implemented following the 1916 convention between the U.S. and Great Britain (on behalf of Canada) for the protection of birds migrating between the U.S. and Canada. Subsequent amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and the former Soviet Union. The MBTA makes it unlawful to pursue, hunt, take, capture, kill or sell birds listed therein. Over 800 species are currently protected under the Act. The statute applies equally to both live and dead birds, and grants full protection to any bird parts, including feathers, eggs and nests.

Magnuson-Stevens Fishery Conservation and Management Act. Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for the National Marine Fisheries Service (NMFS) and the Regional Fishery Management Councils (in this case, the Mid-

Atlantic Fishery Management Council) to comment on activities proposed by federal agencies (issuing permits or funding projects) that may adversely impact areas designated as Essential Fish Habitat (EFH). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse impacts to EFH, as defined in 50 CFR 600.910(A), include any impact that reduces the quality and/or quantity of EFH. Adverse impacts may include:

- Direct impacts such as physical disruption or the release of contaminants;
- Indirect impacts such as the loss of prey or reduction in the fecundity (number of offspring produced) of a managed species; and
- Site-specific or habitat-wide impacts that may include individual, cumulative, or synergetic consequences of a Federal action.

Marine Protection, Research and Sanctuaries Act (MPRSA), Section 103. The Marine Protection, Research, and Sanctuaries Act prohibits the dumping of material into the ocean that would unreasonably degrade or endanger human health, the marine environment, or economic potential. Section 103 regulates the transportation and disposal of dredged materials in the ocean. Permits for ocean dumping of dredged materials are issued by the US Army Corps of Engineers (USACE) and are subject to approval by the US Environmental Protection Agency (EPA). Ocean dumping is only permitted if there are no other reasonable alternative sites.

Hudson River Valley National Heritage Area. Congress designated the Hudson River Valley National Heritage Area under Title IX of Public Law 104-333 (1996), as amended by Section 324 of Public Law 105-83 (1997). The National Heritage Area extends from Yonkers, New York to Troy, New York, comprising the 10 counties of Albany, Rensselaer, Columbia, Greene, Ulster, Dutchess, Orange, Putnam, Westchester, and Rockland, and the Village of Waterford in Saratoga County. The Hudson River Valley National Heritage Area Act of 1996 has the following purposes:

- To recognize the importance of the history and the resources of the Hudson River Valley to the Nation;
- To assist the State of New York and the communities of the Hudson River Valley in preserving, protecting, and interpreting these resources for the benefit of the Nation; and
- To authorize Federal financial and technical assistance to serve these purposes. (Public Law 104-333 Title IX Sec. 903)

The Hudson River Valley Greenway Communities Council and the Greenway Conservancy serve as the management entities, and must develop a management plan for the National Heritage Area. The Hudson River Valley National Heritage Area Management Plan was approved by the Secretary of the Interior in 2002. The Management Plan’s goals include, among others, to safeguard and enhance the area’s natural heritage through conservation of its resources.

16-2-2 NEW YORK STATE

Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern. The Endangered and Threatened Species of Fish and Wildlife, Species of

Special Concern 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 these species as listed in 6 NYCRR §182.6.

Protection of Waters, ECL Article 15. The New York State Department of Environmental Conservation (NYSDEC) is responsible for administering Protection of Waters regulations to prevent undesirable activities on surface waters (streams, lakes, and ponds). NYSDEC and the New York State Department of Transportation (NYSDOT) signed a Memorandum of Understanding (MOU) regarding Environmental Conservation Law (ECL) Articles 15 and 24. Pursuant to the MOU, NYSDOT does not need to obtain individual permits for projects regulated by ECL Article 15, but must comply with the provisions set forth in the MOU and the intent of the law. The New York State Thruway Authority (NYSTA) is exempt from the permit requirements of Article 15 pursuant to the MOU between NYSDOT and NYSDEC. The project will be progressed in accordance with NYSDOT/NYSDEC's MOU.

Removal of Trees and Protect Plants. NYSDEC, through the New York Natural Heritage Program, maintains a list of plant species that are listed as endangered, threatened, rare, or exploitably vulnerable. Section 9-1503 of the ECL states that: "[n]o person shall, in any area designated by such list or lists, knowingly pick, pluck, sever, remove, damage by the application of herbicides or defoliants, or carry away without the consent of the owner thereof, any protected plant."

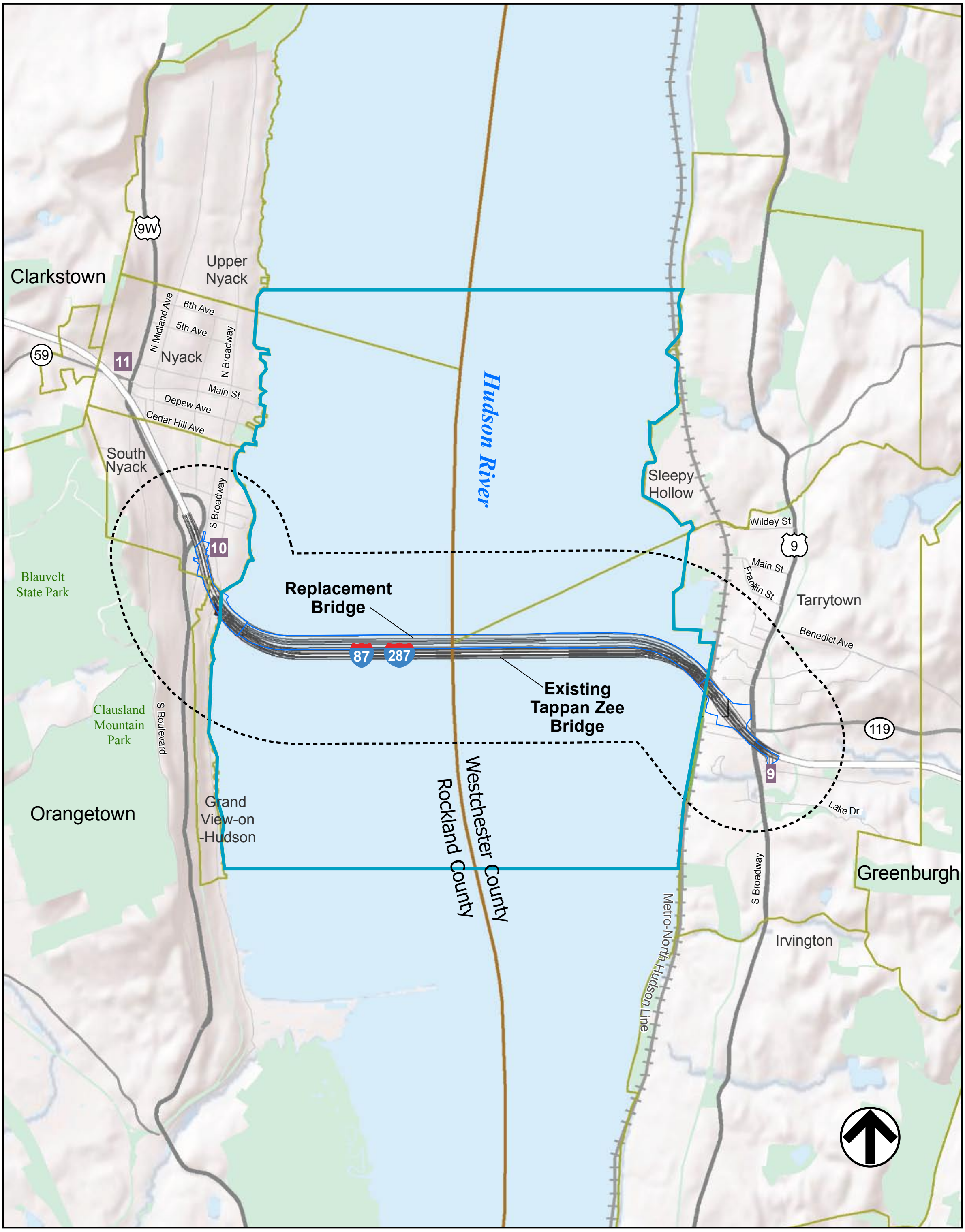
Tidal Wetlands Act, (ECL Article 25). Tidal wetlands regulations apply anywhere tidal inundation occurs on a daily, monthly, or intermittent basis. In New York, tidal wetlands occur along the salt-water shore, bays, inlets, canals, and estuaries of Long Island, New York City and Westchester County, and the tidal waters of the Hudson River up to the salt line. NYSDEC administers the tidal wetlands regulatory program and the mapping of the state's tidal wetlands. A permit is required for almost any activity that would alter wetlands or the adjacent areas (up to 300 feet inland from wetland boundary). The northern limit of NYSDEC's tidal wetlands jurisdiction is to the south of the existing bridge.

16-3 METHODOLOGY

16-3-1 STUDY AREA

Potential adverse effects to ecological resources can include both direct, physical effects—such as loss of habitat due to excavation, filling, dredging, and new structures—and indirect effects, such as stormwater runoff, resuspension of sediments, and acoustic disturbance during pile driving (hydroacoustic effects). Four study areas are considered in this chapter to account for the areas exposed to potential effects from operation and construction of the Replacement Bridge Alternative, particularly sedimentation and hydroacoustic effects (see **Figure 16-1**). Operational impacts that could potentially occur as a result of bridge operations following construction are discussed in this chapter, while construction-related impacts are discussed further in Chapter 18 "Construction Impacts." The four study areas are as follows:

- The study area for evaluation of impacts to terrestrial resources and wetlands generally comprises the area of disturbance, or project area.



0 1/2 1 MILE
SCALE

Project Area

Aquatic Resources, Threatened & Endangered Species, and Special Habitats Study Area (1/2-Mile Radius)

Hydroacoustic Study Area (1.5 Miles)

TAPPAN ZEE HUDSON RIVER CROSSING
Environmental Impact Statement

Figure 16-1
Ecology Study Areas

- The study area for evaluation of impacts to aquatic resources, terrestrial and aquatic threatened and endangered species, and special habitats comprises the area extending ½ mile north and south of the Interstate 87/287 right-of-way generally between Interchange 10 (Route 9W) in Rockland County and Interchange 9 (Route 9) in Westchester County, including the Hudson River.
- The study area for evaluation of hydroacoustic effects extends across the entire width of the Tappan Zee Reach of the Hudson River, and based on modeled sound isopleths with a 10 dB reduction associated with proposed Best Management Practices (BMPs), extends approximately 1.5 miles in both up and downriver directions.
- The study area for evaluation of dredge material placement on aquatic resources at the Historic Area Remediation Site (HARS) in the New York Bight for the ultimate disposal area of dredged material from construction of the access channel. Transport by ocean scow and placement at HARS in the New York Bight would offer a number of benefits to the project including cost, schedule, logistics, and the avoidance of impacts to the surrounding residential communities on the Rockland and/or Westchester shorelines. The dredged material has been determined suitable for placement at the HARS (see **Appendix H-7**). Because the potential impacts of transport and disposal of dredged material at the HARS are related to construction rather than project operation, further consideration of potential impacts to resources such as protected species and EFH is provided in Chapter 18, "Construction Impacts". **Appendix F-9**, "Essential Fish Habitat Assessment," and **Appendix F-10**, "Biological Assessment," provide a detailed description of the existing condition at the HARS.

16-3-2 DATA SOURCES

Existing conditions for ecological resources within the study area are summarized from a number of data sources, including:

- Existing information identified in literature and obtained from governmental and nongovernmental sources, including the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps; NYSDEC freshwater and tidal wetlands maps; New York Natural Heritage Program (NYNHP) Environmental Resource Mapper; 2000-2005 New York State Breeding Bird Atlas; NYSDEC Herp Atlas Project; National Audubon Society 2010 Christmas Bird Count; and Hook Mountain Hawk Watch data.
- Responses to requests for information on rare, threatened, or endangered, candidate, or proposed species in the vicinity of the project site. These requests were submitted to NMFS and the New York Natural Heritage Program (NYNHP), a joint venture of NYSDEC and the Nature Conservancy. Additionally, online lists for federally threatened, endangered, candidate, and proposed species for Westchester and Rockland Counties maintained by USFWS were reviewed for this assessment.
- Sampling surveys completed for the project, including fish catch surveys, oyster and submerged aquatic vegetation (SAV) surveys, sonar and grab samples, benthic

invertebrate sampling, and surveys of bridge piers for attached fauna and flora (see **Appendix F-1**).

- Existing information from wetlands, vegetation, and wildlife surveys previously conducted in the bridge project area from 2006-2008 and during follow-up ecological surveys conducted on October 18, 2011 and March 6, 2012.
- Data from a wetland delineation performed on April 12, 2012 (**Appendix F-3**).
- JASCO Modeling Report presenting potential scenarios for hydroacoustic impacts related to pile-driving activities during construction of the Replacement Bridge Alternative dated March 2011 (**Appendices F-4a and F-4b**).
- JASCO Draft Comprehensive Report on the Pile Installation Demonstration Project (PIDP) dated July 2012 (**Appendix F-5**).
- Fish abundance and distribution data obtained from the Hudson River Utilities Year Class Reports for the Hudson River Biological Monitoring Program (ASA, 2006). Fish and blue crab contaminant data from various sources compiled in the National Oceanic and Atmospheric Administration (NOAA) Hudson River database (NOAA, 2002).
- Hudson River Utilities' Longitudinal River and Fall Shoals Biological Monitoring Program data sets obtained from Hudson River Utilities and NYSDEC from 1998 to 2009, and shortnose and Atlantic sturgeon data obtained from NYSDEC from 1980 to 2002.
- National Marine Fisheries Service (NMFS) Biological Opinion (BO) on the proposed project issued following completion of formal consultation under Section 7 of the ESA (**Appendix F-6**).
- NMFS determination on the Essential Fish Habitat (EFH) assessment (**Appendix F-7**).
- USFWS Section 7 ESA consultation letter for the Indiana bat, bog turtle, and New England cottontail (**Appendix F-8**).
- Existing information on physicochemical conditions, habitat, and faunal species at the HARS disposal site obtained from several USACE and USEPA documents (see **Appendix F-9,** "Essential Fish Habitat Assessment.").
- NMFS BO on the PIDP following completion of formal consultation under Section 7 of the ESA (**Appendix F-14**).
- Literature on the ecology and life history of Hudson River aquatic resources, as cited throughout the chapter.

16-4 AFFECTED ENVIRONMENT

This section characterizes existing terrestrial resources, including ecological communities and wildlife; aquatic resources, including wetlands and aquatic biota; threatened and endangered species; and special habitats for the study area for each resource. Existing conditions for ecological resources in the potential construction staging areas are described in Chapter 18, "Construction Impacts."

16-4-1 TERRESTRIAL RESOURCES

16-4-1-1 TERRESTRIAL ECOLOGICAL COMMUNITIES

The majority of the project area is comprised of Interstate 87/287 and its associated ramps, overpasses, and structures (i.e., NYSTA/New York State Police [NYSP] facilities, toll plaza, and noise walls), with pockets or strips of vegetation bordering these features. The vegetated ecological communities of the project area are dominated by non-native and invasive species associated with disturbed habitats. In New York State, disturbed habitats are generally defined as terrestrial cultural communities (Edinger et al. 2002). Terrestrial cultural ecological communities are those that "are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the substrate, 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." Terrestrial ecological communities within the project area include urban vacant lots, mowed lawns, mowed lawns with trees, paved path/road, and railroad. In the project area, characteristic species include non-native invasive species including Norway maple (*Acer platanoides*) and tree-of-heaven (*Ailanthus altissima*) scattered in the canopy and shrub strata, and mugwort (*Artemisia vulgaris*), foxtail grasses (*Setaria faberi*, *Setaria* sp.), and Japanese honeysuckle (*Lonicera japonica*) in the herbaceous layer. Asiatic bittersweet (*Celastrus orbiculatus*) and porcelainberry (*Ampelopsis brevipedunculata*) are present in all strata in some locations. Because these areas are constantly disturbed by human activities (e.g., clearing, mowing, roadway and rail traffic), have little vegetation, or are dominated by non-native invasive vegetation, terrestrial ecological communities tend to be of low ecological value. However, there is a large ginkgo tree (*Ginkgo biloba*) that was recorded on the NYSDEC's "Big Tree Register" in 1990 located at the NYSTA/NYSP facilities. The NYSDEC Big Tree Register recognizes native and naturalized tree species of record size and promotes an interest of their care and preservation. In 1990, the ginkgo tree measured 98 ft in height with a 69 ft crown (NYSDEC 1990).

In addition to these terrestrial cultural communities, successional forest communities are also present within the project area. In Rockland County, the successional forests comprise the Interstate 87/287 right-of-way area south of the roadway. In Westchester County, one area of successional forest is located south of the roadway to the west of the toll plaza and another area is located south of the roadway to the east of South Broadway. Successional forests are forests that develop on sites that have been cleared or otherwise disturbed. These forests tend to have the following characteristics: consist of wind dispersed species with high light requirements that are well adapted to disturbed areas; contain young (less than 25 to 50 years old) canopy species of small diameter with low or no regeneration of these species in other strata; and have relatively low canopy height with low tree diversity and poor development of strata. Species in the shrub and herbaceous strata may be similar to those of old fields (i.e., they are dominated by forbs or grasses) or they may include species that occurred on or near the site prior to disturbance (Edinger et al. 2002). Evidence of disturbance (i.e., brush piles) may be present in this community. Within the project area, this community is best defined as a successional southern hardwoods forest. Norway maple and black locust (*Robinia pseudoacacia*) are the most common trees. Each species forms a monotypic stand in some locations within the project area, and in other locations, all three species are present in the canopy. The understory of this community includes Japanese knotweed (*Polygonum cuspidatum*) and mugwort. Vines, particularly porcelainberry and Asiatic bittersweet, form dense blankets over vegetation within the herbaceous and shrub layers, and in some cases, reach into the canopy. In other locations, non-native and native species tolerant of urban conditions such as foxtail grasses, mugwort, common burdock (*Arctium minus*), multi-flora rose (*Rosa multiflora*), white snakeroot (*Ageratina altissima*), and seaside goldenrod (*Solidago sempervirens*) are present. This community tends to be of low ecological value due to the low species diversity, dominance of non-native and invasive vegetation, and poor development of strata.

16-4-1-2 WILDLIFE

Terrestrial sections of the project area in Westchester and Rockland Counties are heavily developed and characteristic of a suburbanized landscape. Undisturbed habitats are lacking, and most of the habitat available to wildlife is constrained to small woodlots, residential yards, tree-lined streets, and recreational parks. The project area includes the eastern edge of Blauvelt State Park, but does not encompass any of the park's interior forest habitat that is farther to the west. As such, terrestrial wildlife communities in the project area are largely composed of disturbance-tolerant species that are associated with fragmented habitats and forest edges and can co-exist with anthropogenic activities in highly disturbed areas. See **Appendix F-2** for tables of wildlife with the potential to occur in the project area.

The Hudson River section of the project area provides foraging habitat for many species of waterfowl and seabirds, as well as wintering bald eagles (*Haliaeetus leucocephalus*). The Palisades ridgeline is a concentration point of birds of prey migrating south during autumn. Peregrine falcons (*Falco peregrinus*), which have increasingly adapted to life in urban areas, have consistently nested on the Tappan Zee Bridge since the 1980s (Mildner 1988, USFWS 1997).

Birds

Over 200 species of birds occur in the lower Hudson Valley, owing to the region's geographical position and habitat diversity. Some are present year-round, whereas others only nest in, overwinter in, or migrate through the area. These species are listed in **Appendix F-2** along with the seasons in which they occur and their relative commonness in the region (DeOrsey and Butler 2006, Bochnik 2011). <u>The project area offers little habitat for species that are intolerant of degradation and disturbance. The nearest Audubon Important Bird Areas[1] are approximately three miles north of the existing bridge.</u>

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[1] <u>Important Bird Areas, or IBAs, are sites that provide essential habitats for one or more species of bird. IBAs include sites for breeding, wintering, and/or migrating birds. IBAs may be a few acres or thousands of acres, but usually they are discrete sites that stand out from the surrounding landscape. IBAs may include public or private lands, or both, and they may be protected or unprotected (http://web4.audubon.org/bird/iba/).</u>

Breeding

The Breeding Bird Atlas[2] is a survey to document the distribution of breeding birds across New York State. The most recent survey was conducted from 2000–2005 and documented 90 species as confirmed or probable/possible breeders in the survey blocks in which the study area is located (Blocks 5854B and 5954A). Block 5854B covers sections of Blauvelt State Park and Clausland Mountain County Park which are relatively large tracts of contiguous forest. Therefore, forest-interior bird species such as scarlet tanager (*Piranga olivacea*) and black-throated blue warbler (*Dendroica caerulescens*) appear in the atlas but are unlikely to breed in the project area, which lacks habitat to meet the requirements of such area-sensitive species (Robbins et al. 1989, Poole 2005). Sixty seven of the 90 species in the atlas are considered to have the potential to breed in the project area on the basis of their habitat requirements and relative commonness in the region. The majority are disturbance-tolerant, generalist species that have small area requirements, thrive along forest edges, and are ubiquitous to suburban woodlots and residential yards.

Waterbirds can be found on or flying over the Hudson River during the breeding season, including double-crested cormorant (*Phalacrocorax auritus*), Canada goose (*Branta canadensis*), ring-billed gull (*Larus delawarensis*), great black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), mallard (*Anas platyrhynchos*), and mute swan (*Cygnus olor*). Most of the river's shorelines in the project area are rip-rapped and lack shallow waters and exposed mudflats which limits foraging habitat suitability for wading birds such as snowy egret (*Egretta thula*), great egret (*Ardea alba*), great blue heron (*Ardea herodias*), and green heron (*Butorides virescens*). Appropriate nesting habitat for colonial waterbirds is not present in the project area, although black-crowned night herons (*Nycticorax nycticorax*), an extreme habitat generalist relative to other species (Hothem et al. 2010), may nest in the project area.

Peregrine falcons, a NYS endangered species, are known to nest in nest boxes on the Tappan Zee Bridge (Mildner 1988, USFWS 1997). Any pair nesting on the bridge is likely the only breeding pair in the project area, as peregrine falcons defend large territories that often extend well over a mile beyond the nest (White et al. 2002) and no other suitable nesting locations are present.

Winter

Many of the birds that occur in the project area during the breeding season are year-round residents that remain during winter. The National Audubon Society's 2010 Christmas Bird Count documented 117 species wintering in Rockland and Westchester Counties. However, due to the high level of anthropogenic activities and lack of appropriate habitats, many of these species would not occur in the project area. Landbird species expected to occur in the terrestrial habitats of the project area during winter include mostly urban-adapted species. Waterfowl and other waterbirds are commonly found on the lower Hudson River during winter, while bald eagles also overwinter along the lower Hudson River where they often sit on ice flows amidst areas with open water.

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[2] http://www.dec.ny.gov/animals/7312.html/

Migration

Most of New York State is overlapped by migration flyways for waterfowl, shorebirds, and birds of prey. Broad-front migrants, such as warblers and other songbirds, which do not follow distinct flyways like these other groups of birds, generally pass through the state in high numbers as well. Each of these groups of birds occurs in the lower Hudson River valley during migration.

The location of the replacement bridge on the lower Hudson River is not in proximity to any significant ecological barrier to birds that would create a funnel or otherwise concentrate migrating landbirds through this specific area. Migrating birds of prey occur in increased abundance along the Palisades, but well above the study area where they ride daytime updrafts coming off the ridgeline. Based on count data from the nearby Hook Mountain Hawk Watch in Nyack, NY (NEHW 2008), birds of prey that are expected to pass over the project area during the daytime include turkey vulture (*Cathartes aura*), black vulture (*Coragyps atratus*), osprey (*Pandion haliaetus*), bald eagle, northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), broad-winged hawk (*Buteo platypterus*), red-tailed hawk, American kestrel (*Falco sparverius*), merlin (*Falco columbarius*), and peregrine falcon. On relatively rare occasions, northern goshawk (*Accipiter gentilis*), rough-legged hawk (*Buteo lagopus*), and golden eagle (*Aquila chrysaetos*) may also pass over the study area. Migrating waterfowl also occur in the area, but the lower Hudson River is not a major migration corridor for waterfowl (Bellrose 1968).

Although the terrestrial habitats in the project area provide breeding and wintering habitat for only a limited number of bird species, they may represent suitable stopover habitats for numerous other bird species migrating through the region. Most species are more generalistic in their habitat preferences during migration than during the non-migratory periods, and thus, more species are likely to occur in the project area during spring and autumn than at other times of year.

Mammals

As with the bird community, the degree of forest fragmentation and development in the project area limits the mammal community to species accustomed to disturbed habitats in urban and suburban residential areas. Mammals expected to occur in the terrestrial sections of the project area include white-tailed deer (*Odocoileus virginianus*), striped skunk (*Mephitis mephitis*), eastern cottontail (*Sylvilagus floridanus*), groundhog (*Marmota monax*), raccoon (*Procyon lotor*), white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), moles (*Scalopus* spp.), eastern chipmunk (*Tamias striatus*), gray squirrel (*Sciurus carolinensis*), and Virginia opossum (*Didelphis virginiana*). In addition, eastern coyote (*Canis latrans*), red fox (*Vulpes vulpes*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cenerius*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*) have the potential to occur in the project area (see **Appendix F-2**).

Reptiles and Amphibians

Reptile and amphibian species richness and diversity are particularly high in the lower Hudson Valley, where the range limits of many northern and southern species converge (Gibbs et al. 2007). However, most habitats present in the project area are human-modified and degraded, and unable to support many reptiles and amphibians other than those species that are disturbance-tolerant (see **Appendix F-2**).

The NYSDEC Herp Atlas Project was a 10-year survey (1990-1999) of the geographic distribution of herpetofauna in New York State. Of the 73 species of amphibians and reptiles that occur in the state, 25 were documented in the atlas blocks that cover the project area (*White Plains* and *Nyack* USGS quadrangles). These blocks span areas with larger and higher quality habitats than those within the project area, and thus many species represented in the atlas are unlikely to occur in the project area. Manicured lawn and upland disturbed forest, which support low levels of reptile and amphibian species richness, are dominant habitat types in the project area. Aquatic habitats such as lakes, streams, and vernal pools, which are required by many of the region's reptile and amphibian species, are scant in the project area and limited to man-made ponds surrounded mostly by manicured lawn and a small freshwater wetland on the campus of the Lyndhurst Museum on the Westchester County side. On the basis of their habitat associations (Mitchell et al. 2006, Gibbs et al. 2007) and habitat availability in the study area, the following reptiles and amphibians are considered to have the potential to occur: red-backed salamander (*Plethodon cinereus*), American toad (*Bufo americanus*), Fowler's toad (*Bufo fowleri*), spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbeiana*), snapping turtle (*Chelydra serpentina*), red-eared slider (*Trachemys scripta elegans*), garter snake (*Thamnophis sirtalis*), northern brown snake (*Storeria dekayi*), ring-neck snake (*Diadophis punctatus*), and black rat snake (*Elaphe obsoleta obsoleta*)..

16-4-1-3 THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

Table 16-1 lists the threatened or endangered species and species of special concern with the potential to occur in Rockland and Westchester counties.

Late flowering boneset (*Eupatorium serotinum*) was previously a state-listed endangered herbaceous plant. This plant occurs in thickets and clearings (Newcomb 1977), bottomlands, moist woods, and sometimes in dry open spaces (Gleason and Cronquist 1963; Clemants and Gracie 2006). This species was on NYNHP's "2010 Rare Plant Status List—Native Pioneer Plant Watch List." This list contains native species that have fewer than 21 occurrences but are considered pioneer species, or weedy in nature, and predicted to increase in numbers over time. They are usually recent additions to the state and are actively colonizing disturbed sites. On May 23, 2012, this plant was removed from NYSDEC's "Protected Native Plant" list and is no longer listed as endangered. This plant was observed throughout the study area growing in disturbed habitats.

Table 16-1
Threatened, Endangered, Candidate, and Special Concern Species

Species	Scientific name	Status
Birds		
Golden eagle[1]	*Aquila chrysaetos*	NY-E
Bald eagle	*Haliaeetus leucocephalus*	NY-T
Peregrine falcon	*Falco peregrinus*	NY-E
Osprey	*Pandion haliaetus*	NY-SC
Sharp-shinned hawk	*Accipiter striatus*	NY-SC
Cooper's hawk	*Accipiter cooperii*	NY-SC
Red-shouldered hawk[1]	*Buteo lineatus*	NY-SC
Northern goshawk[1]	*Accipiter gentilis*	NY-SC
Northern harrier[1]	*Circus cyaneus*	NY-T
Pied-billed grebe	*Podilymbus podiceps*	NY-T
Common loon	*Gavia immer*	NY-SC
Mammals		
Indiana bat	*Myotis sodalis*	US-E
New England cottontail	*Sylvilagus transitionalis*	US-C
Reptiles and amphibians		
Bog turtle	*Clemmys [Glyptemys] muhlenbergii*	US-T, NY-E
Eastern box turtle	*Terrapene carolina*	NY-SC
Spotted turtle	*Clemmys guttata*	NY-SC
Marbled salamander	*Ambystoma opacum*	NY-SC
Southern leopard frog	*Rana sphenocephala*	NY-SC

Notes:
[1]Occurance in study area primarily limited to passage overhead during migration.
E=Endangered; T=Threatened; C=Candidate; SC=Special Concern. All US endangered species are also listed as endangered at the NY State level.

Sources: USFWS County Lists; NYNHP Environmental Resource Mapper; NYNHP request letters; Hook Mountain Hawk Watch data; 2000-2005 NYS Breeding Bird Atlas; 2010 Audubon Christmas Bird Count.

Threatened, endangered, and New York State special concern reptile and amphibian species documented during the NYSDEC Herp Atlas Project in the survey blocks that contain the study area include marbled salamander (*Ambystoma opacum*; special concern), southern leopard frog (*Rana sphenocephala*; special concern), spotted turtle (*Clemmys guttata*; special concern), and eastern box turtle (*Terrapene carolina*; special concern).

Peregrine falcon (NYS endangered) and osprey (NYS special concern) were the only state- or federally listed bird species documented during the 2000-2005 Breeding Bird Atlas in the survey blocks encompassing the study area. Threatened, endangered, and special concern species documented during the National Audubon Society's Christmas Bird Counts in Rockland and Westchester Counties in 2010 include bald eagle (NYS threatened), sharp-shinned hawk (special concern), Cooper's hawk (special concern), red-shouldered hawk (special concern), and common loon (special concern).

The Hook Mountain Hawk Watch in Nyack, NY has documented the extensive use of the Palisades ridgeline as a migration pathway by birds of prey during fall (NEHW 2008, HMHW 2011). Threatened, endangered, and special concern species of birds of prey that are known to routinely migrate over the study area include bald eagle (NY threatened), sharp-shinned hawk (NY special concern), Cooper's hawk (NY special concern), red-shouldered hawk (NY special concern), northern harrier (NY threatened), and osprey (NY special concern). Golden eagle (NY endangered) and northern goshawk (NY special concern) also migrate through the area on relatively rare occasions.

Bog Turtle

The bog turtle is a federally threatened and New York State endangered species, and appears on USFWS lists of endangered, threatened, candidate, and proposed species for Rockland and Westchester Counties. However, bog turtles have been extirpated from Rockland County (USFWS 2001) and their extant status in Westchester County is based on a few observations from the early 1990's (USFWS 2001, NYNHP 2011). Any bog turtle populations that are potentially persisting in Westchester County are expected to occur in its northeastern corner, near the Connecticut border (Klemens 1993, Miller and Klemens 2002, Gibbs et al. 2007), where some of the last appropriate habitat for the species in the county remains (Miller and Klemens 2002). This is also the only portion of Westchester County in which the bog turtle was documented during the 1990-1999 NYSDEC Herp Atlas.

Bog turtles are habitat specialists, requiring calcareous fens or wet meadows with cool, shallow, slow-moving water, deep and soft soils, and tussock-forming herbaceous vegetation (Gibbs et al. 2007). During the October 18, 2011 field survey, it was clear that no habitat types within the study area (see *Terrestrial Ecological Communities* above) are remotely suitable for the bog turtle (Mitchell et al. 2006). The NYNHP Environmental Resource Mapper also indicates no non-historical records of the bog turtle within 0.5 miles of the study area. Given the lack of suitable habitat in the study area and the questionable status of the species in Westchester County, occurrence of bog turtles in the study area is extremely improbable and the project will have no impact on the species or habitat on which it depends. USFWS has concurred with this finding (see **Appendix F-8**, "USFWS Section 7 Letter").

Indiana Bat

The Indiana bat is a temperate, insectivorous bat that is a New York State and federally listed endangered species. The Indiana bat's life cycle can be coarsely divided into two primary phases- hibernation and reproduction. The Indiana bat emerges from the caves in which they hibernate (i.e., hibernacula) in early spring. Males disperse and remain solitary until mating season at the end of the summer. Pregnant females form maternity colonies in which to rear the young. Maternity roosts, roosting sites of post-lactating females, and roosting sites of solitary males are usually under loose bark or in the crevices of trees. Indiana bat roosting sites have been documented in numerous species of deciduous trees. Tree availability, diameter, altitude, bark characteristics, and sun exposure appear to be the most important factors in roost site selection (Kurta 2004, USFWS 2007). Roosts in New York (Britzke et al. 2006) and elsewhere (USFWS 2007) are typically in large trees with a diameter greater than 16 inches and a height taller than 52 feet, but roosts in smaller trees can occur (USFWS 2007). The trees are usually dead or nearly dead and decayed (Menzel et al. 2001, Kitchell 2008).

The Indiana bat often roosts near forest gaps or edges where trees receive direct sunlight for much of the day (Callahan et al. 1997, Menzel et al. 2001). Habitats used by the Indiana bat during summer are varied and include riparian, bottomland/floodplain, and upland forests (Humphrey et al. 1977, Britzke et al. 2006, Watrous et al. 2006) often within agricultural landscapes (Murray and Kurta 2004, Watrous et al. 2006, USFWS 2007). Maternity colonies are typically located in areas with abundant natural or artificial freshwater sources (Carter et al. 2002, Kurta et al. 2002, Watrous et al. 2006, USFWS 2007). Spring and autumn habitats of the Indiana bat have not been well described, but appear to be largely similar to their summer habitat (Britzke et al. 2006, USFWS 2007).

During autumn, the Indiana bat mates and deposits fat stores in preparation for winter hibernation. Hibernacula are typically in caves or abandoned mines where ambient temperatures remain above freezing (USFWS 2007). Only eight Indiana bat hibernacula are currently known in New York State, none of which are located within the study area or elsewhere in Rockland and Westchester Counties (NYSDEC Undated).The terrestrial ecological communities observed within the study area during the October 18, 2011 field survey, including mowed lawn, mowed lawn with trees, and successional forest, are not among those that support the Indiana bat. Typical foraging habitats of the species, such as forested wetlands and forested stream and lake borders (Humphrey et al. 1977, Menzel et al. 2001, Murray and Kurta 2004), are lacking in the study area, as are large, dead or dying trees in forest gaps that would provide suitable roosting locations.

The Tappan Zee Hudson River Crossing Project is approximately 35 to 40 miles from a known hibernaculum in Ulster County, which is a distance the Indiana bat may migrate to reach breeding grounds. A study in New York found that most reproductive female bats emerging from winter hibernacula migrate less than 40 miles to their maternity sites (Sanders et al. 2001 and Hicks 2004, as cited in USFWS 2007). Therefore, the study area is within sufficient proximity to a known hibernaculum in Ulster County for individuals associated with this hibernaculum to possibly migrate to, and establish a breeding site within, the study area. However, the project area is heavily developed with residential and commercial land uses. Tree cover is sparse and limited to scattered clusters of trees in the residential neighborhoods and public rights-of-way on both sides of the bridge landings. The project site is not within a landscape of forested streams and wetlands, forest gaps, and agricultural fields that the Indiana bat utilize for breeding and foraging (Humphrey et al. 1977, Menzel et al. 2001, Murray and Kurta 2004). Given these habitat limitations, occurrence of the Indiana bat in the project area for roosting or foraging is not probable.

New England Cottontail

The New England cottontail is a species of Special Concern in New York State and a candidate for federal protection under the ESA. The current distribution of the New England cottontail in New York is limited to areas east of the Hudson River in Columbia, Dutchess, Putnam, and Westchester Counties (Litvaitis et al. 2006, Tash and Litvaitis 2007).

New England cottontails are found in shrubland, thicket, and similar dense, early successional habitats. Although they will utilize small and isolated fragments of these habitats, including unmaintained and densely vegetated highway margins (Litvaitis et al. 2006, 2008), the field survey conducted on October 18, 2011 identified no densely vegetated margins or other such habitat in the study area that would be appropriate for the species. Additionally, most known populations of New England cottontails in Westchester County occur in the eastern side of the county (Novak 2011), distant from the study area. Therefore, the project will have no effect on this species based on lack of appropriate habitat in the study area.

16-4-2 AQUATIC RESOURCES

The project area encompasses intertidal and subtidal habitats of varying depths, ranging from shallow intertidal shorelines to shallow subtidal shoals and deeper channel habitats.[3] Along the shorelines, coarse woody and rocky debris provide structural refuge and foraging substrates for fishes. Benthic habitat includes submerged aquatic vegetation and oyster beds, as well as unvegetated areas of coarse sandy to fine silty sediments. The navigation channel provides deeper open-water and deep-water benthic habitats. NMFS has identified this region of the Hudson as essential fish habitat (EFH) for 16 federally managed species, and an attached report provides a comprehensive evaluation of potential project impacts to EFH and EFH fish species (see **Appendix F-9**). Two federally endangered fish species occur in this region of the Hudson River, the shortnose sturgeon (*Acipenser brevirostrum*) and the recently listed Atlantic sturgeon (*Acipenser oxyrinchus*). The New York Bight Distinct Population Segment (DPS) of the Atlantic sturgeon is known to occur in the Hudson River. Individuals from four other Atlantic sturgeon DPSs in the Atlantic Ocean could also occur in the Hudson River (see the attached Biological Assessment [BA] in **Appendix F-10** and the NMFS BO in **Appendix F-6**).

Both species forage in this portion of the river as they migrate to and from their upriver spawning grounds far to the north of the Tappan Zee Bridge. This portion of the river is not used as spawning grounds for either ESA species. Critical habitat has not been designated for shortnose sturgeon and, at this time, no critical habitat has been proposed for any DPS of Atlantic sturgeon. However, NYSDOS has identified several areas in the Hudson River that are essential to shortnose reproduction and survival (NYSDOS 2012 http://www.nyswaterfronts.com). These areas are located far north of the project area. The attached BO and BA provide a comprehensive evaluation of the status of these two species in the Hudson River and an effects determination of the project activities at individual and population levels (see **Appendix F-6 and Appendix F-10**). A comprehensive list of references concerning sturgeon life history and distribution is also provided in **Appendix F-10.**

Inputs from freshwater tributaries and tidal exchange create a salinity gradient along the 150 miles of the Hudson River estuary, which is especially dynamic within the Tappan Zee region. Seasonal variations in temperature and precipitation further influence the

[3] Assessment of potential construction impacts related to transport and disposal of dredged material at the Historic Area Remediation Site (HARS) is provided in Chapter 18, “Construction Impacts.”

salinity regime within this region. At the mouth of the river, salinities approach full-strength seawater, but with increasing distance upstream from the mouth of the estuary, salinities decrease, with the extent of saline waters usually limited to the Cornwall region (RM 55). The northern portions of the River are fresh, but water levels there remain influenced by tidal fluctuations downstream. The result of tidal exchange in the downstream portion of the estuary and freshwater contribution from upstream and from the surrounding watershed, along with the diversity of aquatic habitats, creates a dynamic ecosystem that provides a range of habitat for marine, estuarine, and freshwater fish species.

16-4-2-1 WETLANDS

National Wetland Inventory Wetlands

The USFWS NWI (see **Figure 16-2**) classified the waters of the Hudson River within the vicinity of the project as estuarine subtidal oligohaline (salinity of 0.5 to 5 parts per thousand [ppt]) wetlands with an unconsolidated bottom (E1UBL6).

State-Mapped Wetlands

The NYSDEC-mapped tidal wetlands in the project area include littoral zone[4] with some small areas of intertidal wetlands[5] along both the Westchester County and Rockland County shorelines (see **Figure 16-2**). One mapped intertidal wetland is also present just south of the project area on the east side of the river. The limit of NYSDEC's tidal wetland jurisdiction is the south side of the existing bridge. No NYSDEC tidal wetlands are mapped north of the bridge. No NYSDEC freshwater wetlands are mapped within the project area.

Federal Jurisdictional Wetlands

Westchester County

On the east side of the river, a small stream and forested wetland area (0.23 acres) is located approximately 200 feet south of the existing bridge and immediately west of the toll plaza, at the bottom of a steep slope. This area was delineated on April 12, 2012 according to the USACE Wetlands Delineation Manual.[6] The stream flows through a disturbed successional forest dominated by Norway maple (*Acer platanoides*) with European black alder (*Alnus glutinosa*) and oak (*Quercus* sp.) at lower percentages in the canopy. Multi-flora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), wineberry (*Rubus phoenicolasius*), and Japanese knotweed (*Polygonum cuspidatum*) form dense thickets along the stream banks and upland areas, particularly

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[4] Littoral Zone is in the tidal wetland zone that that includes all lands under tidal waters which are not included in any other category. Provided, there shall be no littoral zone under waters deeper than six feet at mean low water (6 NYCRR § 661.4).

[5] Intertidal Wetland is the vegetated tidal wetland zone, designated IM on an inventory map, lying generally between average high and low tidal elevation. The predominant vegetation in this zone is low marsh cordgrass, *Spartina alterniflora*.

[6] USACE 1987 Wetland Delineation Manual and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (Version 2.0) (January 2012).

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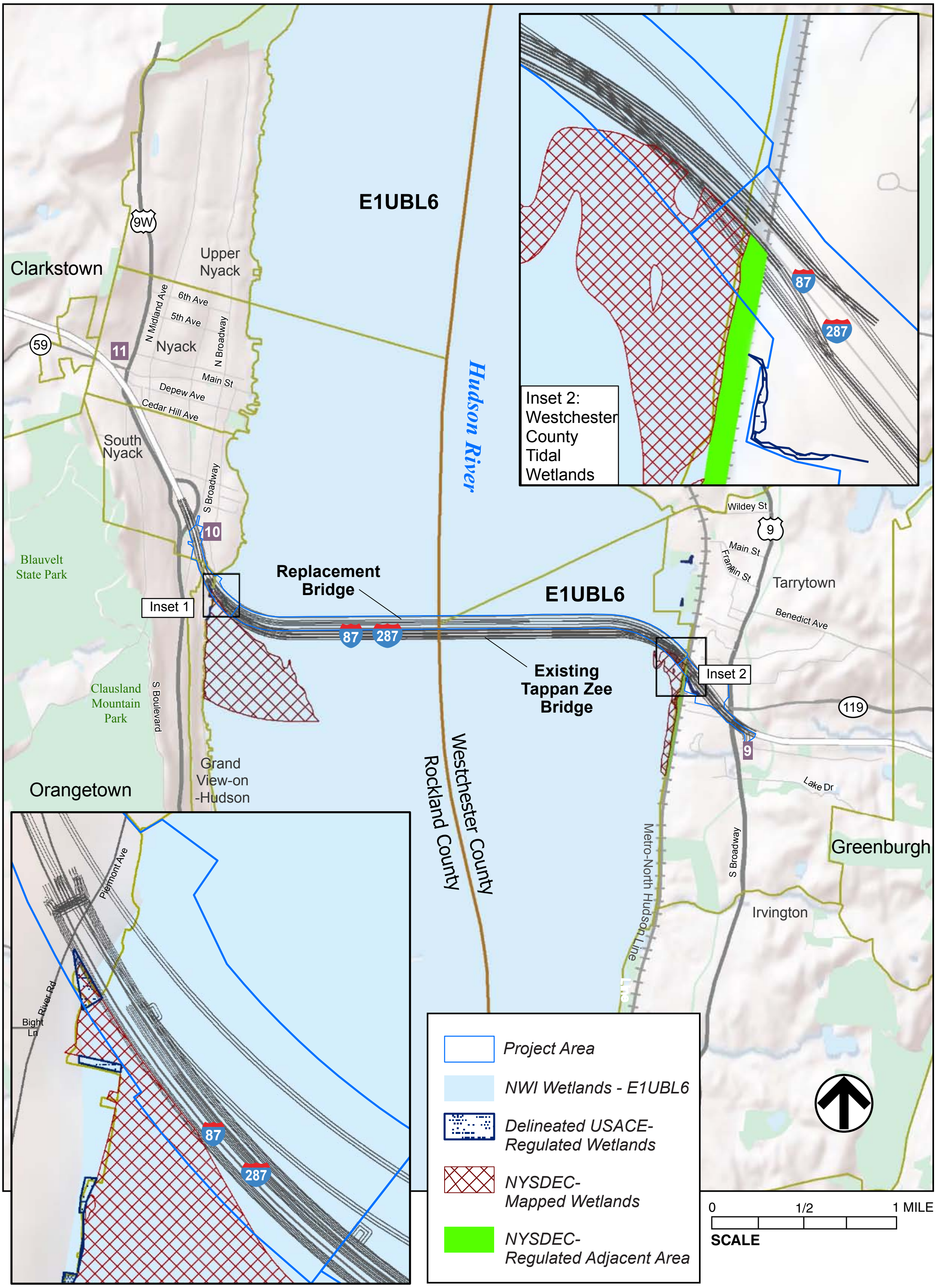

Figure 16-2
Tidal Wetlands

at the higher contour elevations. Large rocks, boulders, metal, asphalt, pipes, and slabs of concrete are present within the streambed at the higher elevations. Particularly along the southern edge of the site, the streambed is cut deeply into the hill with large sections of bank erosion (AKRF 2012).

At the toe of the slope, the stream flows through a foundation structure and takes a sharp bend to the north. The stream flows parallel to the Metro North Railroad (MNR) tracks and the toe of slope along a flat streambed for approximately 250 feet until it turns directly west and flows under the MNR tracks to the Hudson River. The tree canopy along the streambed and associated wetland area is dominated by European black alder with a small number of Norway maple. The shrub layer contains pockets of common privet (*Ligustrum vulgare*). Skunk cabbage (*Symplocarpus foetidus*) is present in small pockets within the herbaceous layer with patches of garlic mustard (*Alliaria petiolata*), poison ivy (*Toxicodendron radicans*), and Indian strawberry (*Duchesnea indica*). While there are non-wetland species present in the herbaceous layer, these are represented in low percentages and are not dominant. In general, the species composition/absolute percent cover in the understory is relatively scarce in comparison to the European black alder-dominated canopy (AKRF 2012).

In addition to the stream and associated seeps, drainage channels were noted within the project site. These drainage channels are mainly in disturbed areas consisting of gravel and other fill materials. In some locations, these drainage channels are diverted through culverts under paths or under ground. Some of these drainage channels empty into the stream at the toe of the slope. Although hydrology was observed within these channels, hydric soils and hydrophytic vegetation were not (AKRF 2012). Ditches that drain only uplands and do not carry a relatively permanent flow of water are generally not jurisdictional under the CWA. Therefore, these drainage areas are not likely to meet the federal wetland criteria under the USACE Wetlands Delineation Manual.

Rockland County

On the west side of the river, the shoreline typically consists of unvegetated intertidal beaches composed of coarse sand with scattered boulders. Immediately north of the bridge, the shoreline is bulkheaded. South of the bridge, three stormwater outfalls are present in a tidally influenced cove. All of the outfalls have active discharges. The largest outfall is rectangular and measures approximately 3 feet in height and about 4.5 feet in width. The other two outfalls are round and measure approximately 5 feet and 2 feet in diameter, respectively. The bed of the cove is comprised of cobbles and rocks. In a pool at the entrance to the cove, the rocky bed begins to transition to a substrate consisting of sand and rock. Outside of the cove, the substrate consists of sand and mudflats. The banks of the cove consist of riprap backed by a steep slope dominated by Norway maple and black locust in the canopy. Japanese knotweed is present in small patches on the riprap, on the slope, and in one location in the bed of the cove next to the 2 foot diameter outfall. No hydrophytic vegetation is present in the cove or along the banks of the cove. Thus, this wetland would not possess the three parameters (i.e., hydrophytic vegetation, hydric soils, and hydrology) for designation as a wetland in accordance with the USACE Wetland Delineation Manual.

16-4-2-2 AQUATIC BIOTA

Phytoplankton

Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Several species can obtain larger sizes as chains or in colonial forms. Light penetration, turbidity and nutrient concentrations are important factors in determining phytoplankton productivity and biomass.

In one 1998 study focusing on the Hudson River, investigators collected 161 phytoplankton species. Diatoms are generally the most widely represented class of phytoplankton, accounting for 78 percent of the different taxa collected, with green algae (15 percent), blue-green algae (cyanobacteria) (3 percent), golden algae (chrysophyceae) (2.5 percent), dinoflagellates (1 percent), and cryptophyceae (a type of flagellate algae) (0.6 percent) comprising the remainder of the phytoplankton community. High turbidity and rapid mixing of the Hudson River (which lower light availability) limit primary production by phytoplankton (Smith et al. 1998).

Submerged Aquatic Vegetation and Benthic Algae

Submerged aquatic vegetation (SAV) are rooted aquatic plants that are often found in shallow areas of estuaries, at water depths of up to six feet at low water (Holochuck 2000). SAV communities exhibit high rates of primary productivity and are known to support abundant and diverse epifaunal and benthic communities. These organisms are important because they provide nursery and refuge habitat for fish. Light penetration, turbidity and nutrient concentrations are all important factors in determining SAV and benthic algae productivity and biomass.

NYSDEC has mapped the distribution of SAV in the Hudson River from Hastings-on-Hudson to Troy using 1997, 2002, and 2007 data. No SAV is mapped in the immediate area of disturbance; however, SAV beds are mapped within a ½-mile radius of the bridge on the Rockland County shoreline both north and south of the bridge (see **Figure 16-3**). SAV surveys were conducted as part of the project in 2009 to confirm the locations identified on the NYSDEC maps. The dominant species of SAV collected as part of the surveys is the native water celery (*Vallisneria americana*); two other species were collected in the vicinity of the project area, including Eurasian water-milfoil (*Myriophyllum spicatum*) and sago pondweed (*Potamogeton pectinatus*). SAV beds were found along the western bank of the river; on the east bank, SAV was only found north of the bridge. These SAV areas are not within the project's construction limits.

Zooplankton

Zooplankton are an integral component of aquatic food webs—they are primary grazers on phytoplankton and detritus material, and are themselves used by organisms of higher trophic levels as food. Copepods, cladocerans, and rotifers are the primary representatives of zooplankton species in the Hudson River. Zooplankton also include life stages of other organisms such as fish eggs and larvae (i.e., ichthyoplankton) that spend only part of their life cycle as plankton. Analysis of long-term data from the Hudson River Utilities monitoring program indicates Atlantic tomcod (*Microgadus tomcod*), bay anchovy (*Anchoa mitchilli*), striped bass (*Morone saxatilis*), and white perch (*Morone americana*) are the dominant ichthyoplankton species. The higher-level

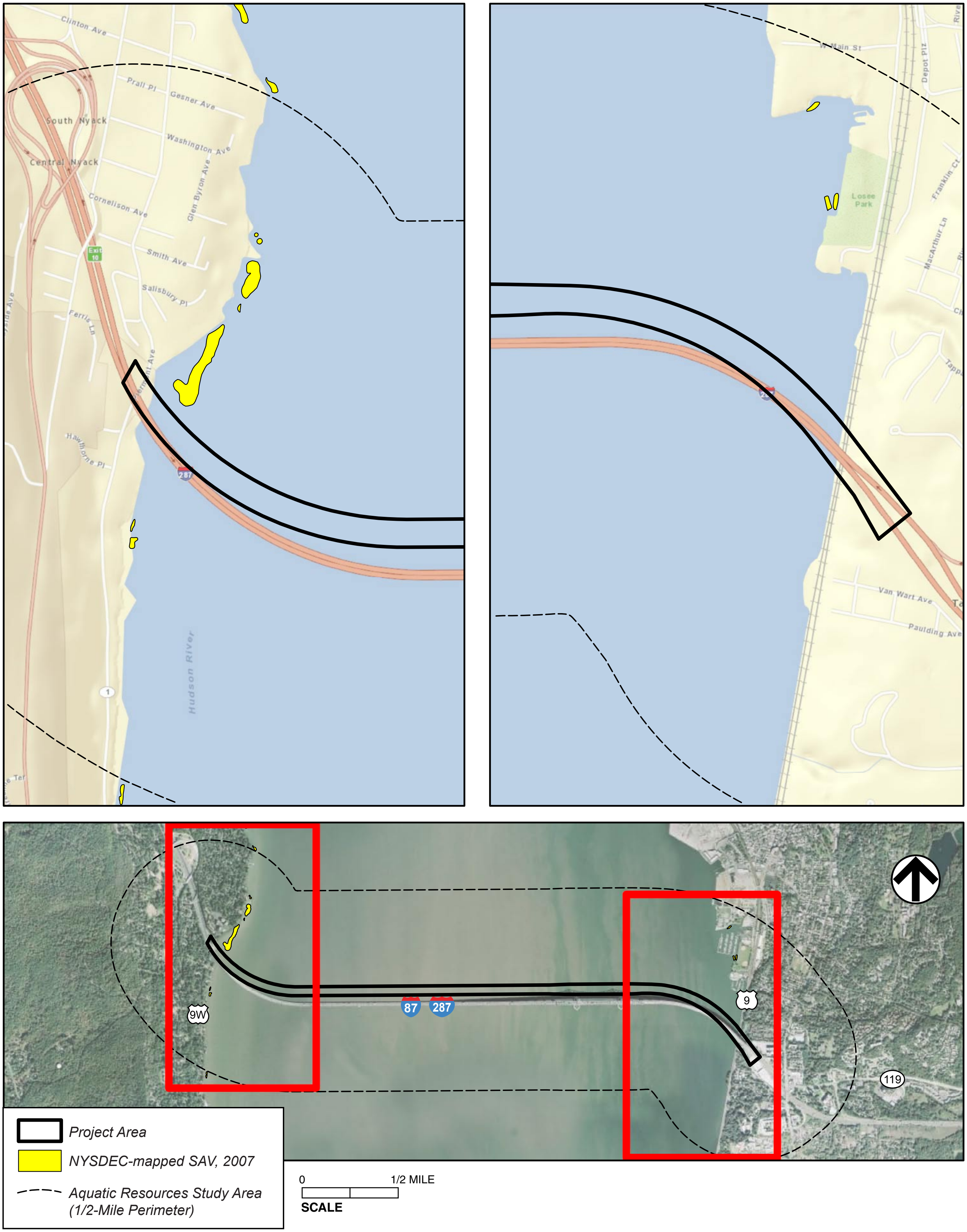

Figure 16-3
Submerged Aquatic Vegetation (SAV)

consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species, such as striped bass and white perch during their early life stages.

Benthic Invertebrates

Invertebrate organisms that inhabit river bottom sediments as well as surfaces of submerged objects (such as bridge piers, riprap, and debris) are commonly referred to as benthic invertebrates. These organisms are important to an ecosystem's energy flow because they convert detrital and suspended organic material into carbon (or living material); moreover, they are also integral components of the diets of ecologically and commercially important fish and waterfowl species.

Some of these animals live on top of the substratum (epifauna) and some live within the substratum (infauna). Substrate type (rocks, pilings, sediment grain size, etc.), salinity, and dissolved oxygen (DO) levels are the primary factors influencing benthic invertebrate communities; secondary factors include currents, wave action, predation, succession, and disturbance.

Versar (Llanso et al. 2003) collected benthic samples from the lower Hudson River estuary (RM 11 to 40) in 2000 and 2001 which included the vicinity of the project area. In general, they found the greatest numbers of species per sample in the lower portions of the project area (south of the Tappan Zee Bridge) and lowest numbers north of the bridge. The greatest benthic biomass occurred in shallow regions of Croton Bay and north of Piermont Pier on the western side of the river. Taxa which showed the greatest densities included oligochaete worms (*Tubificoides spp*.), the clam *Rangia cuneata*, and the amphipod *Leptocheirus plumulosus*. They also found the barnacle *Balanus improvisus* and the pollution-tolerant polychaete worms *Marenzelleria viridis* and *Heteromastus filiformis* to be present in relatively high abundances.

Bimonthly sampling of benthic resources in the bridge vicinity was conducted between March 2007 and January 2008 (see **Appendix F-1)**. Samples were taken in the vicinity of the footprint of the existing and proposed bridges as well as the locations of the proposed temporary causeways along the southeast and southwest portions of the existing bridge (see **Figure 16-4**). Forty-one bottom benthic locations and six bridge pier locations were sampled for the project.

A total of 48 species was collected during the bottom sediment sampling program. Total numbers, species richness, and species diversity (which considers both the number of species and the evenness of distribution) were calculated. Generally, the species richness and numbers of individuals were lower in late winter and early spring, and higher in the summer and fall. Species diversity, while relatively constant throughout the year, was observed to be highest in July and lowest in January. Barnacles (*Balanus spp.*) and the amphipod *Leptocheirus plumulosus* were two of the dominant taxa collected in each of the six sampled months. A one-way analysis of variance (ANOVA) indicated that, for the most part, there was no statistically significant difference in benthic diversity, total numbers of individuals, or species richness between the current and proposed bridge alignments. There was often a statistical difference for the benthic metrics between the approach areas for the causeways and the other locations. These approach areas south of the bridge are thought to accumulate thick sediment deposits, which may account for the observed lower metrics associated with benthic community characteristics.

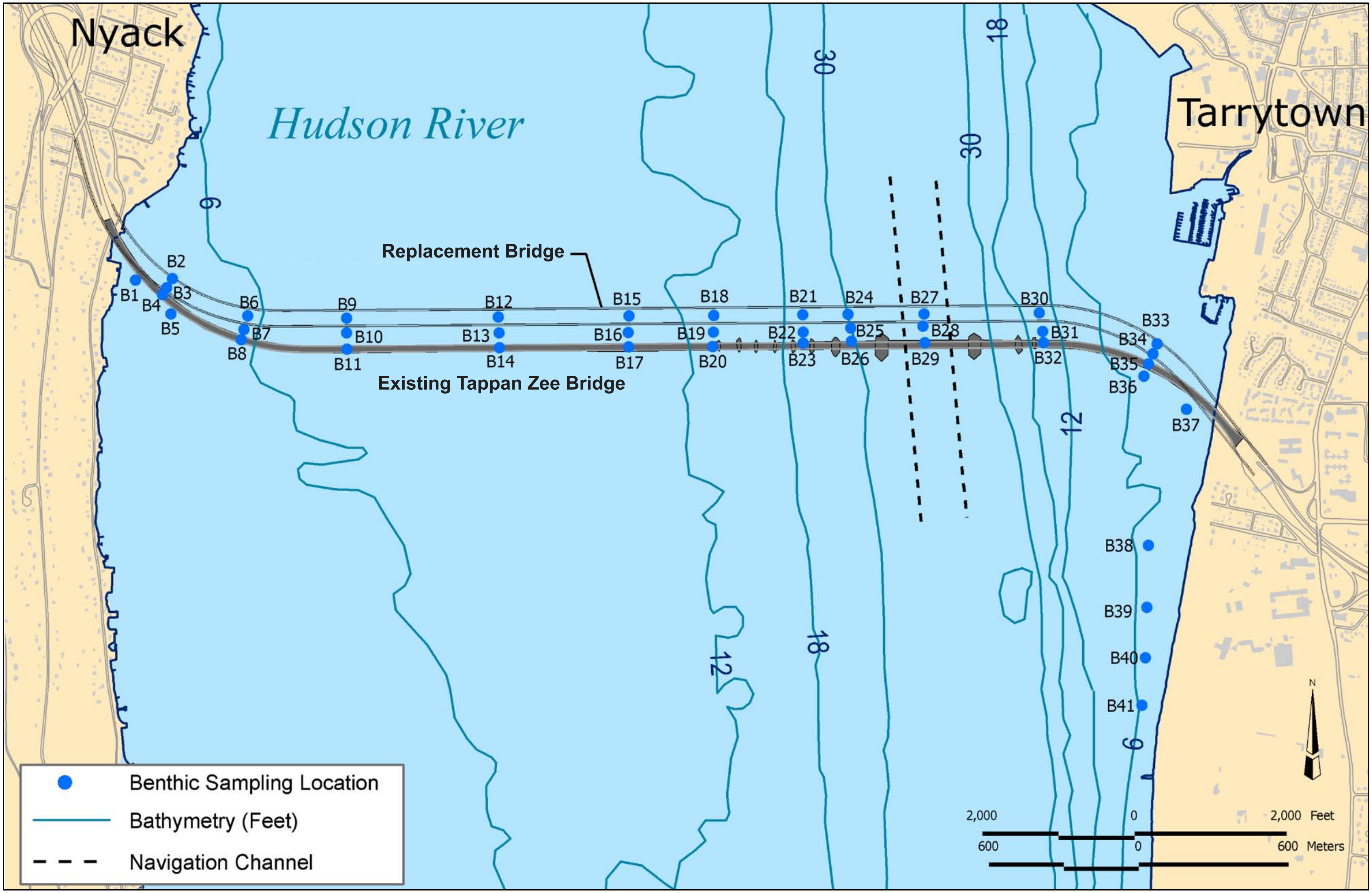

Figure 16-4
Benthic Sampling Locations

Benthic invertebrate sampling of the existing bridge piers conducted for the project in 2007 identified a total of 8 taxa and 2 taxa of benthic algae. The polychaete worm *Nereis spp.*, amphipods, barnacles, grass shrimp, mud crabs, isopods, oysters, and ribbed mussels were collected from the piers, as well as red and green algae. These organisms were collected in similar densities on three types of pier structure, namely, steel, concrete and timber.

The eastern oyster (*Crassosterea virginica*) is a reef-building organism found in intertidal and subtidal zones of estuaries along the east coast of the United States. Because they are filter feeders, oysters can greatly influence nutrient cycling in estuaries and affect phytoplankton biomass and water clarity. Oysters require a hard surface to grow. Juveniles attach themselves to adult oysters that are already attached to rocks, shell, or other oysters. Excessive deposition of soft, fine sediments can have a deleterious effect on oyster beds by modifying bottom habitat to the point where juvenile oyster settlement is no longer successful. A survey to determine the boundaries of existing oyster bed habitat was conducted in October, 2009 using seismic profiling and side-scan sonar with grab samples confirming the findings of the sonar. The boundaries of historical and 2009 mapped oyster habitats are shown in **Figure 16-5**. Oyster beds were mapped approximately two miles north and south of the existing bridge from depths of 8 to 30 feet. Seven potential oyster beds were identified south of the bridge and six potential beds to the north. All identified oyster beds except one were confirmed to contain at least some live organisms, with beds exhibiting differences in terms of oyster density, amount of shell hash, gravel, or sandstone fragments. See **Appendix F-1** for a more complete description of the differing character and status of the individual oyster beds (e.g., either dense, diffuse, or remnant).

Fish

The Hudson River estuary's fish community is species-rich. The estuary's species diversity is enhanced by its mid-latitude location on the Atlantic Coast. Southern tropical marine forms enter the Hudson River during the summer, and a number of northern fishes are near their southern limit. A report by Smith and Lake (1990) noted that 201 species have been documented in the Hudson River. These species were classified by their probable origin, which demonstrated that the Hudson River fish community, particularly in the estuarine reach, is a mixture of both temperate and tropical marine forms, freshwater forms, and intentional and accidental introductions (ASA 2006).Over the period from 1974 to 2006, the total number of species collected annually in the Utilities monitoring program has varied from 64 to 104. Despite the large number of species that are occasionally found in the estuary, the majority of the fish represent only a limited number of species. More than 99 percent of the total fish community is comprised of only 10–15 percent of the species. In stable ecosystems, low species diversity may be an indicator of environmental stress. However, in highly dynamic and unstable ecosystems such as the Hudson River estuary, the biological community may be dominated by only a few species that are well adapted to such naturally dynamic conditions (ASA 2006).

Each of the fish species that occurs in the river can be classified by their salinity tolerance. Marine species live in the open Atlantic Ocean and nearshore waters and venture into the estuary during the warmer months of the year when salinity is relatively high. These species typically occupy the lower reaches of the estuary. Estuarine

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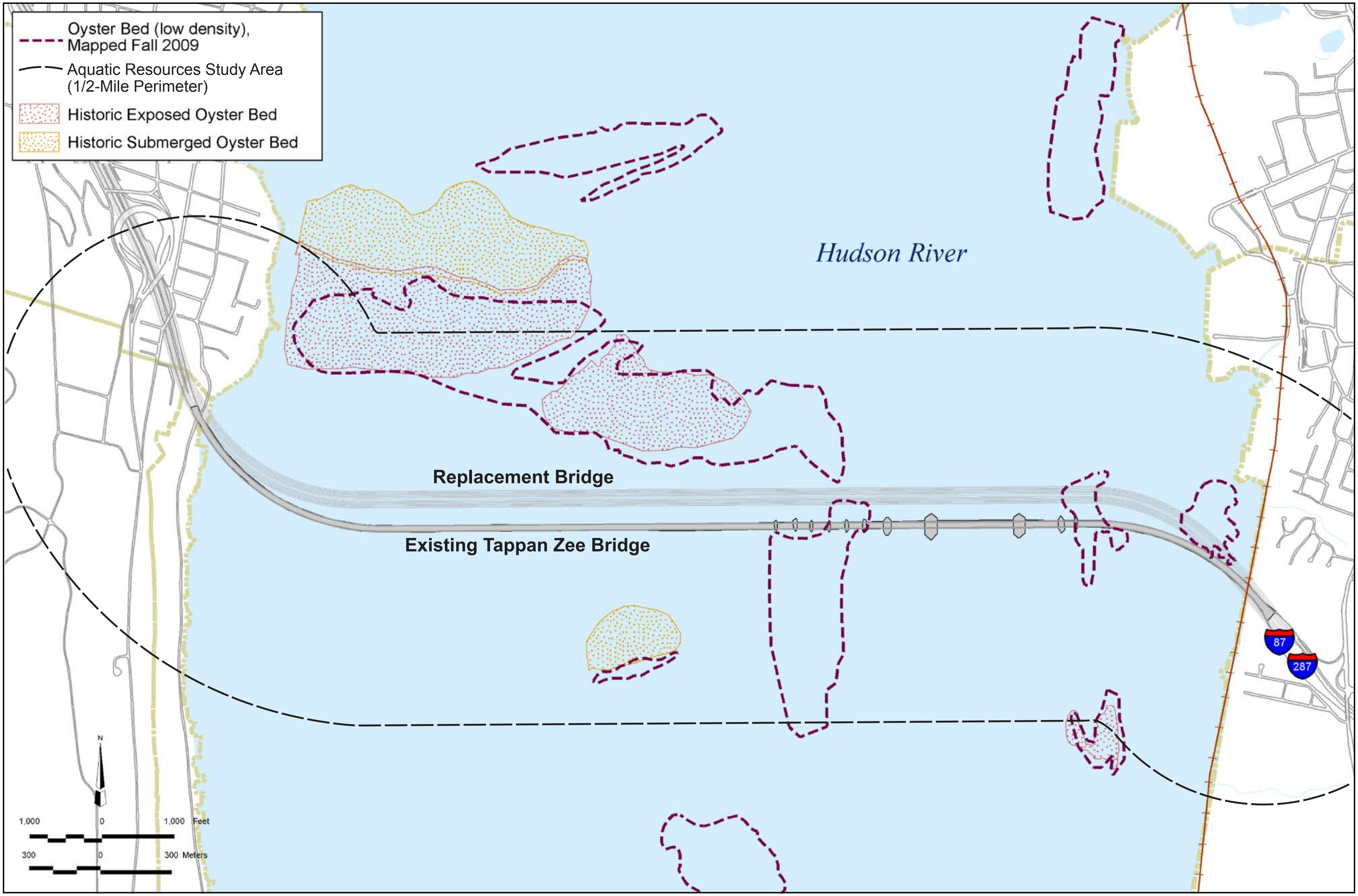

TAPPAN ZEE HUDSON RIVER CROSSING
Environmental Impact Statement

Figure 16-5
Oyster Beds

species occupy a large portion of the brackish estuary year-round and may be occasionally found in freshwater and marine reaches. Freshwater species live in the Hudson River and rarely, if ever, venture into low-salinity areas of the estuary such as the region in the vicinity of the Tappan Zee Bridge. Several fish species that occur in the Hudson River migrate between the Atlantic Ocean and freshwater habitats of the River (diadromous fish). These include anadromous fish, which migrate from the Atlantic Ocean into freshwater habitats, typically for spawning, and catadromous fish, which leave the river to spawn in the open ocean.

The dominant marine species collected in the Utilities monitoring program in the Tappan Zee region from 2000–2009 was the bay anchovy. Bay anchovies are found in salinities ranging from fresh to seawater and may be the most abundant species in the western north Atlantic (Newberger and Houde 1995). Other marine species which were abundant in the Utilities program included weakfish, Atlantic menhaden, Atlantic croaker, butterfish, and bluefish. Estuarine species are generally euryhaline (i.e., tolerant of wide salinity ranges), and are year-round residents of the saline portions of the Hudson River. Abundant estuarine species collected by the Utilities monitoring program included white perch, banded killifish, Atlantic silverside, and hogchoker. Anadromous species, which use the estuary as spawning and nursery grounds, include alewife, American shad, Atlantic sturgeon, Atlantic tomcod, blueback herring, and striped bass. Adults typically enter the estuary in the spring (except for tomcod which typically spawn in late winter and juveniles are present by late April) and migrate upstream to low-salinity brackish and freshwater areas to spawn. The young fish then use the near-shore shoal areas for food and habitat as they make their way downstream, and generally leave the estuary in the fall. American eel (*Anguilla rostrata*) is the only catadromous species that occurs in the Hudson. Although the Utilities data indicate that there are wide variations in the annual totals of collected eels, overall there has been a sharp decline in the number of individuals captured during these surveys since the mid-1980s.

A number of changes in abundance trends within the Hudson River fish community have occurred in recent years. Heimbuch (2008) reported that average biomass of age 1 and older striped bass has increased over fivefold during the periods 1981–1990 and 1991–2005. This increase has been accompanied by declines in the populations of blueback herring, alewife, white perch, and Atlantic tomcod. Blueback herring and alewife have also been designated as candidate species under the ESA on November 2, 2011 due to population declines. It has been postulated that the increase in the predatory demand of striped bass could have been responsible for the decline of these other species (Heimbuch 2008). These five species comprised 85 percent of the catch of estuarine and diadromous species collected by beach seines from 1980 through 2000 (Hurst et al. 2004). Also, a stock assessment performed on American shad in 2007 indicated that the spawning stock, including the Hudson River population, has substantially declined (ASMFC 2007). Since March 2010 recreational and commercial fishing for American shad has been prohibited. This can be contrasted with the ASMFC’s assessment of bluefish which considered the coastal stock to be rebuilt and not overfished (ASMFC 2009).

Fish Utilization of the Project Area

Two independent fisheries datasets were used to characterize fish utilization of the study area: a one-year survey within the study area for the project, and the results of Utilities-sponsored fisheries monitoring program (1998-2007) within the Tappan Zee region (river miles 24-33), which includes the study area for the proposed project. The dataset from the one-year survey is specific to the study area. The 10-year dataset provides a characterization of the fish community within the vicinity of the study area and region over a longer time scale.

The one-year fish survey was conducted for the project between April 2007 and May 2008 to further characterize the fish community and examine seasonal differences in abundance. These surveys combined hydroacoustics, gill nets, and trap nets to characterize the species composition, relative abundances, and distributions of fish populations within the project area (see **Appendix F-1**).

Results of the hydroacoustic surveys indicate that the horizontal, vertical, and geographical distribution of fishes within the Tappan Zee region and in the project area, in particular, is substantially influenced by temperature and salinity. In the colder months of the year (December through April), the fish populations are concentrated in deeper waters with higher salinities. In the late winter and early spring, a distinct halocline (i.e., salinity gradient) was observed at a depth of approximately 19.7 feet (6 meters), below which fish densities increased. As the water temperature increased during late spring, the halocline dissipated and the salinity in the project area increased in the shallower depths. Also observed was a marked increase in the abundance of fishes at those depths, although the greatest abundances continued to occur in the deepest portion of the channel. In the warmer summer months of the year, early life stages of many species were present within the project area. Presumably these concentrations are salinity driven with higher salinities south of the bridge during winter and increased salinities throughout the Tappan Zee region during the warmer months from June through October. A large percentage of the individuals that were captured were members of schooling species.

A total of 25 species and just over 2,000 individual fishes and hundreds of blue crabs were collected during approximately 700 hours of gill-net sampling within the project area between April 2007 and May 2008 (see **Table 16-2**). Fish were caught at all sampling locations within the project area throughout the year. In the colder months of the year, the total numbers of fish caught at all locations were markedly lower than the numbers of fish caught during the warmer months of the year. Moreover, there were higher numbers of fish caught at the sampling locations with greater water depths. Anadromous and estuarine fishes were captured in every sampling event. Marine fishes were only captured in the warmer months of the year.

Table 16-2
List of Fish Species Occurring within the Project Area
Based on Gill-net Sampling, 2007-2008

Common name	Scientific name	Assemblage
Alewife	*Alosa pseudoharengus*	Anadromous
American eel*	*Anguilla rostrata*	Catadromous
American shad	*Alosa sapidissima*	Anadromous
Atlantic butterfish	*Peprilus triacanthus*	Marine
Atlantic menhaden	*Brevoortia tyrannus*	Marine
Atlantic tomcod	*Microgadus tomcod*	Estuarine
Bluefish	*Pomatomus saltatrix*	Marine
Blueback herring	*Alosa aestivalis*	Anadromous
Blue runner	*Caranx crysos*	Marine
Common carp	*Cyprinus carpio*	Freshwater
Gizzard shad	*Dorosoma cepedianum*	Freshwater
Hickory shad	*Alosa mediocris*	Marine
Hogchoker	*Trinectes maculatus*	Estuarine
Naked goby*	*Gobiosoma bosci*	Estuarine/Marine
Northern kingfish	*Menticirrhus saxatilis*	Estuarine/Marine
Northern sea robin	*Prionotus carolinus*	Marine
Oyster toad fish*	*Opsanus tau*	Estuarine/Marine
Porgy	Family Sparidae	Marine
Shortnose sturgeon	*Acipenser brevirostrum*	Anadromous
Spot	*Leiostomus xanthurus*	Estuarine/Marine
Striped bass	*Morone saxitalis*	Anadromous
Summer flounder	*Paralichthys dentatus*	Estuarine/Marine
Weakfish	*Cynoscion regalis*	Estuarine
White catfish	*Ameiurus catus*	Freshwater
White perch	*Morone americana*	Estuarine
Note: * Species only captured in fish traps.		

In comparison to the one-year dataset, 10 years of fishery data from the Utilities-sponsored fisheries monitoring program were analyzed to evaluate fish-species composition and abundance between 1998 and 2007 within the Tappan Zee region. The seven most abundant species collected during this sampling effort are presented in **Appendix F-11**, Table 1. Three of these species (bay anchovy, striped bass, and weakfish) made up about 94 percent of the standing stock abundance. Only two of the seven species analyzed in **Appendix F-11** were not collected during the one-year survey. These included Atlantic croaker and bay anchovy, the latter of which is one of the most abundant fish taxa collected in the Hudson River. Bay anchovy were not collected during the one-year survey due to the use of gill nets and fish traps, which do not effectively sample this small species as a result of the large mesh size.

The use of multiple gear types and sampling programs that differ over temporal and spatial intensity provides a comprehensive assessment of the fish community of the study area. Any specific gear type or targeted sampling program will have bias for the size of fish collected and the type of habitat that can be sampled. As a result, no single gear type can effectively capture the entire fish community. Any apparent underestimate in species composition in the one-year dataset compared to the 10-year dataset is a result of: the considerably smaller area sampled during the one-year survey, the shorter time period over which samples were collected, and differences in sampling gear (i.e., active vs. passive gears, small vs. large net-mesh) between surveys. A sampling program that covers a larger spatial and temporal extent utilizing active sampling gears would be expected to collect a greater number of species than one that covers a smaller area over a shorter time period using passive sampling gears.

As shown in **Table 16-3** and discussed below under “Essential Fish Habitat,” the project area is within a portion of the Hudson River/Raritan/Sandy Hook Bays, New York/New Jersey Estuary EFH (see **Appendix F-9** for a comprehensive evaluation of project impacts to EFH and EFH species).

Table 16-3
Federally Managed Species with Essential Fish Habitat (EFH) Designations in the Project Sites

Species	Eggs	Larvae	Juvenile	Adult	Spawning Adult
Red Hake		M,S	M,S	M,S	
Winter Flounder	M,S	M,S	M,S	M,S	M,S
Windowpane Flounder	M,S	M,S	M,S	M,S	M,S
Atlantic Sea Herring		M,S	M,S	M,S	
Bluefish			M,S	M,S	
Atlantic Butterfish		M	M,S	M,S	
Atlantic Mackerel			S	S	
Summer Flounder		F,M,S	M,S	M,S	
Scup	S	S	S	S	
Black Sea Bass			M,S	M,S	
King Mackerel	X	X	X	X	
Spanish Mackerel	X	X	X	X	
Cobia	X	X	X	X	
Clearnose Skate			X	X	
Little Skate			X	X	
Winter Skate			X	X	

Notes:
S = EFH designation includes the seawater salinity zone (salinity > or = 25 ppt).
M = EFH designation includes the mixing water/brackish salinity zone (0.5 ppt < salinity < 25 ppt).
F = EFH designation includes the tidal freshwater salinity zone (0 ppt <or = salinity < or = 0.5 ppt).
X = EFH has been designated for a given species and life stage.
Blank cells indicate that no EFH designation occurs for the particular life stage.
Source: National Marine Fisheries Service. “Summary of Essential Fish Habitat (EFH) Designation” posted on the Internet at http://www.nero.noaa.gov/hcd/ny3.html

Threatened and Endangered Species

The USFWS database list of federally threatened, endangered, candidate, and proposed species for Westchester and Rockland Counties includes several listed fish species: the shortnose sturgeon, Atlantic sturgeon, alewife, and blueback herring. All are known to occur within the study area. Because sturgeon is anadromous, these species fall under the jurisdiction of NMFS under the ESA. Shortnose sturgeon is also currently listed for protection by the State of New York as an endangered species. Five DPSs of Atlantic sturgeon have been recently listed federally as either threatened or endangered under the ESA. On June 22, 2012, NMFS issued its BO for both the shortnose and Atlantic sturgeons as part of the formal consultation process under Section 7 of the ESA (see **Appendix F-6**). Detailed information on life history and habitat requirements for both species is presented in the BA prepared for the project (see **Appendix F-10**) and the BO (see **Appendix F-6**). There is no federally designated critical habitat for either shortnose or Atlantic sturgeon in the Hudson River. However, NYSDOS has identified several areas in the Hudson River essential to shortnose reproduction and survival (NYSDOS 2012 http://www.nyswaterfronts.com). These fish spawn, develop, and most overwinter in the mid-Hudson River north of the project area. Dovel et al. (1992) indicated that the spawning grounds for shortnose sturgeon extends from just below the Troy Dam to river kilometer 212 (RM 131) and eggs and larvae can be expected to remain in this region for approximately four weeks post spawning (NYSDEC 2003).

Shortnose Sturgeon

The federal-and-state-endangered shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the Hudson River, ranging from New York Harbor to the Troy Dam. These fish spawn and develop, and most overwinter, in the mid-Hudson River north of the Tappan Zee Bridge (NYSDEC 2003). Shortnose sturgeon spend most of their lives in the Hudson River estuary and prefer colder, deeper waters for all life stages (Bain 1997) but can also forage in shallower water where suitable food sources are present. In early spring, shortnose sturgeon migrate upstream to spawn in the freshwater reach of the river between the Troy Dam and RM 131 (Dovel et al. 1992), which is well upstream of Tappan Zee.

Eggs and larvae are predominately confined to freshwater reaches above the saline area and would not be expected to occur in the Tappan Zee region. The juveniles (fish ranging from 2 to 8 years old) can be found in brackish areas of the Hudson River. Although some shortnose adults and juveniles may be found in the Tappan Zee region, the primary summer habitat for shortnose sturgeon appears to be located above Beacon, NY (Bain 1997, Bain et al. 2007). Dovel et al. (1992) concluded that most or all adults form an overwintering concentration near Kingston. Bain (1997), however, described a second late fall and overwintering area near Haverstraw Bay between km 54 and 61 (RM 33-37).

The Hudson River shortnose sturgeon population was estimated to contain approximately 61,057 fish (Bain et al. 1998, 2007). These studies show that the population has increased by more than 400 percent since the 1970s. According to Woodland and Secor (2007), the shortnose sturgeon is showing signs of strong recovery in the Hudson River, although some population segments, especially in the south, still display low abundance. Size and body condition of the fish caught in these studies indicate the population is primarily healthy, long-lived adults. Hoff et al. (1988, in Bain 1997) reported most captures of adult shortnose sturgeon during river monitoring of fish distributions by the Hudson River electric utilities from 1969 to 1980 occurred between river miles (RM) 24 to 76 (from near the New York/New Jersey border up to near Poughkeepsie).

From 2000-2009, the utilities monitoring program collected 289 juvenile and adult shortnose sturgeon using a beam trawl during the Fall Shoals survey. The majority of these fish were collected north of West Point (RM 47) and were adults. Only 8 shortnose sturgeon were collected in the Tappan Zee region. Greater than 90 percent of all shortnose sturgeon was collected from bottom habitats in waters greater than 20 feet in depth. A review of commercial catch data provided by NYSDEC indicated that from the years 1980–2002, shortnose sturgeon were collected in the Tappan Zee vicinity (RM 25-27) in 14 of 23 years. The Utilities also report the number and size of shortnose sturgeon collected as part of their Striped Bass and Atlantic tomcod sampling program.

A total of 12 shortnose sturgeon were captured in gill nets during the project's bi-monthly fish-sampling effort within the Tappan Zee project area between April 2007 and May 2008. The sturgeon were captured primarily in the warmer months of the year—between May and October—at both the bridge and reference locations in water depths between 6 and 30 feet (1.8 and 9.1 m). Although no individuals were captured during sampling events conducted between December and April, it is possible that the species is present during those months, though not in significant numbers, within the Tappan Zee region. Cold waters may have slowed its movements enough so that the fish would not to be captured by the gill net, a stationary and passive gear type.

Atlantic Sturgeon

There are seven to ten genetically diverse populations of Atlantic sturgeon along the east coast of the United States and Canada (Wirgin et al. 2000, Grunwald et al. 2008). As of February 6, 2012, NMFS issued two final rules (77 FR 5880-5912; 77 FR 5914-5982) that list five DPSs as threatened (Gulf of Maine) or endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) under the ESA. These rules were effective as of April 6, 2012. The New York Bight DPS includes Atlantic sturgeon spawned in the River. There is potential for individuals originating from other DPSs to occur in the Hudson River and in the project area, but they would be expected to occur in relatively low numbers compared to Atlantic sturgeon originating from the New York Bight DPS (see **Appendix F-6 and Appendix F-10**).

Contrary to shortnose sturgeon, which spend a great deal of their lives in the Hudson River, Atlantic sturgeon spend most of their lives in marine waters along the Atlantic coast. It is a large, anadromous, bottom-feeding species that spawns in the Hudson River and matures in marine waters; females return to spawn at age 15 or older and males return earlier at 12 years or older (Bain 1997, citing other authors). Young et al. (1988) reported that in the Hudson River, maturity of female Atlantic sturgeon begins at age 11 and increases gradually for the next 10 years until all females are mature. In the Hudson River, Atlantic sturgeon are found in the deeper portions and do not occur farther upstream than Hudson, New York.

Atlantic sturgeon migrate from the ocean upriver to spawn above the salt front from April to early July (Smith 1985, Stegemann 1999). An NYSDEC tracking study which tagged fish with sonic tags indicated that most fish arrived in the Hudson River from early April to late June and left the river by late July (NYSDEC 2011).

Eggs and larvae would not be expected to occur in the Tappan Zee region. Overfishing, reduction of key spawning areas, and pollution have been suggested as reasons for the range-wide decline of this species (Smith 1985, Bain 2004). Individuals are only expected to occur near the project site as transient individuals while traveling to or from Hudson River spawning, nursery, and overwintering areas. NMFS cites locks and dams, overfishing and the more recent impact of bycatch and habitat degradation as causes for the decline in Atlantic sturgeon populations throughout the Northeast (NMFS, Species of Concern Atlantic sturgeon www.nmfs.noaa.gov/). The Atlantic Sturgeon Status Review Team (2007) identified bycatch, water quality, lack of state and/or Federal regulatory mechanisms and dredging activities as the most significant stressors to Atlantic sturgeon. Kahnle et al. (1998) estimated the age-zero Hudson River population in 1994 to be 9,529, based on the capture of 15 captive-hatched and 14 wild origin, age-1 Atlantic sturgeon in 1995. Of the total, 4929 would have been captive-hatched and 4,600 of wild origin. An estimate of 863 spawning adult fish per year, consisting of approximately 596 males and 267 females, was calculated based on fishery dependent data collected from 1985-1995 (Kahnle et al. 2007).

From 2000–2009, the Utilities Monitoring Program collected 241 juvenile and sub-adult Atlantic sturgeon using a beam trawl during the Fall Shoals survey. The majority of these fish were collected north of West Point (RM 47). Only five Atlantic sturgeon were collected in the Tappan Zee region. Greater than 95 percent of all Atlantic sturgeon were collected from bottom habitats in waters greater than 20 feet in depth. Between 2000–2009 the Utilities Long River Program collected 16 yolk and post yolksac larvae, all upstream of Cornwall (RM 58). The Utilities also report the number and size of Atlantic sturgeon collected as part of their Striped Bass and Atlantic tomcod sampling program.

No Atlantic sturgeon were captured in gill nets during the project's bi-monthly fish-sampling effort within the project area. However, the carcass of an Atlantic sturgeon was observed floating approximately 500 feet (152.4 meters) north of the bridge in May 2008.

Commercial catch data provided by NYSDEC from observed fishing trips for the American shad gill net fishery (NYSDEC unpublished data) indicated that, from the years 1980–2002, Atlantic sturgeon were collected in the Tappan Zee vicinity (RM 25-27) in 14 of 23 years. However, Atlantic sturgeon were collected in only one year after 1992, which was accompanied by a reduction in commercial fishing effort. A separate adult Atlantic sturgeon tracking program was developed by NYSDEC which began tagging fish in 2006 with digital sonic tags. The study results confirm that the Tappan Zee Bridge area serves as a migration corridor for adult Atlantic sturgeon. Most of the fish that were tagged arrived in the Hudson from early April to late June and left the river by late July.

Candidate Species

Candidate species is one for which NMFS, "has published a positive finding on a petition to list it under the ESA or for which the agency has announced that [they] are conducting a status review." Alewife and blueback herring were designated as candidate species on November 2, 2011, and a status review is currently ongoing for river herring (alewife and blueback herring) from which a determination will be made under the ESA to determine if listing is warranted for either or both species. It is not likely that the status review will be completed prior to the publication of the Final Environmental Impact Statement (FEIS). Candidate status does not carry any procedural or substantive protections under the ESA. Existing conditions and impact analyses for blueback herring and alewife are included in this document with the general fish discussions.

Protection for candidate species and others in decline (e.g., American shad) has been incorporated into the project's construction plan through a number of different strategies intended to minimize the potential impacts to the fish community. The Environmental Performance Commitments (EPCs) are described in Chapter 18, "Construction Impacts," and in the BO, BA, and EFH assessments. These commitments, along with many of the measures specified in the BO and the NYSDEC proposal for compensatory mitigation (**Appendix F-12**), would also benefit candidate species. For example, a proposed secondary channel restoration program in the upper estuary currently proposed as mitigation for project impacts may provide direct benefits to shad and herring.

16-4-3 SPECIAL HABITAT AREAS

16-4-3-1 USFWS SIGNIFICANT HABITATS

The Lower Hudson River Estuary, the northern extent of which is the Haverstraw Bay, has been designated as a USFWS Significant Habitat of the New York Bight. The Lower Hudson supports regionally significant fish populations and wintering and migratory birds that feed there. It is the primary nursery and overwintering area for striped bass in the Hudson River estuary. There are 151 bird species and 80 fish species designated by the USFWS as of special emphasis (e.g., federally and state-listed species) that use the Lower Hudson (USFWS 1997).

16-4-3-2 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The New York State Department of State (NYSDOS) has designated several Significant Coastal Fish and Wildlife Habitats (SCFWH) within the stretch of the Hudson River between River Miles 11 and 40. These SCFWHs include Haverstraw Bay and Croton River and Bay (9.7 m, or 6 miles, north of the bridge), the Lower Hudson Reach (6.4 m, or 4 miles, south of the bridge), and Piermont Marsh (3.2 m, or 2 miles, south of the bridge). The NOAA and NYSDEC have designated Piermont Marsh part of the Hudson River National Estuarine Research Reserve. No SCFWHs occur within the study area.

16-4-3-3 ESSENTIAL FISH HABITAT (EFH)

The project area for aquatic resources is within a portion of the Hudson River Estuary/Raritan/Sandy Hook Bays, New York/New Jersey Estuary EFH (NOAA 2012)[7]. **Table 16-3** lists the species and life stages of fishes identified as having EFH in this broad area. An EFH Assessment has been prepared as part of the consultation process under the Magnuson-Stevens Act and provides a detailed discussion of EFH and potential impacts to EFH from the Replacement Bridge Alternative. The EFH consultation with NMFS for the Replacement Bridge Alternative has been completed (see **Appendices F-7 and F-9**). Sixteen EFH species have been identified by NMFS for the Hudson River estuary. Eleven of these species were collected during fisheries sampling in the Hudson River, the majority of which were found in highest abundance in the lower reaches of the estuary from the Battery to Yonkers (river miles 0-23). Only three of these species—Atlantic butterfish, bluefish, and summer flounder—were captured during the 2007-2008 sampling program for the project. These marine species were captured in the warmer months of the year when higher water temperatures and salinities are present within the project area. Six additional EFH species were collected in the Utilities Fall Shoals and Long River Monitoring Program between 1998 and 2007, albeit relatively infrequently in the Tappan Zee region (RM 24-33) compared to collections in the lower reaches of the estuary. Among these species were winter flounder, bluefish, Atlantic herring, windowpane flounder, summer flounder, Atlantic butterfish, Atlantic mackerel, Spanish mackerel, and scup.

An EFH determination was issued by NMFS on June 22, 2012 (see **Appendix F-7**).

16-5 ENVIRONMENTAL EFFECTS

16-5-1 NO BUILD ALTERNATIVE

In the future without the project, terrestrial and aquatic resources within the project site would remain in their current conditions and would continue to provide habitat to wildlife, as described in the previous sections.

The No Build Alternative would continue operation of the existing Tappan Zee Bridge. NYSTA would continue to coordinate maintenance and repair activities with NYSDEC and the New York City Department of Environmental Protection (NYCDEP) to implement peregrine falcon protection measures developed with these agencies. Therefore, there would be no impacts from continued operation of the existing bridge.

16-5-2 REPLACEMENT BRIDGE ALTERNATIVE

The Replacement Bridge Alternative would replace the existing Tappan Zee Bridge with two new parallel structures to the north of its existing location. As described in Chapter 2, “Project Alternatives,” there are two options for the Replacement Bridge Alternative’s approach spans (Short Span and Long Span Options) and two for the main span (Cable-stayed and Arch Option). The evaluation of potential impacts from these options considers the potential impacts from the Replacement Bridge Alternative in general,

[7] EFH assessment at the HARS is considered in Chapter 18, “Construction Impacts.”

noting differences in the potential for adverse impacts for the two approach span options as appropriate.

16-5-2-1 TERRESTRIAL RESOURCES

Terrestrial Ecological Communities

As discussed in Chapter 18, "Construction Impacts," the construction of the Rockland County and Westchester County landings, maintenance ramps, toll plaza, and associated interchanges of the project would take place mostly within the paved road communities of the project area. There would be a permanent impact on approximately 2 acres of the vegetated ecological communities (i.e., mowed lawn, mowed lawn with trees, successional southern hardwoods, and urban vacant lot) due to added paved service roads under both the Long Span and Short Span Options. These ecological communities are common throughout the region and are of low ecological value due to low species diversity, high level of anthropogenic activities, and dominance of non native, invasive vegetation. Therefore, the removal of 2 acres would not result in any adverse impacts to these ecological communities throughout the region. Disturbed areas not occupied by permanent structures (about 7 acres) would be revegetated with native species indigenous to this region of New York to the greatest extent practicable in accordance with a landscape plan that would be in compliance with E.O.13112, "Invasive Species."

Wildlife

Noise disturbance

Operation of the project would involve traffic noise from vehicles crossing the bridge. Anthropogenic noise levels can influence wildlife community composition by displacing some species while increasing the abundance of others (Bayne et al. 2008, Francis et al. 2009). Anthropogenic noise can decrease fecundity (Habib et al. 2007) and increase predation rates (Chan et al. 2010). At the individual level, physiological and behavioral responses of animals to anthropogenic noise generally include increased acute stress levels, increased heart rates, and fleeing from the source of the noise. However, such responses are usually in response to unusual, newly introduced disturbances, and animals often gradually habituate to and tolerate loud noises after initial exposure (Bowles 1995).

Because the project area has been developed with present land use for many years, the wildlife communities in the project area have already been shaped in part by existing noise levels. These communities are primarily composed of urban-adapted, disturbance-tolerant species that inhabit areas with high noise levels and other disturbances resulting from the existing bridge and heavily traveled roadways. Operation of the replacement bridge is not expected to increase disturbance levels above what is currently attributable to the existing bridge, and thus any species currently inhabiting the area would continue to occur in the area in the future. Individual animals currently inhabiting the area are habituated to existing noise levels from roadway traffic; operation of the replacement bridge would not elicit any new incremental negative physiological or behavioral responses, and would not alter current rates of predation or reproductive success. Overall, noise resulting from operation of the Replacement Bridge Alternative would not have any adverse impacts to wildlife.

Bird collisions and disorientation

Obstruction beacons and other lights can disorient night-migrating birds and result in collisions with structures, particularly in foggy conditions with low cloud cover when birds migrate at lower altitudes (Gauthreaux and Belser 2006, Longcore et al. 2008, Gehring et al. 2011). Thus, lighting used during operation of the replacement bridge could impact birds migrating over the Hudson River at night (primarily songbirds). Collision risk, however, would be highly dependent on the light characteristics, and could be diminished through the selection of particular lighting schemes.

Bird collision risk would also be influenced by the bridge's design features and height. Both design options for the main span (Cable-stayed and Arch) include steel support cables, with which birds may collide when used to support communication towers (Longcore et al. 2008). Because they share many similar characteristics and bird collisions with bridges have yet to be well-studied, USFWS uses data from communication towers as a proxy for analyzing potential impacts from cable-stayed bridges. Communication towers with support cables have been found to kill 16 times as many birds as free-standing towers of the same height (Gehring et al. 2011), although cables used for bridges are substantially wider and more visible to birds than those that are typically used for communications towers. The Cable-stayed Option for the replacement bridge would likely require the use of more support cables than the arch option, and by intersecting more air space, could pose a slightly greater risk for bird collisions.

Although specific designs have not yet been developed, it is likely that the Cable-stayed Option will be taller than the Arch Option. The maximum height of the support towers used in the Cable-stayed Option would be approximately 539 feet above mean high tide, and the maximum height of the arch would be approximately 339 feet above mean tide (the tallest point of the existing bridge stands approximately 300 feet above mean tide). Bird collisions with artificial structures are often strongly related to structure height (Kerlinger 2000). For example, several studies have found bird mortality at communication towers taller than 300 meters (984 feet) to be significantly greater than mortality at towers that are less than 150 meters (492 feet) tall (Longcore et al. 2008). Most birds migrate at altitudes of 200-750 meters (656-2461 feet; Able 1970, Mabee et al. 2006) and rarely fly below 90 meters (295 feet) during clear weather (Mabee and Cooper 2004). At 539 feet and 339 feet, neither design option would intersect the strata of airspace in which migrating birds most commonly fly. However, relatively short structures may represent collision hazards during inclement weather and when their lighting scheme is such that birds are attracted to and/or disoriented by the light. Ultimately, the potential for bird collisions with the replacement bridge would be most dependent on the bridge's lighting characteristics.

The USFWS recommends the following lighting scheme to reduce the potential for bird collisions with bridges (Manville 2005):

- Use low-intensity, low-wavelength blue, turquoise, or green lights. Avoid red and yellow lights.

- Use blue jelly jar LED (light emitting diodes) lights on suspension cables and rectangular blue LED lights on bridge deck. These lights have low energy consumption, produce bright but directional light (25 percent as bright as 100W bulb), and provide long-distance viewing while minimizing light pollution.
- Minimize the use of lights during spring and fall bird migration periods, particularly during overcast, cloudy, or foggy conditions.

In addition, collision risk can be dramatically reduced by using flashing obstruction lights instead of steady-burning lights (Longcore et al. 2008, Gehring et al. 2009). As design progresses, NYSDOT/NYSTA will look to implement as many of these measures as possible while remaining compliant with USCG and Federal Aviation Administration (FAA) obstruction lighting regulations.

Unlike other structures such as communications towers, wind turbines, power lines, and buildings, bird collisions with bridges have seldom been documented and bridges have not been implicated as significant causes of bird collision mortality (Banks 1979, Avery 1979, Evans-Ogden 1996, Erickson et al. 2005, Drewitt and Langston 2008, Manville 2009, Lebbin et al. 2010, Arnold and Zink 2011). With thoughtful selection of lighting characteristics, such as those above, there is little reason to expect the replacement bridge to be a significant collision hazard to night-migrant birds. Unless attracted by navigational or decorative lighting, night-migrating birds would typically fly at altitudes well above the airspace intersected by the replacement bridge (Able 1970, Mabee and Cooper 2004, Mabee et al. 2006). Further, the location of the replacement bridge on the lower Hudson River is not a significant funnel or geographical barrier for migrating landbirds that would bring substantial concentrations of birds past the structure. Collisions of birds with the replacement bridge would likely be restricted to nighttime periods of dense fog and extremely low cloud cover, and would not be expected to amount to a source of mortality that would be capable of affecting their population sizes (cf. Arnold and Zink 2011). For perspective from a recent and nearby study of bird collisions, extensive observations of night-migrants from the top of a brightly illuminated skyscraper in New York City found that only 22% of the autumn migration periods of 2004 and 2005 had overcast conditions that brought migrants close to the building and caused them to briefly circle before continuing onwards. Out of the 33,800 total migrants observed during the study, only 7 individuals collided with the building (all of which occurred on 1 rainy night) (DeCandido 2007). During spring 2004, none of the 3,415 observed migrants collided with the building (DeCandido and Allen 2006). Night-time collisions of migratory birds with illuminated city skyscrapers have been well publicized, but the reality is that collisions with buildings at night are relatively rare and are largely limited to sporadic episodes of mass mortality that can occur with the right mix of extremely poor weather conditions and particularly disorienting lighting characteristics (DeCandido and Allen 2006). Throughout the city, bird collisions with buildings are mostly attributable to daytime strikes with lower story reflective glass windows, not nighttime collisions with upper floors of skyscrapers (Gelb and Delecretaz 2006, 2009; Klem et al. 2009). Night-time collisions with the replacement bridge would likely be a similarly rare occurrence and have no significant impact on migratory birds with the use of proper lighting.

Threatened, Endangered, and Special Concern Species

Plants

The previously listed state-endangered late flowering boneset (*Eupatorium serotinum*) is present within portions of the successional southern hardwoods community of the project site. At the time of the publication of the Draft Environmental Impact Statement (DEIS), late flowering boneset was on the NYNHP's "2010 Rare Plant Status List - Native Pioneer Plant Watch List." This list contains species that were under review for potential delisting by the state. On May 23, 2012, NYSDEC delisted late flowering boneset and removed the plant from the state's "Protected Native Plants" list. For this reason, it is assumed that populations of this plant are secure and that the construction of the project would not result in an adverse impact on populations of this species within the region. Therefore, there would be no adverse impacts to state-listed plants from operation of the project.

Wildlife

Threatened, endangered, or special concern species that are considered to have the potential to occur within the bridge study area include bald eagle, peregrine falcon, common loon, and pied-billed grebe. Because operation of the replacement bridge is not expected to increase disturbance levels above what is generated by the existing bridge and approach roadways, none of these species would be impacted by the operation of the project. Each species would have the potential to occur in the area with the same likelihood as at present. As described in Chapter 18, "Construction Impacts," the peregrine falcon nest boxes would be relocated to the replacement bridge to provide an alternative nest site for the resident pair of peregrine falcons. The boxes were placed on the existing bridge over 20 years ago by NYSTA and have been adopted by the falcons. Nest site abandonment in urban peregrine falcons is extremely rare when successful nesting has occurred in prior years (Cade et al. 1996). The nesting season of peregrine falcons in New York City is generally from February through August. The timing of nest box relocation and the siting of the boxes on the replacement bridge would be performed consistent with an Article 11 incidental take permit and in consultation with NYSDEC and NYCDEP wildlife biologists to help ensure a successful transition. As such, it is expected that the falcons would relocate to boxes on the new bridge.

Every effort will be made to ensure that the nest box is relocated outside of the nesting season. In the event that relocation of the nest box could potentially interfere with the breeding season, erection of an "osprey platform" in the river nearby could potentially represent a suitable and attractive nest site for peregrine falcons. Peregrine falcons have been known to nest on platforms intended for osprey. Measures to be implemented under this circumstance where the nest box cannot be relocated outside the nesting season would be developed in consultation with NYSDEC wildlife biologists. Therefore, there would be no adverse impact to peregrine falcons from operation of the project.

Each of the threatened, endangered, and special concern bird species is primarily a daytime migrant, and none are common victims of collisions with artificial structures (Drewitt and Langston 2008, Gehring et al. 2009, Smallwood and Karas 2009). As such, operation of the project would not present a collision risk for threatened, endangered, and special concern species of birds.

There is a very low probability that the Indiana bat would occur in the project area. In a letter dated May 25, 2012, NYSDOT submitted documentation regarding Endangered Species Act consultation to the FHWA with an effects determination for the Indiana bat of "May affect, but not likely to adversely affect" (see Appendix F-8). FHWA concurred with this determination in a letter to the USFWS dated May 31, 2012 (see **Appendix F-8**) and entered into informal consultation with the USFWS for the Indiana bat. Pursuant to section 7(a)(2) of the ESA (87 Stat. 884, as amended; 16U.S.C 1531 et seq.), the USFWS concurred with FHWA, NYSDOT, and NYSTA's determination that the proposed project may affect, but is not likely to adversely affect, the federally-listed endangered Indiana bat (see **Appendix F-8**).

Analysis provided to initiate consultation for the bog turtle (federally listed) and New England cottontail (species of special concern in New York state, and candidate for federal listing) found that for the purposes of consultation under Section 7(a)(2) of the ESA, the project will have no effect on either species or their habitats. This determination was reached based on the fact that no suitable habitat occurs in the area for these species. USFWS concurs with this finding in their letter dated June 20, 2012 (see **Appendix F-8**) and has determined that no further coordination or consultation under the ESA is required at this time.

16-5-2-2 AQUATIC RESOURCES

Wetlands

As described above under "Existing Conditions," wetlands identified by NYSDEC in the vicinity of the project include littoral zone and intertidal wetlands. These wetlands are located south of the existing bridge. No vegetated intertidal wetlands under the jurisdiction of NYSDEC or USACE are present in the project area.

As discussed in Chapter 18, "Construction Impacts," there would be a temporary impact of 0.076 acres to the small stream and forested wetland corridor (totaling 0.23 acres) due to upland construction of the temporary access road for the temporary work platform at the Westchester Bridge Staging Area. After construction is complete, the area would be restored as compensatory mitigation for the temporary disturbance during construction in accordance with the joint mitigation rule (Federal Register dated April 10, 2008, 73 FR 19594 through 19705). The mitigation measures that would be explored in coordination with the USACE as part of the compensatory mitigation plan would likely include the removal of the temporary access road decking and support structures, rehabilitation activities such as removal of construction and demolition debris, channel and bank stabilization, removal of invasive plant species, and restoration of a native plant community. Therefore, there would be no permanent adverse effect to wetlands.

As discussed above, implementation of erosion and sediment control measures (e.g., silt fences and straw bale dikes) and stormwater management measures implemented through the development of a stormwater pollution prevention plan (SWPPP) would minimize the potential for stormwater runoff from construction of the access road to affect the forested wetland corridor (0.23 acres) at the Westchester Bridge Staging Area.

Because the projected wetland impacts would be small in size (0.076 acres) and temporary and restored post-construction, and because remaining wetlands would retain their functions and values, the intent of E.O. 11990 would be met. There would be no net loss to functions and values of impacted wetlands.

Aquatic Biota and Habitat

The new bridge would occupy similar acreage as the existing structure. After demolition of the existing bridge, there would be a net loss of open water benthic habitat under the Short Span Option of 0.92 acres and a gain of 0.58 acres of open water benthic habitat under the Long Span Option.

It has been maintained that shading of estuarine habitats can result in decreased light levels and reduced benthic and water-column primary production, both of which may adversely affect invertebrates and fishes that use these areas, particularly with respect to use as refuge and foraging habitat (Able et al. 1998, and Struck et al. 2004). The amount of area shaded by overwater structures will be affected by the height and width of the structure, construction materials and orientation of the structure relative to the arc of the sun (Burdick and Short 1995, Fresh et al. 1995 and 2000, Olson 1996, 1997 in Nightingale and Simenstad 2001) and piling density. Shading due to bridges has been found to affect plant communities such as tidal marshes and SAV, as well as benthic invertebrate communities within tidal marshes (Struck et al. 2004, and Broome et al., 2005 in CZR 2009). However, adverse effects on marsh vegetation and benthic macroinvertebrates have been found to be minimal when the bridge height-to-width ratio is greater than 0.7 (Struck et al, 2004, Broome et al. 2005 in CZR 2009). Significantly fewer oligochaete worms, which are common in the Hudson River, were found under bridges with a height-to-width ratio less than 0.7 when compared to marshes not affected by shading (Struck et al. 2004). Struck et al. (2004) found that bridges with height-to-width ratios greater than 1.5 had the lowest light attenuation beneath the bridge.

Because the elevations of the existing Tappan Zee Bridge and the Replacement Bridge Alternative are not consistent over the length of the structure (see **Figure 2-5**), the height-to-width ratio of the bridge varies along its length. Table 16-4 compares the ratio of the existing bridge and the Short and Long Span Options for the Replacement Bridge Alternative at the stations indicated in **Figure 2-5**. The two spans of the Replacement Bridge Alternative would be separated by a gap of up to 70 feet. The height-to-width ratios presented below provide an indication of the potential for the existing and Replacement Bridge Alternative to result in shading impacts. As indicated below, the height-to-width ratio for the portion of the existing bridge within the causeway (the western approach to the main span comprising Stations 845+00 to approximately 905+00) is low, ranging from 0.25 to 0.34. The ratio for these same stations for the Replacement Bridge Alternative, Short and Long Span Options, are generally much greater, ranging from 0.21 near the shoreline to 1.07. The ratios for the Long Span Option are slightly less because the height for this approach option is lower than the Short Span Option. The portion of the western approach just prior to the main span (Stations 920+00 to 935+00) has a ratio that ranges from 0.60 to 1.11 for the existing bridge. Again, the ratios of these stations for the Replacement Bridge Alternative are much greater, ranging from 1.07to 1.47. The ratio for the main span of the existing bridge is 1.57 and for the Replacement Bridge Alternative, ratios range from 1.39 to

1.67. The ratios for the eastern approach are fairly similar for the existing and Replacement Bridge Alternative, ranging from 0.83 to 1.43 with the Long Span Option for the Replacement Bridge Alternative having the lower ratios.

The ratios in **Table 16-4** consider the height-to-width ratio separately for the two spans of the Replacement Bridge Alternative, assuming that the separation between the decks of the two spans (i.e., 70 feet at the main span and then decreasing toward the shorelines) allows light to penetrate between the two structures. This represents the best case analysis. Under the worst case, which assumes no separation between the spans of the Replacement Bridge Alternative and which would conservatively result in a halving of the height-to-width ratios presented in **Table 16-4**, the Replacement Bridge Alternative would result in smaller ratios (i.e., more shading) near the Rockland County shoreline, but greater ratios for the remainder of the western approach. Overall, the height-to-width ratios imply that if the Replacement Bridge Alternative was treated as a single structure, with no separation between the spans, there would be a decrease in the potential for shading impacts to aquatic resources over much of the western approach.

Table 16-4
Height-to-Width Ratios for the Existing Bridge and Short and Long Span Options for the Replacement Bridge Alternative at Various Stations Across the Length of the Bridge

Location	Existing	Short Span		Long Span	
	91 ft-wide deck	96ft-wide	87ft-wide	96ft-wide	87ft-wide
845+00	0.34	0.34	0.38	0.34	0.38
860+00	0.25	0.44	0.48	0.21	0.23
875+00	0.25	0.62	0.69	0.39	0.43
890+00	0.25	0.79	0.87	0.60	0.67
905+00	0.25	0.97	1.07	0.83	0.92
920+00	0.60	1.15	1.26	1.07	1.18
935+00	1.11	1.33	1.47	1.29	1.43
950+00	1.57	1.51	1.67	1.51	1.67
965+00	1.57	1.45	1.60	1.39	1.53
980+00	1.13	1.29	1.43	1.11	1.23
995+00	1.20	1.15	1.26	0.83	0.92

The approximately 2-acre permanent platform at the Rockland Bridge landing would result in additional aquatic habitat affected by shading. While the additional shading caused by the platform would result in impacts to the immediate area below the platform, adverse impacts are not anticipated to aquatic resources in the study area due to the abundance of remaining habitat.

Approximately 13 acres of oyster habitat would be adversely impacted during construction operations (discussed in Chapter 18, “Construction Impacts”), some or all of which may be permanently lost due to dredging and armoring of the bottom. NYSDEC has proposed, and NYSDOT and NYSTA have accepted, the restoration of 13 acres of hard bottom/shell oyster habitat and the reintroduction of oysters to the habitat as part of the compensatory mitigation for the project (see **Appendix F-12**).

Other habitat changes associated with dredging, armoring and introduction of hard substrates are evaluated in Chapter 18, "Construction Impacts."

Fish

Operation of the project would involve traffic noise from vehicles using the bridge. However, because the bridge has existed for nearly 60 years in this location, the fish community currently in the project area has already been acclimated to existing noise levels from roadway traffic. Operation of the replacement bridge is not expected to increase disturbance levels above what is currently attributable to the existing bridge, and thus any species currently inhabiting the area would continue to occur in the area during operation of the replacement bridge. Presumably any noise levels which currently elicit a behavioral response under the current condition would continue to elicit a similar response after completion of the replacement bridge. Overall, noise resulting from operation of the replacement bridge would likely not have any adverse impacts on the fish community.

Currently stormwater runoff from Interstate 87/287 along the roadway approach to the bridge is conveyed in a system of catch basins, ultimately discharging directly to the Hudson River. As discussed in Chapter 15, "Water Resources", stormwater management practices (SMPs) to treat stormwater quality would be designed and constructed in accordance with the NYSDEC's SWMDM, NYSDOT's Highway Design Manual, NYSDOT's The Environmental Manual, and NYSTA's engineering guidance. With the implementation of the SMPs at the landing areas for the Replacement Bridge Alternative, the discharge of stormwater runoff from the project would result in a net decrease in pollutant loading to the Hudson River for total suspended solids (TSS) and would result in just a small increase in pollutant loading for phosphorus (TP). In addition to TSS and TP, the SMPs would collect the water quality volume or "first flush" stormwater runoff from the bridge landings in Rockland and Westchester Counties and would also capture and convey oil and grease to the water quality treatment facilities located in these two areas. Thus, the SMPs would minimize the potential for adverse changes to Hudson River water quality from the discharge of stormwater from the Replacement Bridge Alternative, and therefore, the project would not have the potential to result in adverse impacts on aquatic biota.

Threatened, Endangered, and Special Concern Species

Threatened, endangered, or special concern species that are considered to have the potential to occur within the bridge study area include shortnose sturgeon and Atlantic sturgeon. Because operation of the replacement bridge is not expected to increase noise levels above what is generated by the existing bridge outside the construction period, neither of these species would be impacted by the operation of the project after construction of the proposed bridge and demolition of the existing bridge has been completed. Both species would have the potential to occur in the area with the same likelihood as at present.

The project area does not represent a spawning area for Atlantic or shortnose sturgeon, which occurs in more northern reaches of the estuary. Furthermore, eggs and larval stages of either species would not be expected to occur in the Tappan Zee region.

There is no federally designated critical habitat for the shortnose or Atlantic sturgeon in the Hudson River. As a consequence, there can be no effect or impact on critical habitat due to replacement bridge operations. However, NYSDOS has identified several areas in the Hudson River that are essential to shortnose reproduction and survival. However, these are located far north of the project area.

16-5-2-3 SPECIAL HABITATS

USFWS Significant Habitat

As discussed above and in Chapter 15, "Water Resources," the project operation would not result in significant adverse impacts on water quality or the species identified as important for the USFWS Significant Habitat of the Hudson River. In addition, with the implementation of lighting measures, relocation of the peregrine falcon nests, stormwater management plans to treat stormwater quality for the landing areas for the Replacement Bridge Alternative, erosion and sediment control measures to prevent degradation of potential wetland areas, and a wetland mitigation plan, operation of the Replacement Bridge Alternative would not result in adverse effects to terrestrial resources, wetlands, or threatened and endangered species.

Significant Fish and Wildlife Habitat

The project is not located in an area that is considered SCFWH by the New York State Department of State (NYSDOS). The closest SCFWH is the Piermont Marsh, which is located two miles south of the bridge, far outside the projected plumes of increased suspended sediment for the worst-case in-water construction scenarios discussed in Chapter 18, "Construction Impacts." Therefore, operation of the project would not result in adverse impacts to the resources of Piermont Marsh.

Essential Fish Habitat (EFH)

The primary potential indirect impacts to EFH species from the project include the physical disturbance as a result of loss of habitat change, changes in interpier water velocities, total suspended solids (TSS), re-deposition of sediments from dredging activities, and operational impacts on water quality. Loss of bottom habitat due to the placement of the piles and other structures (including armoring of the dredged channel) would be minimal and would not be expected to result in significant reductions in fish habitat or prey availability. Furthermore, the loss of these habitats will be fully or nearly fully offset by the removal of the existing bridge and associated piles to below the mud line.

Upon completion of construction, the operational impacts of either option would be largely positive. The wider spacing of piers for both options would reduce benthic scour and allow for more sunlight to enter the water column, thereby reducing the conditions currently experienced along the western causeway of the existing bridge and by the generally greater height-to-width ratios for the proposed project. Much of the potential shading impacts from the Replacement Bridge would be offset by the removal of the existing bridge. Operation of the project would not result in adverse impacts to water quality of the Hudson River, or adversely affect aquatic habitat due to under-bridge lighting.

Appendix F-9 (EFH assessment) of the FEIS addresses in detail the potential impacts to EFH within the study area. Of the 16 EFH species designated for the Hudson River, 10 species were excluded from the analysis due to lack of occurrence in samples collected during the Utilities fish survey upstream of river mile 23 at Yonkers or due to lack of EFH, specifically suitable salinity and water depths, in the project area. Of those six EFH species that could potentially be impacted by dredging, the benthic species (i.e., summer flounder, windowpane, and winter flounder) are more likely to be affected than the pelagic species (i.e., Atlantic butterfish, Atlantic herring, and bluefish). The temporary modification in bottom habitat due to dredging and armoring would affect less than 2 percent of the soft sediments in the Tappan Zee region (also discussed in Section 6.1.3 of the BA). Greater than 98 percent of the remaining benthic habitat in the Tappan Zee region would be unaffected by dredging activities related to the construction channel and would continue to provide EFH. Therefore, the temporary change in habitat within the dredged construction channel, followed by recovery of the soft bottom benthic community as sediment becomes deposited at the completion of construction, would not be expected to adversely affect the three EFH species that are directly associated with benthic habitat.

In a letter dated June 22, 2012, NMFS referring to EFH stated that “impacts associated with bridge construction and removal may adversely affect living aquatic resources and their habitats”; however, specific determination was not made for dredging activities. In their BO, though, NMFS supports the above FEIS finding by indicating that “the dredging footprint represents a very small percentage of the soft bottom habitat of the Tappan Zee region (1.2 percent) and the Hudson River Estuary (0.2 percent). Thus, the temporary reduction of benthic fauna within the dredged area would not substantially reduce foraging opportunities for the river's sturgeon populations. As the area returns to soft sediment and is recolonized by benthic invertebrates, sturgeon will regain any lost foraging habitat.” For these same reasons, the temporary loss of habitat due to dredging of the access channel would not substantially reduce foraging opportunities for any EFH species that rely on the bottom habitat.

In their June 22, 2012 letter (**Appendix F-7**), NMFS provided conservation recommendations to avoid and minimize impacts to EFH. Specifically, these recommendations included a project schedule and activity plan, inclusion of seasonal dredging windows, limiting the amount of re-suspension and dispersal of fine sediment, monitoring of the dredged areas, and a mitigation and restoration plan. In the response to the June 22, 2012 letter, FWHA provides a detailed discussion for each of the Conservation Recommendations and will continue consultation with NMFS with respect to implementation (see **Appendix F-7**).

Except for the permanent loss of up to 13 acres of oyster habitat, and potential impacts of shading associated with the net change between new bridge construction and removal of the existing structure, the FEIS concludes that remaining impacts are largely either temporary or minimal, and not reasonably expected to have a long-term impact on aquatic resources, including EFH and protected species. In their BO, the NMFS Protected Resources Division agrees with the conclusions articulated in the FEIS regarding the temporary or minimal extent of impacts due to project activities on shortnose and Atlantic sturgeon survival, movement, and their ability to forage in the Hudson River. The BO identifies additional RPMs to be implemented to further ensure the protection of shortnose and Atlantic sturgeon, as well as the greater fish community. The RPMs, which NMFS considers necessary and appropriate, have been agreed to by the project sponsors and are also discussed in Chapter 18, “Construction Impacts,” of the FEIS as well as in the BO. In their response to the EFH assessment, NMFS Habitat Conservation Division expressed the view that, "bridge construction and removal may adversely affect living aquatic resources and their habitats," but offered EFH conservation recommendations to "avoid and minimize impacts to our resources."

NYSDEC did not dispute the general conclusions reached in the DEIS, but is of the opinion that the scale and duration of these temporary impacts warrant mitigation. Despite differences of opinion with NYSDEC regarding the significance of these temporary impacts, the project sponsors have agreed to implement NYSDEC's proposed compensatory mitigation and net conservation benefit plan. Collectively, the adoption and implementation of the EPCs, the proposed mitigation measures, and the RPMs identified in the NMFS BO will ensure that permanent and temporary impacts to living aquatic resources have been minimized or adequately mitigated and compensated for.

16-6 MITIGATION

As discussed above, with the implementation of lighting measures, relocation of the peregrine falcon nests, stormwater management plans to treat stormwater quality for the landing areas for the Replacement Bridge Alternative, and erosion and sediment control measures to prevent degradation of potential wetland areas, operation of the Replacement Bridge Alternative would not result in adverse impacts to terrestrial resources, wetlands, or terrestrial threatened and endangered species.

As discussed in Chapter 18, "Construction Impacts," mitigation measures to offset potential permanent impacts of up to 13 acres of oyster habitat, temporary impacts to bottom habitats due to dredging, and other impacts to open water habitats and fish resource species were developed in consultation with NYSDEC and NMFS. NYSDEC's proposed compensatory mitigation and net conservation benefit plan is summarized in **Appendix F-12** and consists of the following elements:

- Compensatory mitigation measures to offset dredging-related impacts to the benthic community;
  - Restoration of 13 acres of hard bottom/shell oyster habitat in the immediate vicinity of the existing bridge and reintroduction of oysters to the habitat;
  - A secondary channel restoration project at Gay's Point, Columbia County;
  - Wetlands enhancement at Piermont Marsh that includes *Phragmites* control on approximately 200 acres within the marsh, restoration of flow to an historic oxbow, development of a green infrastructure project to improve the quality of runoff entering Sparkill Creek, and restoration of historic wetlands at the northern end of the marsh.
- Measures that would achieve a net conservation benefit, including:
  - Mapping of Hudson River shallows to document benthic habitat used by sturgeon;
  - A study of sturgeon foraging habits;

- A sturgeon capture and tag study;
- Tracking of acoustically marked sturgeon (stationary and mobile tracking); and
- Preparation of written material to be used as part of ongoing outreach to reduce impacts of commercial by-catch of Atlantic sturgeon in the near shore Atlantic Ocean.

FHWA, NYSDOT, and NYSTA are committed to implementing the compensatory mitigation and measures to achieve a net conservation benefit under 6 NYCRR Part 182 proposed for the project by the NYSDEC (see **Appendix F-12**).

In addition, a sediment condition and benthic study will be performed following project construction to determine sediment conditions and benthic recovery status. A wetland planting plan using species native to this region of New York would also be developed with USACE for the temporary loss of 0.076 acres of forested wetland at the Westchester Bridge Staging Area.