Biological Evaluation of Impacts to Northern Long-Eared Bat, Rufa Red Knot, Piping Plover, and Roseate Tern

Seabrook Station, Unit 1

Proposed License Renewal to Operating License No. NPF-86

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Enclosure

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Abbreviations, Acronyms, and Symbols

°F	degrees Fahrenheit
°C	degrees Celsius
ac	acre(s)
ADAMS	Agencywide Documents Access and Management System
CFR	*Code of Federal Regulations*
cm	centimeter(s)
ECOS	Environmental Conservation Online System
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended
fps	foot (feet) per second
ft	foot (feet)
FWS	U.S. Fish and Wildlife Service
FSEIS	NUREG–1437, Supplement 46, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station, Final Report*
g	gram(s)
gal	gallon(s)
ha	hectare(s)
in.	inch(es)
IPaC	Information for Planning and Conservation
kg	kilogram(s)
km	kilometer(s)
lb(s)	pound(s)
m	meter(s)
m^3	cubic meter(s)
m/s	meter(s) per second
mi	mile(s)
mm	millimeters
NextEra	NextEra Energy Seabrook, LLC
NHFGD	New Hampshire Fish and Game Department
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
oz	ounce(s)
Seabrook	Seabrook Station, Unit 1

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared this evaluation to comply with the provisions of Section 7 of the Endangered Species Act of 1973, as amended (ESA), in support of the NRC staff's review of NextEra Energy Seabrook, LLC's (NextEra) application for a renewed license for Seabrook Station, Unit 1 (Seabrook) in the Town of Seabrook, Rockingham County, New Hampshire. The NRC previously considered the potential effects of the proposed Seabrook license renewal on federally listed species under U.S. Fish and Wildlife Service (FWS or "the Service") jurisdiction in its final Supplement 46 to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station" (FSEIS), which the NRC issued in July 2015. During the development of the FSEIS, the NRC consulted with the FWS concerning the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii dougallii*). The NRC concluded that the proposed license renewal was not likely to adversely affect these species, and the FWS concurred with this determination in a letter dated September 1, 2010. This document examines the potential impacts of the proposed license renewal on two federally listed species under FWS jurisdiction that the FWS has listed as threatened since the NRC staff completed its environmental review: the northern long-eared bat (*Myotis septentrionalis*) and rufa red knot (*Calidris canutus rufa*). Additionally, this document considers whether any new or updated information exists related to the piping plover and roseate tern.

2.0 Description of the Proposed Action

2.1 Proposed Action

The proposed Federal action is the NRC's decision whether to issue a renewed operating license that would authorize NextEra to operate Seabrook for an additional 20 years. Seabrook's current operating license (No. NPF-86) is in effect until March 15, 2030. License renewal would authorize operations to continue until March 15, 2050. Operating conditions would not change under the proposed action, and license renewal would not involve any new construction, land clearing, or other ground-disturbing activities. Seabrook operations are described briefly below. The NRC has also prepared an environmental impact statement related to the proposed action and pursuant to the National Environmental Policy Act of 1969, as amended, the title of which is: Supplement 46 to NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Seabrook Station" (FSEIS) (NRC 2015a). Section 2.1 of the FSEIS describes the Seabrook facility and its operations in greater detail. All information in this section is derived from the FSEIS unless otherwise cited.

2.2 Seabrook Site and Location

Seabrook is situated on an 889-ac (360-ha) site in the Town of Seabrook, Rockingham County, New Hampshire, 2 mi (3.2 km) west of the Atlantic Ocean on a peninsula bordered by Browns River, Hunts Island Creek, and estuarine marshlands. Seabrook is approximately 2 mi (3.2 km) north of the Massachusetts state line, 15 mi (24 km) south of the Maine state line, and 10 mi (16 km) south of Portsmouth, New Hampshire. The closest metropolitan areas are Manchester, New Hampshire (31 mi (50 km) west-northwest) and Boston, Massachusetts (41 mi (66 km) south-southwest). Figure 1 depicts the location of Seabrook and the surrounding region within 6 mi (10 km).

The Seabrook site is divided into two lots. Lot 1 encompasses approximately 109 ac (44 ha) of mostly developed land, and the operating facility is located on this lot. Operating facility structures include the containment building, primary auxiliary building, fuel storage building, waste processing building, control and diesel generator building, turbine building, administration and service building, ocean intake and discharge structures, circulating water pump house, and service water pump house. Lot 2 is approximately 780 ac (316 ha) and is mainly an open tidal marsh area with fabricated linear drainage ditches and tidal creeks. Figure 2 depicts the layout of the Seabrook site.

2.3 Reactor and Containment Systems

Seabrook is a one-unit pressurized water reactor nuclear-powered steam electric generating facility that began commercial operation on August 19, 1990. In this type of nuclear reactor, water is heated under pressure inside the reactor and then pumped in the primary circulation loop to the steam generator. Within the steam generator, water in the secondary circulation loop is converted to steam that drives the turbines, and the turbines turn the generator to produce electricity. Steam leaving the turbines is condensed by water in the tertiary loop and returned to the steam generator. Tertiary loop water discharges to the Gulf of Maine, which acts as a heat sink. While the tertiary loop is open to the atmosphere, the primary and secondary cooling loops are not.

The Seabrook reactor, steam generators, and related systems are enclosed in a double containment designed to prevent uncontrolled emissions of radioactivity to the environment. The containment structure is a reinforced concrete cylinder with a slab base and hemispherical dome. A carbon steel liner is attached to the inside face of the concrete shell of the containment structure to ensure a high degree of leak tightness. A containment enclosure surrounds the containment structure that is composed of reinforced concrete designed to entrap, filter, and discharge any leakage from the containment structure to the atmosphere through charcoal filters.

Fuel for the reactor core consists of low-enriched (less than 5 percent by weight) uranium-235. Fuel rod burnup does not exceed 62,000 megawatt days per metric ton uranium on average. Seabrook is currently licensed to produce a reactor core power of 3,648 megawatts-thermal. This rate would continue to be the maximum reactor core power level under the proposed license renewal.

2.4 Cooling and Auxiliary Water Systems

Seabrook uses a once-through cooling system that withdraws water from and discharges water to the Gulf of Maine. Water enters the cooling system via an intake tunnel and three associated concrete intake structures that are positioned about 60 ft (18 m) below mean lower low water and about 7,000 ft (2,100 m) offshore from Hampton Beach. Water flows through a 3-mi (5-km)-long tunnel system before it reaches the plant.

Traveling screens with 3/8-in. (0.95-cm) square mesh remove fish, invertebrates, seaweed, and other debris before water is pumped to the main condensers and the service water system. Water passing through the main condensers removes excess heat created by the turbine cycle and auxiliary system. During normal operations, the circulating water system provides a continuous flow of approximately 390,000 gallons

per minute (869 cubic feet per second or 24.6 cubic meters per second) of water to the main condensers and 21,000 gallons per minute (47 cubic feet per second or 1.3 cubic meters per second) to the service water system.

Water that has passed through Seabrook returns to the Gulf of Maine through a 3.0-mi (5.0-km)-long discharge tunnel, which releases water to the gulf at a point approximately 5,000 ft (1,524 m) from the Seabrook Beach shoreline. The National Pollutant Discharge Elimination System (NPDES) permit (EPA 2002) limits discharge flow to 720 million gallons per day (2.7 million cubic meters per day), and the monthly mean temperature rise may not exceed 5 °F (2.8 °C) at the surface of the receiving water.

In the event that the regular supply of cooling water is unavailable, Seabrook has a standby mechanical draft evaporative cooling tower (service water tower) and a 7-day makeup basin. The cooling tower basin has a capacity of 4.0 million gal (15,140 m^3) and is fed from the Gulf of Maine via the service water system. If ocean water is unavailable, or additional water is required, NextEra can access emergency makeup water from the domestic water supply system or from the Browns River via a portable pump.

Figures 3, 4, and 5 depict the Seabrook intake shafts and caps, the profile of the intake tunnel, and circulating water pumphouse, respectively.

The U.S. Environmental Protection Agency (EPA) (2002) imposes conditions and limitations for Seabrook's cooling water use and discharge through NPDES permit no. NH0020338. This permit remains in effect during the EPA's review of NextEra's renewal application, which NextEra submitted to the EPA in 2006.

2.5 Power Transmission System

Three 345-kilovolt transmission lines connect Seabrook to the regional electric grid. Two of these lines are wholly owned and operated by Public Service Company of New Hampshire, and one of the lines is owned and operated by Public Service Company of New Hampshire (in New Hampshire) and National Grid in Massachusetts. These lines will remain a permanent part of the regional transmission system and will continue to be operated and maintained regardless of Seabrook license renewal. No new transmission lines would be constructed to support the proposed license renewal.

2.6 Plant Operations and Maintenance

NextEra routinely performs inspections, testing, surveillance, and other maintenance activities to ensure performance of facility equipment and compliance with environmental and safety requirements. Such activities include reactor vessel materials inspections, boiler and pressure vessel in-service inspection and testing, water chemistry maintenance, programs carried out to meet technical specification surveillance requirements, and various periodic maintenance, testing, and inspection procedures. Certain program activities are carried out during Seabrook operations, while others are carried out during scheduled refueling outages.

2.7 Refueling Outages

Nuclear power plants must periodically suspend the production of electricity for refueling, periodic in-service inspection, and scheduled maintenance. These periods are referred to as refueling outages. During refueling, spent fuel assemblies are removed from the

reactor core and replaced with fresh fuel assemblies. Spent fuel is stored onsite in the spent fuel pool and the dry fuel storage facility. Seabrook schedules its outages on an 18-month cycle, and outages last for approximately 30 days.

Outages typically involve temporary increases in personnel, traffic, site noise, lighting, and general activity. NextEra employs as many as 800 temporary workers for the duration of each outage. Heavy machinery is used to transfer fuel assemblies. However, refueling activities are limited to the industrial portions of the site and do not involve any construction or other land disturbances.

2.8 Radioactive Waste Management

Radioactive wastes are the activation and fission byproducts that result from the irradiation of reactor water during Seabrook operations. The radioactive waste system collects, treats, and disposes of these wastes. Wastes may be liquid, gaseous, or solid. With respect to radioactive emissions from wastes, NextEra must comply with NRC dose standards set forth in 10 CFR Part 20, “Standards for protection against radiation,” and 10 CFR Part 50, “Domestic licensing of production and utilization facilities.” The U.S. Department of Transportation and the State of New Hampshire have additional safety requirements that pertain to transportation of wastes.

The liquid waste processing system treats, filters, and demineralizes liquid waste on a batch basis. Each treated batch is sampled and depending on the sample results, is either reprocessed, returned to the condensate storage tanks for reuse in Seabrook, or discharged. Prior to discharge, each batch is evaluated to meet discharge limit requirements and then released to the Gulf of Maine via the station’s NPDES-permitted discharge transition structure. Radioactive effluent releases require positive operator action, are continuously monitored, and can be automatically terminated in the event of a high radiation alarm or a power failure. Any solid wastes generated as a byproduct of the liquid waste processing system are packaged for offsite shipment.

Gaseous radioactive waste is primarily produced from off-gases from the main condenser. Gaseous wastes are collected in the primary auxiliary building ventilation cleanup exhaust unit where charcoal and particulate filters remove contaminants prior to release to the environment.

Solid radioactive wastes are handled and disposed of through one of several methods depending on the type of waste, radiation level, presence of other hazardous materials, and the availability of disposal space. Wet solid active wastes, such as resins, are transferred from sluice tanks to liners and then packaged for offsite shipment. Solid dry active wastes, such as contaminated paper, plastic, wood, metals, and spent resin, are compacted into either boxes or cargo containers. Large or highly radioactive components and equipment that cannot be compacted are handled, packaged in shipping containers, and transported offsite by qualified personnel or specialized contractors.

Seabrook also generates a small quantity of low-level mixed waste. Class A wastes are collected, sorted, packaged, and shipped offsite to the Clive, Utah, disposal facility for further processing. Seabrook currently ships Class B and C waste to Studsvik, a waste processing facility in Erwin, Tennessee.

Section 2.1.2 of the FSEIS (NRC 2015a) describes radiological waste management at Seabrook in detail.

2.9 Nonradiological Waste Management

Seabrook generates nonradioactive wastes as part of routine plant maintenance, cleaning activities, and plant operations. Under New Hampshire's hazardous waste rules, Seabrook is classified as a Full Quantity Generator of hazardous waste because it generates more than 100 kg (220 lb) of hazardous waste in any single calendar month. Hazardous wastes include waste paint, waste solvents, expired laboratory chemicals, and microfilm processing waste. The EPA regulates the treatment and disposal of hazardous wastes through the Resource Conservation and Recovery Act of 1976, as amended, and associated regulations at 40 CFR Parts 239-299. In New Hampshire, portions of the responsibility for administering the Act have been delegated to the New Hampshire Department of Environmental Services. Section 2.1.3 of the FSEIS (NRC 2015a) describes nonradiological waste management at Seabrook in detail.

3.0 Proposed Action Area

The implementing regulations for Section 7(a)(2) of the ESA define "action area" to mean all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area effectively bounds the analysis of federally listed species and critical habitats because only species and habitats that occur within the action area have the potential to be affected by the Federal action. The terrestrial and aquatic action areas are described in the following sections. Information in this section is derived from the FSEIS (NRC 2015a) unless otherwise cited.

3.1 Terrestrial Action Area

The terrestrial action area consists of the 889 ac (360 ha) Seabrook site. The site lies in the Gulf of Maine Coastal Lowland subsection of the Lower New England Ecoregion. This ecoregion is characterized by delta plains, broad plateaus, gentle slopes, and coastal areas and has an elevation range of sea level to 1,500 ft (450 m). The Gulf of Maine Coastal Lowland subsection is comprised of a narrow region along the coast with low topographic relief, a moderate climate, and tidal marshes, dunes, beaches, and rocky coastline. Vegetation is characteristic of temperate deciduous forest, and pine-oak and white cedar swamps are the locally predominant vegetative communities.

The Seabrook site lies on a triangular promontory of uplands surrounded by tidal marsh to the northeast, east, and southeast. NextEra (2010) estimates that approximately 600 ac (240 ha) of the site contain marshes or wetlands and 300 ac (120 ha) of the site contain uplands. Monostands of smooth cordgrass (*Spartina alterniflora*) lie between mean low and high tide lines. Salt meadow cordgrass (*S. patens*) and common reed (*Phragmites australis*) dominate the areas that extend from mean high tide line to the limits of the spring tide, which are subject to less regular flooding. On higher ground, stands of black-grass (*Juncus gerardi*) form dense grasslands, and switchgrass (*Panicum virgatum*) occurs in a narrow band along the upper reaches of the marsh and gradually merges with upland vegetation. (NextEra 2010)

Upland areas not occupied by the Seabrook footprint contain hardwood-red cedar at the marsh edge. These areas are dominated by eastern red cedar (*Juniperus virginiana*),

black oak (*Quercus veluntina*), and black cherry (*Prunus serontina*). Rock ledges adjacent to the marsh are dominated by oak-hickory stands consisting of northern red (*Q. rubra*), white (*Q. alba*), and black oak as well as shagbark (*Carya ovata*) and other hickories. The remaining upland areas contain hardwood-conifer stands of various oaks, white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*). (NextEra 2010)

The majority of the marsh areas and some forested areas on and around the Seabrook site are designated as the Hampton Marsh Core Conservation Area in the *Land Conservation Plan for New Hampshire's Coastal Watersheds* (Zankel et al. 2006). The Hampton Marsh Core Conservation Area is composed of 7,490 ac (3,031 ha) and contains a contiguous 3,310.8-ac (1,339.8-ha) area of tidal marsh habitat and a 920-ac (372-ha) block of unfragmented forest habitat. In the conservation plan, Zankel et al. (2006) assessed the quality of New Hampshire's unfragmented forest blocks by considering two major factors: (1) the ability to absorb infrequent, devastating natural disasters, including fire and hurricanes, and (2) the ability to support a variety of interior species at population levels that ensure long term viability. Zankel et al. (2006) consider the 920-ac (372-ha) unfragmented forest block within the Hampton Marsh Core Conservation Area to be of a locally significant size and to have the capability to provide habitat for some interior forest species with smaller ranges, although the area is not likely to be able to absorb large-scale natural disturbances. The Hampton Marsh Core Conservation Area also contains 12 exemplary natural communities and system types, of which 3 types are located on the Seabrook site: brackish marsh, high salt marsh, and low salt marsh (NHNHB 2013; Zankel et al. 2006).

In addition to the communities described above, the Seabrook site contains the following habitats: Appalachian pine-oak forest, grasslands, hemlock-hardwood-pine forest, rocky ridge or talus slope, wet meadow and shrub wetland, brackish marsh, and intertidal flats (NHNHB 2013; Sperduto and Nichols 2004). Detailed descriptions of these habitats can be found in the New Hampshire Natural Heritage Bureau's report, *Natural Communities of New Hampshire* (Sperduto and Nichols 2004).

Forested areas in the action area provide habitat to a variety of native wildlife, including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), eastern cottontails (*Sylvilagus floridanus*), painted turtles (*Chrysemys picta*), garter snakes (*Thamnophis* spp.), ribbon snakes (*T. sauritus*), wood frogs (*Rana sylvatica*), American toads (*Bufo americanus*), and various species of squirrels, voles, shrews, and foxes. Common bird species in forested and developed areas include blue jays (*Cyanocitta cristata*), black-capped chickadees (*Poecile atricapillus*), robins (*Turdus migratorius*), black-and-white warblers (*Mniotilta varia*), whip-poor-wills (*Caprimulgus vociferus*), purple finches (*Carpodacus purpureus*), and numerous hawk species.

In 2003, the New Hampshire Audubon Society recognized the Hampton-Seabrook Estuary as an Important Bird Area due to the extensive area of unfragmented marsh habitat that it provides to migratory shorebirds and birds that breed in salt marshes. During a 2006–2007 bird survey (McKinley and Hunt 2008), the New Hampshire Audubon recorded observations of bird use of the estuary from July through November 2006 and May through September 2007 over multiple locations throughout the estuary. During the survey, 23 species of migratory shorebirds were recorded, and an estimated 3,000 to 3,500 individual birds used the estuary between late July and late September, the peak migration period for this area. The semipalmated plover (*Charadrius semipalmatus*) and semipalmated sandpiper (*Calidris pusilla*) were the most abundant species and accounted for approximately one-third of the total individuals. Black-bellied plovers (*Pluvialis squatarola*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs

(*T. flavipes*), least sandpipers (*C. minutilla*), and short-billed dowitcher (*Limnodromus griseus*) were considered common, but not as abundant as the semipalmated plover or semipalmated sandpiper. The saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*) was the most common saltmarsh breeding bird identified during the survey, but this species does not regularly inhabit any of the marsh areas adjacent to the Seabrook site. The North Flats survey site, which is adjacent and to the east of the Seabrook site, contains large exposed flats, mussel flats, and peat banks with *Spartina* species. It is used as a roost site by black-bellied plovers, dunlins (*Calidris alpina*), and short-billed dowitchers and a foraging area by whimbrels (*Numenius phaeopus*), short-billed dowitchers, and willets (*T. semipalmata*) (McKinley and Hunt 2008).

Over 58 ac (23 ha) on the Seabrook site, split into 11 parcels, are legally preserved through conservation easements with the Society for Protection of New Hampshire Forests, the Audubon Society of New Hampshire, or the New Hampshire Fish and Game Department (NHFGD). The land in easement is composed primarily of salt marsh or other unspecified marsh type. The Seabrook site also contains a 1-mi (0.6-km) hiking trail that surrounds the Seabrook Science and Nature Center. The trail and nature center are located adjacent to the developed portion of the site. New Hampshire Nature Conservancy ecologists have identified four State-listed threatened plant species—salt marsh gerardia (*Agalinis maritime*), Missouri rock-cress (*Boechera missouriensis*), hackberry (*Celtis occidentalis*), and the American plum tree (*Prunus americana*)—and one State-listed critically imperiled plant species—the orange horse-gentian (*Triosteum aurantiacum*)—within areas surrounding the trail.

3.2 Aquatic Action Area

The aquatic action area consists of the area affected by intake and discharge of cooling water. In connection with a previously concluded ESA Section 7 consultation for the proposed Seabrook license renewal, the National Marine Fisheries Service (NMFS) (2012) determined the aquatic action area to include:

> the intake area and the region within the Gulf of Maine where effects of the thermal plume are experienced. At the surface, the thermal plume has dissipated a distance of 500 meters. At the bottom, measurements have not been made to determine the exact distance at which the plume is no longer detectable; however, at a distance of 5 miles from the outfall, there are no differences in temperature from ambient… [A]ll direct and indirect effects to listed species are limited to the area where increased water temperatures are experienced; thus, the action area is also limited to this area.

Section 2.2.6 of the FSEIS (NRC 2015a) describes the aquatic environment in the vicinity of Seabrook in detail. Additional information on the aquatic environment is also available in the NMFS's October 10, 2012, letter of concurrence with the NRC's determination that the proposed license renewal is not likely to adversely affect any federally listed species under the NMFS's jurisdiction (NMFS 2012).

4.0 Federally Listed Species Considered

Four species under the FWS's jurisdiction have the potential to occur within the action area (FWS 2018a):

- northern long-eared bat (*Myotis septentrionalis*) (FT),

- rufa red knot (*Calidris canutus rufa*) (FT),
- piping plover (*Charadrius melodus*) (FT), and
- roseate tern (*Sterna dougallii dougallii*) (FE).[1]

The FWS listed the northern long-eared bat and rufa red knot after the NRC staff completed its environmental review. Thus, the NRC staff has not yet considered the potential effects of license renewal specifically on these species. The following sections describe these species' distributions, population trends, and relevant life history information. The staff also makes conclusions in these sections as to whether or not each species may occur in the action area given the available information.

The NRC previously consulted with the FWS regarding the piping plover and the roseate tern.[2] The following sections of this evaluation address these species briefly with an emphasis on whether new or updated information exists since the previous consultation concluded.

4.1 Northern Long-Eared Bat

The FWS listed the northern long-eared bat as threatened throughout its range in 2015 (80 FR 17974). In 2016, the FWS determined that designating critical habitat for the species was not prudent because such designation would increase threats to the species resulting from vandalism and disturbance and could potentially increase the spread of white-nose syndrome (81 FR 24707). Information in this section is organized according to the description of the species in the FWS's *Federal Register* notice associated with the final rule to list the species (80 FR 17974) and is drawn from this source unless otherwise cited.

Taxonomy and Species Description

Although there have been few genetic studies on the northern long-eared bat, the FWS describes it as a monotypic species (i.e., having no subspecies). This species has been recognized by different common names, including Keen's bat, northern Myotis, and the northern bat.

The northern long-eared bat is a medium-sized bat that is distinguished from other *Myotis* species by its long ears, which average 0.7 in. (17 mm) in length. Adults weigh 5 to 8 g (0.2 to 0.3 oz), and females tend to be slightly larger than males. Individuals are medium to dark brown on the back; dark brown on the ears and wing membranes, and tawny to pale-brown on the ventral side. Within its range, the northern long-eared bat can be confused with the little brown bat (*Myotis lucifugus*) or the western long-eared myotis (*M. evotis*).

Distribution and Relative Abundance

Species Range. The northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to

[1] FE = federally endangered and FT = federally threatened under the ESA.
[2] Appendix B contains a summary of this consultation and references to relevant agency correspondence.

the southern Northwest Territories and eastern British Columbia. Its range includes 37 U.S. states. The species is widely distributed within the eastern portion of its range, which includes Delaware, Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Vermont, Virginia, West Virginia, New York, Rhode Island, and the District of Columbia. Prior to documentation of white nose syndrome, northern long-eared bats were consistently captured during summer mist-net and acoustic surveys within this region. However, as white nose syndrome has spread, growing gaps exist within the eastern region where bats are no longer being captured or detected, and in other areas, occurrences are sparse. Frick et al. (2015) documented the local extinction of northern long-eared bats from 69 percent of 468 sites where white nose syndrome has been present for at least four years in Vermont, New York, Pennsylvania, Maryland, West Virginia, and Virginia, which was by far the highest extinction rate among six species of North American hibernating bats considered during the study. Figure 6 depicts the range of the northern long-eared bat.

Status within New Hampshire. Within New Hampshire, the FWS reports 11 currently occupied northern long-eared bat hibernacula, and individuals have also been captured during summer surveys (80 FR 17974). Prior to white nose syndrome being detected in the state (winter 2008–2009), northern long-eared bat was the most common bat species captured in summer surveys in White Mountain National Forest, which lies approximately 100 mi (160 km) northeast of the Seabrook site, in a 1993–1994 study (Sasse and Pekins 1996). In its comments on the species' listing, the NHFGD (2013) stated that although New Hampshire is 82 percent forested and provides an abundance of suitable habitat, data from hibernacula and summer surveys indicate a 99 percent decline in the northern long-eared bat population within the state. The FWS reports that four New Hampshire hibernacula that were previously each occupied by 75 to 127 individuals were all determined vacated in a 2014 hibernacula survey (80 FR 17974). In addition, Moosman et al. (2013) documented a 98 percent decline in capture rates of northern long-eared bats in mist-net surveys over a 7-year pre- and post-white nose period (2005–2011).

Nevertheless, in a 2015 biological assessment associated with the northern long-eared bat final ESA Section 4(d) rule, the FWS (2015a) makes the following estimates related to New Hampshire's northern long-eared bat population:

- 17,160 total adults
- 8,580 total pups
- 429 maternity colonies of an average size of 20 individuals
- 9.8 percent occupancy of the State's available forested habitat

In Rockingham County, the NHFGD's *Wildlife Action Plan* states that data from the county comes from one site and includes just a few individuals. Most summer records of the species within the state are from White Mountain National Forest and northern Cheshire County, although a few occurrences in Merrimack and Hillsborough Counties have been documented as well (NHFGD 2015). Figure 7 depicts the known distribution of northern long-eared bats in New Hampshire.

Habitat

Winter Habitat. Northern long-eared bats predominantly overwinter in hibernacula of various sizes that include underground caves and abandoned mines. Preferred hibernacula have relatively constant, cool temperatures with very high humidity and no air currents. Individuals most often roost in small crevices or cracks in cave or mine walls or ceilings but are also infrequently observed hanging in the open. Less commonly, northern long-eared bats overwinter in abandoned railroad tunnels, storm sewers, aqueducts, attics, and other non-cave or mine hibernacula with temperature, humidity, and air flow conditions resembling suitable caves and mines. The NHFGD (2015) reports that most bats in New Hampshire fly to Vermont, Massachusetts, or New York in the winter due to lack of hibernacula with suitable humidity levels.

Summer Habitat. In summer, northern long-eared bats typically roost individually or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and nonreproductive females may also roost in cooler locations, including caves and mines. Individuals have also been observed roosting in colonies in buildings, barns, on utility poles, and in other man-made structures. The species has been documented to roost in many species of trees, including black oak, northern red oak, silver maple (*Acer saccharinum*), black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sugar maple (*A. saccharum*), sourwood (*Oxydendrum arboreum*), and shortleaf pine (*Pinus echinata*). Foster and Kurta (1999) found that rather than being dependent on particular tree species, northern long-eared bats are likely to use a variety of trees as long as they form suitable cavities or retain bark. Owen et al. (2002) found that tree-roosting maternal colonies chose roosting sites in larger trees that were taller than the surrounding stand and in areas with abundant snags. Carter and Feldhamer (2005) indicate that resource availability drives roost tree selection more than the actual tree species. However, a number of studies have shown that the species more often roosts in shade-tolerant deciduous trees rather than conifers. Additionally, the FWS concludes in its final listing that the tendency for northern-long eared bats to use healthy live trees for roosting is fairly low.

Northern long-eared bats actively form colonies in the summer, but such colonies are often in flux because members will frequently depart to be solitary or to form smaller groups and later return to the main unit. This behavior is described as “fission-fusion,” and it also results in individuals often switching tree roosts (typically every two to three days). Roost trees are often close to one another within the species’ summer range with various studies documenting distances between trees ranging from 20 ft (6.1 m) to 2.4 mi (3.9 km).

Spring Staging. Spring staging is the time period between winter hibernation and spring migration to summer habitat when bats begin to gradually emerge from hibernation. Individuals will exit the hibernacula to feed, but re-enter the same or alternative hibernacula to resume periods of physical inactivity. The staging period is believed to be short for the northern long-eared bat and may last from mid-March through early May with variations in timing and duration based on latitude and weather.

Fall Swarming. Fall swarming is the time period between the summer and winter seasons and includes behaviors such as copulation, introduction of juveniles to hibernacula, and stop-overs at sites between summer and winter regions. Both males and females are present together at swarming sites, and other bat species are often

present as well. For northern long-eared bats, the swarming period may occur between July and early October, depending on latitude within the species' range. Northern long-eared bats may use caves and mines during swarming. Little is known about roost tree selection during this period, but some studies suggest that a wider variation in tree selection may occur during swarming than during the summer.

Roost Trees. Northern long-eared bats roost in cavities, crevices, hollows, or under the bark of live and dead trees and snags of greater than 3 in. (8 cm) diameter at breast height. Isolated trees may be considered suitable habitat when they exhibit these characteristics and are less than 1,000 ft (300 m) from the next nearest suitable roost tree within a wooded area. Northern long-eared bats appear to choose roost trees based on structural suitability rather than exhibiting a preference for specific species of trees.

Biology

Hibernation. Northern long-eared bats hibernate during winter months. Individuals arrive at hibernacula in August or September, enter hibernation in October and November, and emerge from hibernacula in March or April. The species has shown a high degree of repeated hibernaculum use, although individuals may not return to the same hibernacula in successive seasons. Northern long-eared bats often inhabit hibernacula in small numbers with other bat species, including little brown bats, big brown bats (*Eptesicus fuscus*), eastern small-footed bats (*Myotis leibii*), tri-colored bats (*Perimyotis sub*flavus), and Indiana bats (*M. sodalis*). Northern long-eared bats have been observed moving among hibernacula during the winter hibernation period, but individuals do not feed during this time, and the function of this behavior is not well understood.

Migration and Homing. Northern long-eared bats migrate relatively short distances (between 56 and 89 km (35 and 55 mi)) from summer roosts and winter hibernacula. The spring migration period typically occurs from mid-March to mid-May, and fall migration typically occurs between mid-August and mid-October.

Reproduction. Northern long-eared bats mate from late July in northern regions to early October in southern regions. Hibernating females store sperm until spring, and ovulation takes place when females emerge from hibernacula. Gestation is estimated to be 60 days, after which time females give birth to a single pup in late May or early June. Females raise their young in maternity colonies, which generally consist of 30 to 60 individuals (females and young). Roost tree selection changes depending on reproductive stage with lactating females roosting higher in tall trees with less canopy cover. Young are capable of flight as early as three weeks following birth. In New Hampshire, sub-adults have been captured as early as July (Sasse and Pekins 1996). Maximum lifespan for northern long-eared bats is estimated to be up to 18.5 years, and the highest rate of mortality occurs during the juvenile stage.

Foraging Behavior. Northern long-eared bats are nocturnal foragers that use hawking and gleaning in conjunction with passive acoustic cues to collect prey. The species' diet includes moths, flies, leafhoppers, caddisflies, beetles, and arachnids. Individuals forage 1 to 3 m (3 to 10 ft) above the ground between the understory and canopy of forested hillsides and ridges with peak foraging activity occurring within five hours after sunset.

Home Range. Northern long-eared bats exhibit site fidelity to their summer home range, during which time individuals roost and forage in forests. Studies indicate a variety of home range sizes—from as little as 8.6 ha (21.3 ac) to as large as 172 ha (425 ac). Some studies indicate differences in ranges between sexes, while others find no significant differences.

Factors Affecting the Species

The FWS identifies white nose syndrome, a disease caused by the fungus *Pseudogymnoascus destructans* that affects hibernating bats, to be the predominant threat to this species' continued existence. Other factors include human disturbance of hibernacula and loss of summer habitat due to forest conversion and forest management.

Occurrence within the Action Area

As previously described, the action area contains approximately 300 ac (120 ha) of upland forest habitat, including hardwood-red cedar, oak-hickory, and hardwood-conifer communities. These areas likely provide suitable habitat for northern long-eared bats, although no specific assessment has been made of the extent or quality of such habitat in the action area nor have any known roost trees been identified in the action area. However, given the general habitat requirements of this species and the large amount of forested habitat within the action area, the NRC staff conservatively assumes that suitable habitat to varying degrees is present throughout the action area. No known hibernacula are present.

No surveys have been conducted for northern long-eared bats within the action area, and NextEra (2018) reports no known occurrences of the species on the Seabrook site. However, given the likely presence of suitable habitat, the NRC staff conservatively assumes that the species may be present year-round in the action area. However, if present, the species is likely to occur rarely or occasionally and in low numbers due to the limited numbers reported by the NHFGD for Rockingham County and the prevalence of white nose syndrome within the region.

4.2 Rufa Red Knot

The FWS listed the rufa red knot as threatened wherever found effective in 2015 (79 FR 73706). The FWS has not designated critical habitat for the species. Information in this section is organized according to the description of the species in the FWS's *Federal Register* notice associated with the proposed rule to list the species (78 FR 60024) and is drawn from this source or the FWS's *Federal Register* notice for the final rule (79 FR 73706) unless otherwise cited.

Taxonomy and Species Description

The FWS recognizes six subspecies of red knot (*Calidris canatus)*, of which the rufa red knot (*C. canatus rufa*)[3] is one, and each subspecies is believed to occupy a distinct breeding area in various parts of the Arctic. The rufa red knot is a medium-sized (9 to 11 in. (23 to 28 cm) in length) shorebird in the sandpiper family. Adult females on

[3] In this assessment, the term "red knot" refers to the rufa red knot subspecies, *Calidris canatus rufa*, unless otherwise specified.

wintering grounds weigh 124.2 g (4.4 oz) on average, while males weigh 115.7 g (4.1 oz) on average, although individuals can nearly double their weight prior to migration. Plumage on the head, back, and wings are mottled gray, brown, and white, while the face, chest, and belly feathers are red.

Red knots migrate annually between breeding grounds in the Canadian Arctic and several wintering regions, including the Southeastern United States, Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego off the coast of the southern tip of South America. Between both its spring and fall migrations, red knots use key staging and stopover areas to rest and feed.

Breeding

Red knots live up to 7 years (Niles et al. 2008) and likely begin breeding at 2 years (Harrington 2001). The species breeds in June in inland areas near arctic coasts and nests in dry, slightly elevated tundra areas. Breeding success can vary dramatically from year to year based on weather, food availability (insects and other terrestrial invertebrates), and predator (the arctic lemmings *Dicrostonyx torquatus* and *Lemmus sibericus*) abundance. Little information is available on mating fidelity, but the species is known to return to the same breeding grounds each year, and pairs seem to form monogamous bonds throughout the breeding season (Niles et al. 2008). Females lay one clutch of three to four eggs per season. Males and females participate in egg incubation, which lasts for approximately 22 days (Niles et al. 2008). Chicks are born in early July, and the fledgling period lasts 18 days (Niles et al. 2008).

Wintering

Red knots occupy wintering habitat from December to February but may be present in wintering areas as early as September or as late as May. Wintering areas include southeastern United States from Florida to North Carolina, northeastern Gulf of Mexico, northern Brazil, and Tierra del Fuego in southern South America (FWS 2013). Smaller numbers winter in the Caribbean and along the central Gulf coast (Alabama and Mississippi), the mid-Atlantic, and the Northeast United States (FWS 2013). Little information is available on where juveniles spend the winter months, and at least partial segregation between juveniles and adults may occur.

Migration

Red knots migrate up to 19,000 mi (30,000 km) each year—one of the longest migrations known in the animal kingdom—and individuals can undertake flights of several thousand miles without stopping. Figure 8 depicts known stopover areas, and Figure 9 depicts the species' fall and spring migration routes, breeding, and wintering areas.

Northbound migration primarily occurs in February, and stopover areas include the Atlantic coast of Argentina, eastern and northern Brazil, the Virginia barrier islands, and the Delaware Bay. The Delaware Bay is an especially important staging areas for the species. Almost the entire population of red knots uses the region during northbound migration over a two- to three-week period in late May (Niles et al. 2008). However, red knots may occur in varying numbers all along the Atlantic and Gulf coasts from Argentina to Massachusetts in areas of suitable habitat.

Southbound migration occurs from mid-July through August. Important stopover sites include southwest Hudson Bay, James Bay, the St. Lawrence River, the Mingan Archipelago, and the Bay of Fundy, the coasts of Massachusetts and New Jersey, the mouth of the Altamaha River in Georgia, the Caribbean, and the northern coast of South America from Brazil to Guyana.

Stopover Habitat

During migration, red knots use coastal marine and estuarine habitats with large areas of exposed intertidal sediments; ocean- or bay-front areas; and tidal flats in more sheltered bays and lagoons (FWS 2014b; Harrington 2001). Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats; these include sand spits, islets, shoals, and sandbars (Harrington 2008). Red knots primarily migrate in close proximity to the coast, although small numbers are reported annually across the interior of the United States. Red knots exhibit some stopover site fidelity in areas where abundant food resources are consistently available from year to year (FWS 2013).

High-quality roosting habitat is a limiting factor during migration and influences selected stopover sites. Red knots require roosts that provide sufficient distance from high tide, are close to feeding areas, protected from predators, and free from excessive human disturbance. Red knots often choose supra-tidal areas of sandy inlets for roosting.

Diet

The red knot is a specialized molluscivore that primarily eats hard-shelled mollusks, although it may supplement its diet with shrimp, crabs, marine worms, insects, seeds, and vegetable matter. Primary food sources during migration include bivalves, gastropods, amphipods, and occasionally polychaetes (Niles et al. 2008). From the east coast specifically, a variety of prey items have been reported, including blue mussel (*Mytilus edulis*), gem clams (*Gemma gemma*), horseshoe crab (*Limulus polyphemus*) eggs, and amphipods (FWS 2013). On breeding grounds, the red knot diet consists primarily of insects and other terrestrial invertebrates (Harrington 2001).

Abundance

The red knot population declined sharply in the late 1800s and early 1900s. Following hunting restrictions, the population recovered to 100,000 to 150,000 individuals by the 1990s, and the population has since declined again (NatureServe 2017). Survey data from the Tierra del Fuego wintering area and the Delaware Bay spring stopover site suggest a 75 percent decline in the population since surveys began in the 1980s. Survey data from other areas, including the Virginia barrier islands spring stopover site, show no trend since the mid-1990s. NatureServe (2017) reports that the current population is between 18,000 and 33,000 individuals.

The available literature suggests that migrating red knots are not common in New Hampshire (FWS 2013, 2014b; Niles et al. 2008, 2010). The primary stopover and staging areas within the Northeast are south of New Hampshire along the New Jersey, New York, and Massachusetts coastlines. Within New Hampshire, the Audubon Society has reported no more than 50 red knots being observed in any one place between the years of 1986 and 2004 (Niles et al. 2008).

Factors Affecting the Species

Many of the factors that the FWS attributes to the red knot's decline are related to climate change. Such factors include habitat loss from sea level rise and shoreline erosion; asynchronies in the timing of the species' annual cycle; and changes in storm frequency, intensity, and timing at key stopover areas. In the Northeast, Cape Cod, Long Island, and most of coastal New Jersey are particularly susceptible to increasing shoreline erosion associated with sea level rise and increased storm frequency and intensity. Overharvesting and related population decline of horseshoe crabs, whose eggs serve as a critical red knot food source during migration, may also be contributing to the red knot's decline (NatureServe 2017).

Occurrence within the Action Area

As described above, red knots are not commonly observed in New Hampshire and little information is available on the species' use of nearby areas. However, Niles et al. (2008) reports that red knots make intermittent use of Hampton Harbor and Seabrook Harbor, which lie directly east of the action area along the Atlantic coast, as well as White Island, which lies approximately 11 mi (18 km) northeast of the action area in the Atlantic Ocean. When present, the species would use these areas at low tide.

No surveys have been conducted for red knots within the action area, and NextEra (2018) reports no known occurrences of the species on the Seabrook site. However, because of the proximity to known red knot occurrences, the NRC staff assumes that the red knot may use suitable habitat within the action area during its spring and fall migrations. Suitable habitat would include the tidal marsh to the east of Seabrook and the various areas of wet meadow, shrub wetland, brackish marsh, and intertidal flats within the site footprint, which total approximately 600 ac (240 ha). If present, the red knot would occur in low numbers because the species' predominant migratory stopover and staging sites lie south of New Hampshire.

4.3 Piping Plover and Roseate Tern

The piping plover and roseate tern are known to occur along the coastal beaches and oceanic waters east of Seabrook but are unlikely to occur on or in the immediate vicinity of the Seabrook site (FWS 2010a; NRC 2015a). Although the piping plover is known to breed and nest on the beaches of Hampton and Seabrook, New Hampshire, no suitable nesting or foraging habitat for either species exists within the Seabrook action area itself. Accordingly, although the piping plover and roseate tern occur in the region, the presence of either species in the action area would be transient and occasional if present at all.

Information related to the distribution, population trends, and life histories of each species can be found in Section 2.2.8.2.1 of the FSEIS (NRC 2015a). The NRC staff has not identified any new or updated information related to these species and relevant to the proposed action since the NRC's previous consultation with the FWS in 2010. The applicant (NextEra 2018) has also confirmed that it has not identified any new information related to either of these species.

4.4 Summary of Potential Species Occurrence in the Action Area

Table 2 below summarizes the potential for each of the listed species to occur in the action area.

Table 2. Potential Occurrences of Federally Listed Species in the Action Area

	Northern Long-Eared Bat	Rufa Red Knot	Piping Plover	Roseate Tern
Type of occurrence in New Hampshire	resident	transient migrant	breeding and nesting	breeding and nesting
Potential period of occurrence (if present)	year-round, although likely to hibernate outside of New Hampshire October through March	February and mid-July through August	April through July	late April through early September
Likelihood of occurrence in action area	Rare to occasional presence possible in forested areas	Occasional presence possible at low tide	Seasonal presence likely along coast	Seasonal presence likely along coast

5.0 Proposed Action Effects Analysis

This section describes the potential direct, indirect, interrelated, and interdependent effects of the proposed action—the NRC's decision of whether to issue a renewed license that would authorize NextEra to continue to operate Seabrook for an additional 20 years—on northern long-eared bat and red knot. In order to evaluate potential effects, the NRC staff first considers whether each species will be exposed to proposed action-related stressors. If exposure is likely, the NRC staff then evaluates how the exposed individuals are likely to respond.

5.1 Direct and Indirect Effects

5.1.1 Northern Long-Eared Bat

In Section 4.1, the NRC staff concludes that the northern long-eared bat has the potential to rarely or occasionally occur in the action area throughout the year in low numbers.

The potential stressors to northern long-eared bats that could result from operation of a nuclear plant (generically) are as follows.

- Mortality or injury from collisions with plant structures and vehicles
- Habitat loss, degradation, disturbance, or fragmentation, and associated effects
- Behavioral changes resulting from refurbishment and other site activities

Mortality or Injury from Collisions with Plant Structures and Vehicles

A number of studies have documented bat mortality or injury resulting from collisions with man-made structures. Saunders (1930) reported that five bats (of the species eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), and silver-haired bat (*Lasionycteris noctivagans*)) were killed when they collided with a lighthouse in Ontario, Canada. In Kansas, Van Gelder (1956) documented five eastern red bats that collided with a television tower. In Florida, Crawford and Baker (1981) collected 54 bats of seven species that collided with a television tower over a 25-year period; Zinn and Baker (1979) reported 12 dead hoary bats at another television tower in the state over an 18-year period; and Taylor and Anderson (1973) reported one dead yellow bat (*Lasiurus intermedius*) at a third Florida television tower. Bat collisions have been reported with communications towers in North Dakota, Tennessee, and Saskatchewan, Canada; with convention center windows in Chicago, Illinois; and with power lines, barbed wire fences, and vehicles (Johnson and Strickland 2003). More recently, bat collisions with wind turbines have been of concern in North America. Bat fatalities have been documented at most wind facilities throughout the United States and Canada (USGS 2015). For instance, during a 1996–1999 study at the Buffalo Ridge wind power development project in Minnesota, Johnson et al. (2003) reported 183 bat fatalities, most of which were hoary bats and eastern red bats. The U.S. Geological Survey's Fort Collins Science Center estimates that tens to hundreds of thousands of bats die at wind turbines in North America each year (USGS 2015).

Bat collisions with man-made structures at nuclear power plants are not well documented but are likely to be rare based on the available information. In an assessment of the potential effects of Davis-Besse Nuclear Power Station license renewal on northern long-eared bats, the NRC (2014) noted that four dead bats were collected at the plant during bird mortality studies conducted from 1972–1979. Two red bats (*Lasiurus borealis*) were collected at the cooling tower in 1974, and one big brown bat and one tri-colored bat were collected near other plant structures in 1973 and 1974, respectively. The NRC (2014) found that future collisions of bats would be extremely unlikely and, therefore, discountable given the small number of bats collected in the 1972–1979 study and the marginal suitable habitat that the Davis-Besse site provides. The FWS (2014a) concurred with this determination. In a 2015 assessment associated with Indian Point Nuclear Generating Units 2 and 3, the NRC (2015b) determined that bat collisions were less likely to occur at Indian Point than at Davis-Besse because Indian Point does not have cooling towers or similarly large obstructions. The tallest structures on that site are 134-ft (40.8-m)-tall turbine buildings and 250-ft (76.2-m)-tall reactor containment structures. The NRC (2015b) concluded that the likelihood of collision with these and other plant structures that could result in injury or mortality to bats during the license renewal period was extremely unlikely to occur and, therefore, discountable. The FWS (2015b) concurred with this determination. Similarly, Seabrook does not have cooling towers. The tallest structure on the site are the 199-ft (61-m)-tall containment structure and 103-ft (31-m)-tall turbine and heater bay building north of the containment building (NRC 2015a). NextEra (2018) reports no records of injury or mortality of any species of bat on the Seabrook site associated with site buildings or structures. Accordingly, the NRC staff finds the likelihood of future northern long-eared bat collisions with site buildings or structures to be extremely unlikely and, therefore, discountable.

Vehicle collision risk for bats varies depending on time of year, location of roads and travel pathways in relation to roosting and foraging areas, the characteristics of individuals' flight, traffic volume, and whether young bats are dispersing. Although collision has been documented for several species of bats, the Indiana Bat Draft Recovery Plan (FWS 2007) indicates that bat species do not seem to be particularly susceptible to vehicle collisions. However, the FWS (2016) also finds it difficult to determine whether roads pose a greater risk for bats colliding with vehicles or a greater likelihood of deterring bat activity, thus decreasing risk of collision. In most cases, the FWS (2016) expects that roads of increasing size decrease the likelihood of bats crossing the roads and, therefore, reduce collision risk. In the case of the proposed license renewal, vehicle traffic from truck deliveries, site maintenance activities, and staff commuting to and from the site would continue throughout the license renewal period as they have during the current licensing period. Vehicle use would occur primarily in areas that northern long-eared bats would be less likely to frequent, including on established county and State roads or within industrial-use areas of the Seabook site. Additionally, most vehicle activity would occur during daylight hours when the northern long-eared bat is less active. NextEra (2018) reports no records of injury or mortality of any species of bat on the Seabrook site associated with vehicle collisions. Accordingly, the NRC staff finds the likelihood of future northern long-eared bat collisions with vehicles to be extremely unlikely and, therefore, discountable.

Habitat Loss, Degradation, Disturbance, or Fragmentation, and Associated Effects

In its final rule listing the northern long-eared bat (80 FR 17974), the FWS states that forest conversion and forest modification from management are two of the most common causes of habitat loss, degradation, disturbance, or fragmentation affecting the species. Forest conversion is the loss of forest to another land use type, such as cropland, residential, or industrial. Forest conversion can affect bats in several ways, including:

- Loss of suitable roosting or foraging habitat;
- Fragmentation of remaining forest patches, leading to longer flights between suitable roosting and foraging habitat;
- Removal of travel corridors, which can fragment bat colonies and networks; and
- Direct injury or mortality during active forest clearing and construction (80 FR 17974).

Forest management maintains forest habitat at the landscape level but includes practices that can have direct and indirect effects on bats. Impacts from forest management are typically temporary in nature and can include positive, neutral, and negative impacts, such as:

- Maintaining or increasing suitable roosting and foraging habitat within the species' home range (positive);
- Removing trees or small areas of forest outside of the species' summer home range or away from hibernacula (neutral);
- Removing potential roost trees within the species' summer home range (negative);

- Performing management activities near hibernacula that could disturb hibernating bats (negative); and

- Direct injury or mortality during forest clearing (negative) (80 FR 17974).

As previously described in Section 3.0, the action area includes approximately 300 ac (120 ha) of upland forest habitat. NextEra does not intend to expand the existing facilities or otherwise perform construction or maintenance activities within the site's forested areas during the proposed license renewal term (NextEra 2010; NRC 2015a). Accordingly, any potential spring staging, summer roosting, or fall swarming habitat would be unaffected by the proposed license renewal. The continued preservation of the existing forested areas on the site would result in positive impacts to the species, if present within or near the action area.

Behavioral Changes Resulting from Refurbishment and Other Site Activities

Construction or refurbishment and other site activities, such as site maintenance and infrastructure repairs, could prompt behavioral changes in northern long-eared bats. Noise and vibration and general human disturbance are stressors that may disrupt normal feeding, sheltering, and breeding activities (FWS 2016). At low noise levels or farther distances, bats initially may be startled but would likely habituate to the low background noise levels. At closer range and louder noise levels, particularly if accompanied by physical vibrations from heavy machinery, many bats would probably be startled to the point of fleeing from their day-time roosts. Fleeing individuals could experience increased susceptibility to predation and would expend increased levels of energy, which could result in decreased reproductive fitness (FWS 2016, Table 4.1). Increased noise may also affect foraging success. Schaub et al. (2003) found that foraging success of the greater mouse-eared bat (*Myotis myotis*) diminished in areas with noise mimicking the traffic sounds that would be experienced within 15 m (49 ft) of a highway.

Within the action area, noise, vibration, and other human disturbances could dissuade northern long-eared bats from using the existing upland forest habitat during migration, which could also reduce fitness of migrating bats. However, bats that use the action area have likely become habituated to such disturbance because Seabrook has been consistently operating for several decades. According to the FWS (2010b), bats that are repeatedly exposed to predictable, loud noises may habituate to such stimuli over time. For instance, Indiana bats (*Myotis sodalis*) have been documented as roosting within approximately 300 m (1000 ft) of a busy state route adjacent to Fort Drum Military Installation and immediately adjacent to housing areas and construction activities on the installation (U.S. Army 2014). Northern long-eared bats would likely respond similarly.

Continued operation of Seabrook during the proposed license renewal term would not include construction or refurbishment and would involve no other maintenance or infrastructure repair activities other than those routine activities already performed on the site. Levels and/or intensity of noise, lighting, and human activity associated with continued day-to-day activities and site maintenance during the proposed license renewal term would be similar to those that have been ongoing at the site since Seabrook began operating and would only occur on the developed, industrial-use portions of the site. While such disturbances during the proposed license renewal period could result in behavioral changes of migrating or summer roosting bats, such as the

expenditure of additional energy to find alternative suitable roosts, the NRC staff assumes that northern long-eared bats, if present in the action area, have already acclimated to regular site disturbances. Thus, continued disturbances during the license renewal term would not create effects that would be able to be meaningfully measured, detected, or evaluated and would never reach the scale where a take might occur.

Summary of Effects

The potential stressors evaluated in this section are unlikely to result in effects on the northern long-eared bat that could be meaningfully measured, detected, or evaluated or such stressors are otherwise unlikely to occur for the following reasons.

- Bat collisions with nuclear power plant structures in the United States are rare, and none have been reported at Seabrook. Vehicle collisions attributable to the proposed action are also unlikely, and none have been reported at Seabrook.

- The proposed action would not involve any construction, land clearing, or other ground-disturbing activities.

- Northern long-eared bats, if present in the action area, have likely already acclimated to the noise, vibration, and general human disturbances associated with site maintenance, infrastructure repairs, and other site activities. During the proposed license renewal term, such disturbances and activities would continue at current rates and would be limited to the industrial-use portions of the site.

Accordingly, all potential effects on the northern long-eared bat resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action **may affect, but is not likely to adversely affect** the northern long-eared bat.

5.1.2 Rufa Red Knot

In Section 4.1, the NRC staff concludes that the red knot has the potential to occasionally occur in the action area during the species' migratory periods of February and mid-July through August.

The potential stressors to red knots that could result from operation of a nuclear plant (generically) are the same as those assessed above for the northern long-eared bat and are as follows.

- Mortality or injury from collisions with plant structures and vehicles

- Habitat loss, degradation, disturbance, or fragmentation, and associated effects

- Behavioral changes resulting from refurbishment activities and other site activities

Mortality or Injury from Collisions with Plant Structures and Vehicles

The NRC (2013) generically assessed the impacts of bird collisions with plant structures at operating nuclear power plants in NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, Revision 1. In that report, the NRC

(2013) describes bird collision monitoring results at several nuclear power plants including Susquehanna Steam Electric Station in Salem Township, Pennsylvania; Beaver Valley Power Station in Shippingport, Pennsylvania; and Davis-Besse Nuclear Power Station in Oak Harbor, Ohio. The NRC (2013) staff found that natural draft cooling towers pose the largest collision threat on nuclear power plant sites when compared to mechanical draft cooling towers and other plant structures. The largest percentage of documented collision-related mortalities have occurred during the spring and fall migratory periods and have primarily involved songbirds migrating at night. As a result of its review, the NRC (2013) did not find reason to expect any incremental impact on bird populations from cooling tower collision mortality as a result of license renewal, and the NRC concluded that the collision risk on birds that would result from the continued operation of a nuclear power plant during the license renewal period would be small at all nuclear power plant sites. The risk of bird collision with mechanical draft cooling towers or plants with once-through cooling systems, such as Seabrook, was found to be negligible.

Few studies are available that investigate the likelihood of red knot collisions with man-made structures, and most of those studies are associated with wind energy facilities. For instance, in a model of red knot fatality rates associated with a yet-to-be-constructed offshore wind facility in Nantucket Sound, Massachusetts, Gordon and Nations (2016) predicted that 0.16 red knot fatalities per year (equivalent to one fatality every 6.25 years) would occur as a result of collision with facility structures. Turbine towers, which the model assumed to be 133.5 m (438.0 ft) tall, accounted for 90 percent of all collision fatalities in the modeled results. Given that wind turbines rotate, these structures would be inherently harder for red knots to avoid than the stationary buildings and structures found at the Seabrook site.

Since the red knots' listing, the NRC has consulted with the FWS regarding the red knot for two nuclear power plant license renewals: Davis-Besse and Fermi Nuclear Power Plant in Frenchtown, Michigan, both of which have natural draft cooling towers. In both cases, the NRC (2014, 2016) concluded that red knot collisions with plant structures were unlikely and that license renewal of each facility was not likely to adversely affect the species. The FWS (2014, 2015c) concurred with these determinations.

The NRC has identified no information that would indicate that red knot collisions with plant structures at Seabrook are likely during the proposed license renewal term. NextEra (2018) has no records of injury or mortality of any species of birds on the Seabrook site resulting from collision with site buildings or structures. Additionally, if present in the action area, red knots would be unlikely to frequent the industrial portions of the site where buildings or structures could pose a collision risk because suitable habitat does not exist in these areas. Accordingly, the NRC staff finds the likelihood of red knot collisions with site buildings or structures to be extremely unlikely and, therefore, discountable.

In its Federal Register notices associated with the red knot listing (79 FR 73706; 81 FR 24707), the FWS did not identify vehicle collision as a potential threat to the red knot, and the NRC has identified no information during its review that would indicate otherwise. Additionally, NextEra (2018) has no records of injury or mortality of red knots or other shorebirds on the Seabrook site associated with vehicle collisions. Accordingly, the NRC staff finds the likelihood of future red knot collisions with vehicles to be extremely unlikely and, therefore, discountable.

Habitat Loss, Degradation, Disturbance, or Fragmentation, and Associated Effects

As previously described in Section 3.0 of the evaluation, the action area includes approximately 600 ac (240 ha) of suitable red knot stopover habitat, including the tidal marsh to the east of Seabrook and the various areas of wet meadow, shrub wetland, brackish marsh, and intertidal flats within the site footprint. NextEra does not intend to expand the existing facilities or otherwise perform construction or maintenance activities within these areas during the proposed license renewal term (NextEra 2010; NRC 2015a). Accordingly, any potential red knot habitat would be unaffected by the proposed license renewal. The continued preservation of these areas during the proposed license renewal term would result in positive impacts to the species, if present within or near the action area.

Behavioral Changes Resulting from Refurbishment and Other Site Activities

Continued operation of Seabrook during the proposed license renewal term would not include construction or refurbishment and would involve no maintenance or infrastructure repair activities other than those routine activities already performed on the site. Levels and/or intensity of noise, lighting, and human activity associated with continued day-to-day activities and site maintenance during the proposed license renewal term would be similar to those that have been ongoing at the site since Seabrook began operating and would only occur on the developed, industrial-use portions of the site. Such disturbances are unlikely to affect migrating red knots because these disturbances would not occur near suitable stopover habitat within the action area.

Additionally, the NRC staff assumes that red knots, if present in the action area, have already acclimated to some amount of human activity given that the species migrates through highly populated coastal areas such that any minor disturbances that would be experienced as a result of the proposed action would not create additional or noticeable impacts on the species' behavior. Thus, continued disturbances during the license renewal term would not be able to be meaningfully measured, detected, or evaluated and would never reach the scale where a take might occur.

Summary of Effects

The potential stressors evaluated in this section are unlikely to result in effects on the red knot that could be meaningfully measured, detected, or evaluated or such stressors are otherwise unlikely to occur for the following reasons.

- Bird collisions with nuclear power plant structures in the United States are uncommon at sites with once-through cooling systems, such as Seabrook, and no bird collisions have been reported at Seabrook. Vehicle collisions attributable to the proposed action are also unlikely, and none have been reported at Seabrook.

- The proposed action would not involve any construction, land clearing, or other ground-disturbing activities.

- Red knots, if seasonally present in the action area, have likely already acclimated to the noise, vibration, and general human disturbances associated with site maintenance, infrastructure repairs, and other site activities. During the

proposed license renewal term, such disturbances and activities would continue at current rates and would be limited to the industrial-use portions of the site.

Accordingly, all potential effects on the red knot resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action **may affect, but is not likely to adversely affect** the rufa red knot.

5.1.3 Piping Plover and Roseate Tern

During the NRC's previous consultation with the FWS, the NRC determined that license renewal may affect, but is not likely to adversely affect the piping plover and roseate tern. The FWS (2010a) concurred with this determination in 2010. Appendix B summarizes the consultation and provides references to relevant agency correspondence. The NRC staff has not identified any new information that would change its previous conclusions regarding these species. The applicant (NextEra 2018) has also confirmed that it has not identified any new information related to either of these species. Accordingly, the NRC staff's conclusion that the proposed action **may affect, but is not likely to adversely affect** the piping plover and roseate tern remains unchanged.

5.2 Interrelated and Interdependent Effects

Interrelated actions are those actions that are part of a larger action and depend on the larger action for their justification (50 CFR 402.02). Interdependent actions are those actions that have no independent utility apart from the proposed action (50 CFR 402.02). The NRC staff has not identified any information that would indicate that there would be any interrelated or interdependent actions associated with the proposed action.

5.3 Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). When formulating biological opinions during formal ESA Section 7 consultation, the FWS and the NMFS consider cumulative effects when determining the likelihood of jeopardy or adverse modification. During informal consultation, a Federal agency need only consider cumulative effects under the ESA in the biological evaluation if listed species would be adversely affected by the proposed action and formal ESA Section 7 consultation is necessary (FWS 2014c). Because the NRC staff concluded earlier in this evaluation that the proposed license renewal is not likely to adversely affect the northern long-eared bat and red knot, consideration of cumulative effects is not necessary. Further, the NRC staff did not identify any actions within the action area that meet the definition of cumulative effects under the ESA.

6.0 Determination of Effects

Based on the foregoing analysis in Section 5.0 of this evaluation, the NRC staff finds that all potential impacts on the northern long-eared bat and red knot resulting from the proposed action would be insignificant or discountable. For the piping plover and roseate tern, the NRC staff did not identify any new information that would change its previous conclusion of may affect, but not likely to adversely affect, regarding these

species. Therefore, the NRC staff concludes that the proposed action may affect, but is not likely to adversely affect these four species. The staff's conclusions are identified below in Table 3.

Table 3. Effect Determinations for Federally Listed Species

Species	Common Name	Federal Status[a]	Effect Determination
Myotis septentrionalis	northern long-eared bat	FT	may affect, but is not likely to adversely affect
Calidris canutus rufa	rufa red knot	FT	may affect, but is not likely to adversely affect
Charadrius melodus	piping plover	FT	may affect, but is not likely to adversely affect
Sterna dougallii dougalli	roseate tern	FE	may affect, but is not likely to adversely affect

[a] FE = federally endangered and FT = federally threatened under the ESA.

7.0 References

References with Agencywide Documents Access and Management System (ADAMS) accession numbers can be accessed through the NRC's web-based ADAMS search engine at http://adams.nrc.gov/wba/. Click on the "Advanced Search" tab and choose the following criteria under Document Properties: "Accession Number" in the Property box, "is equal to" in the Operator box, and the ADAMS Accession Number of the document in the "Value" box.

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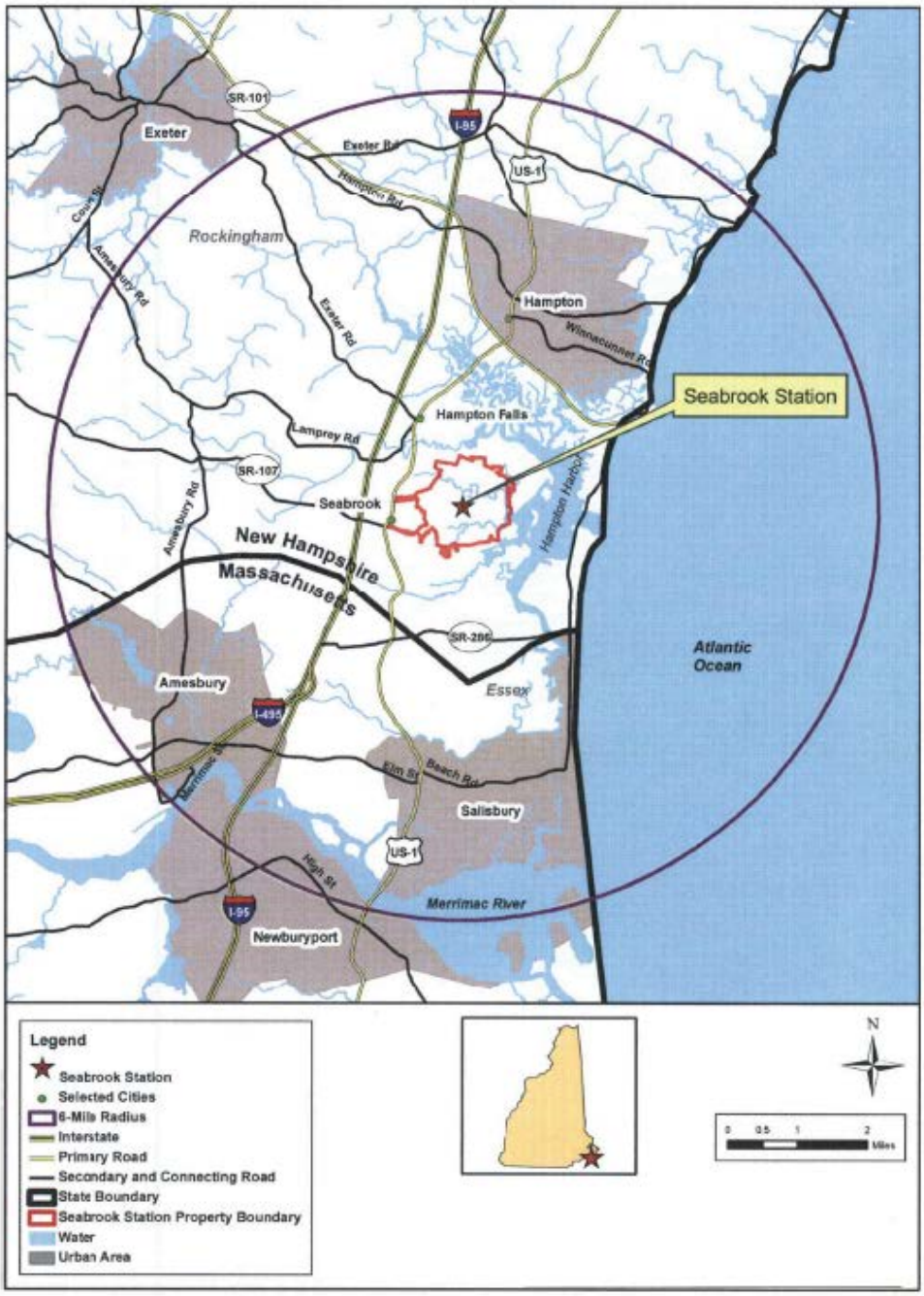
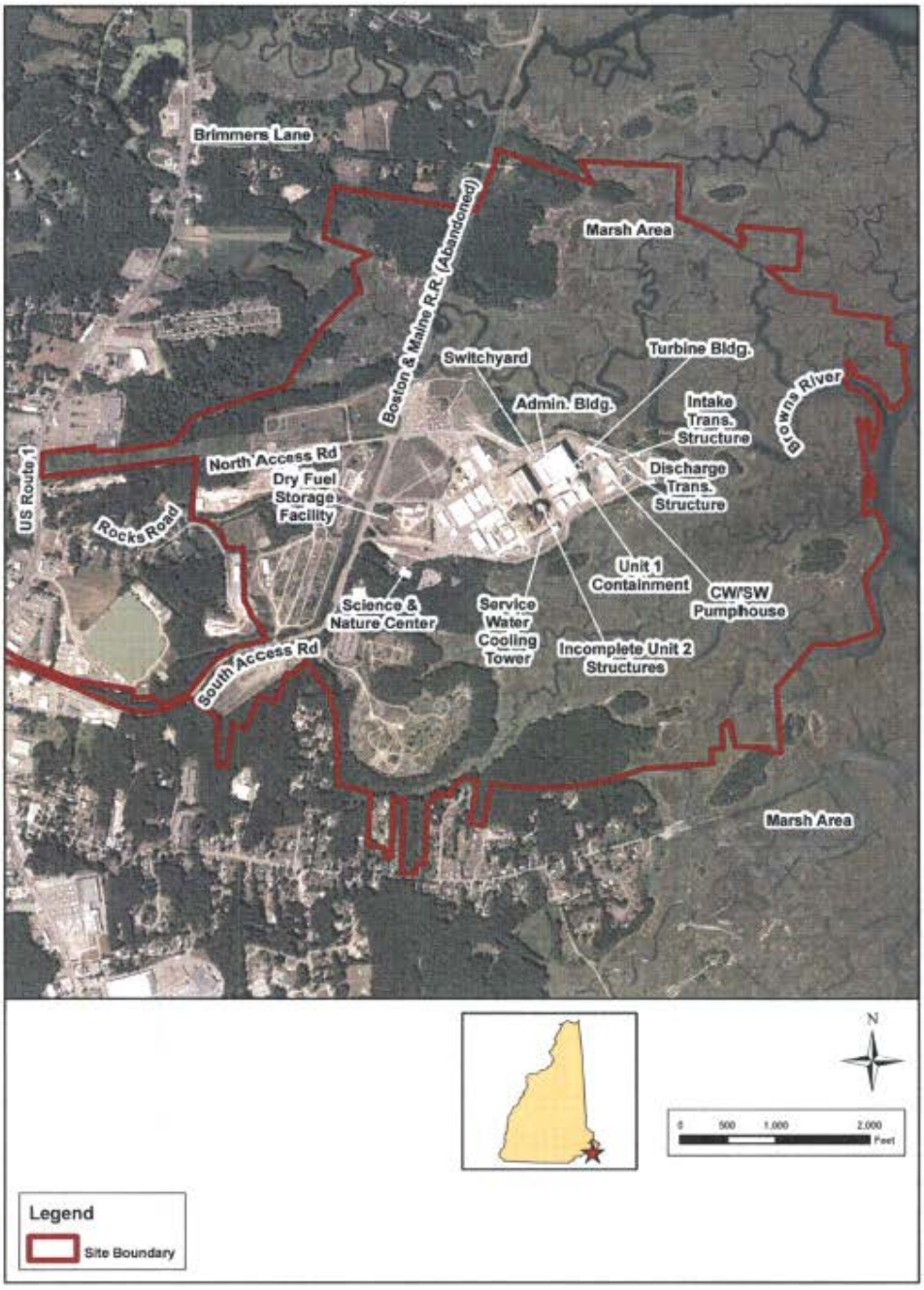
Appendix A. Figures

Figure 1. Seabrook and Surrounding 6-Mi (10-Km) Vicinity



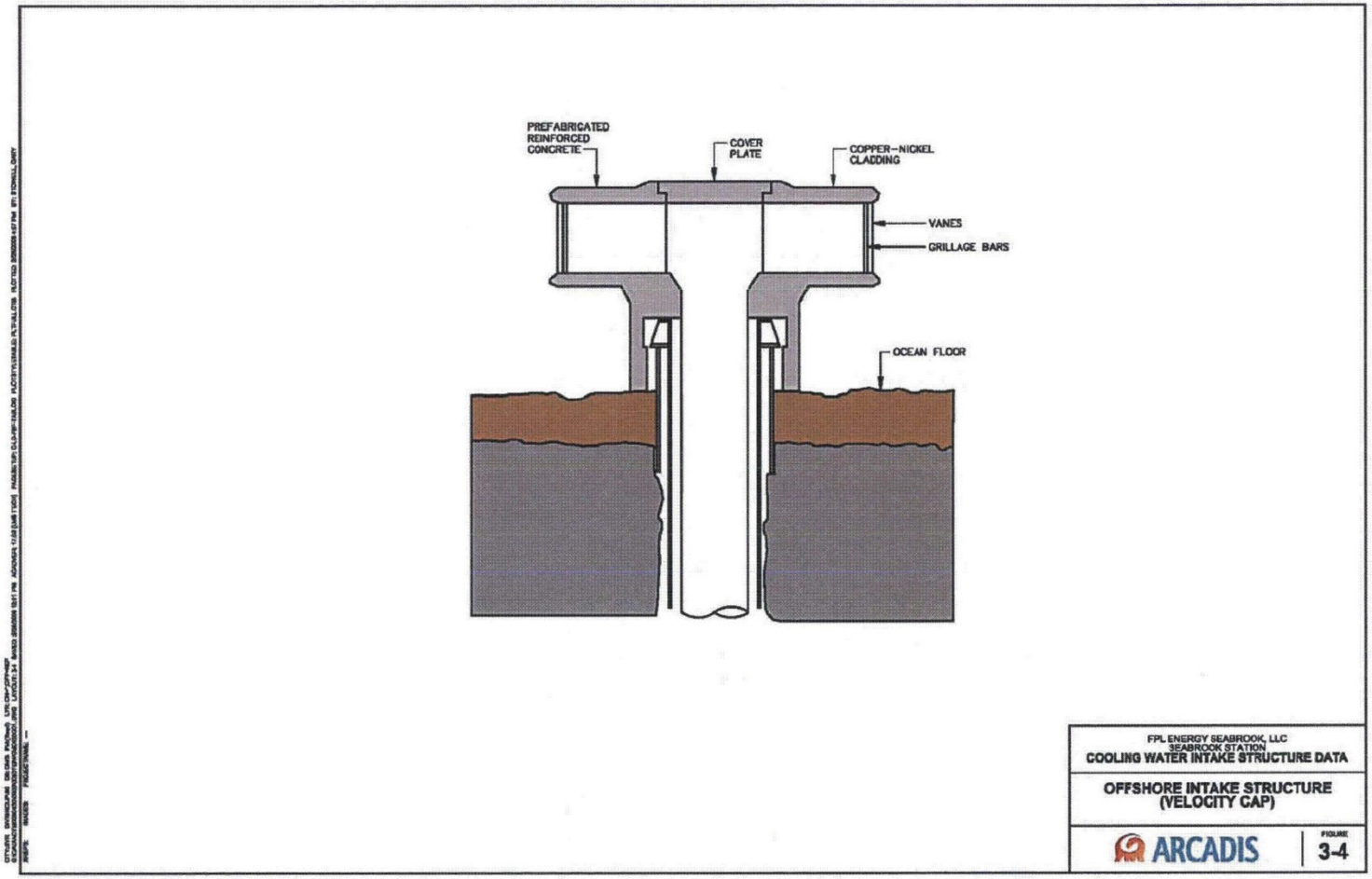
Source: NextEra 2010, Figure 2.1-1

Figure 2. Seabrook Site Boundary and Facility Layout



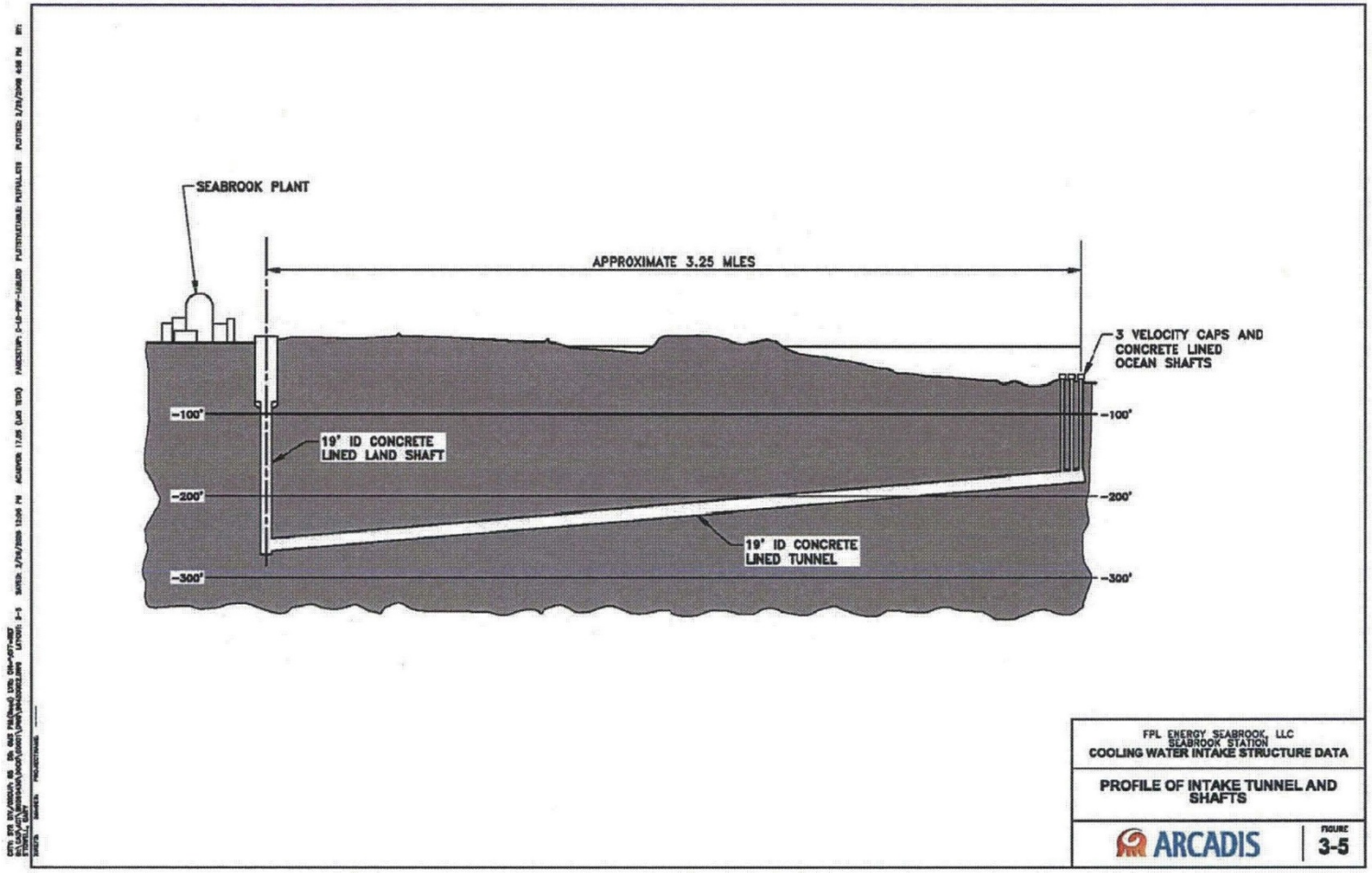
Source: NextEra 2010, Figure 2.1-3

Figure 3. Seabrook Intake Shafts and Caps



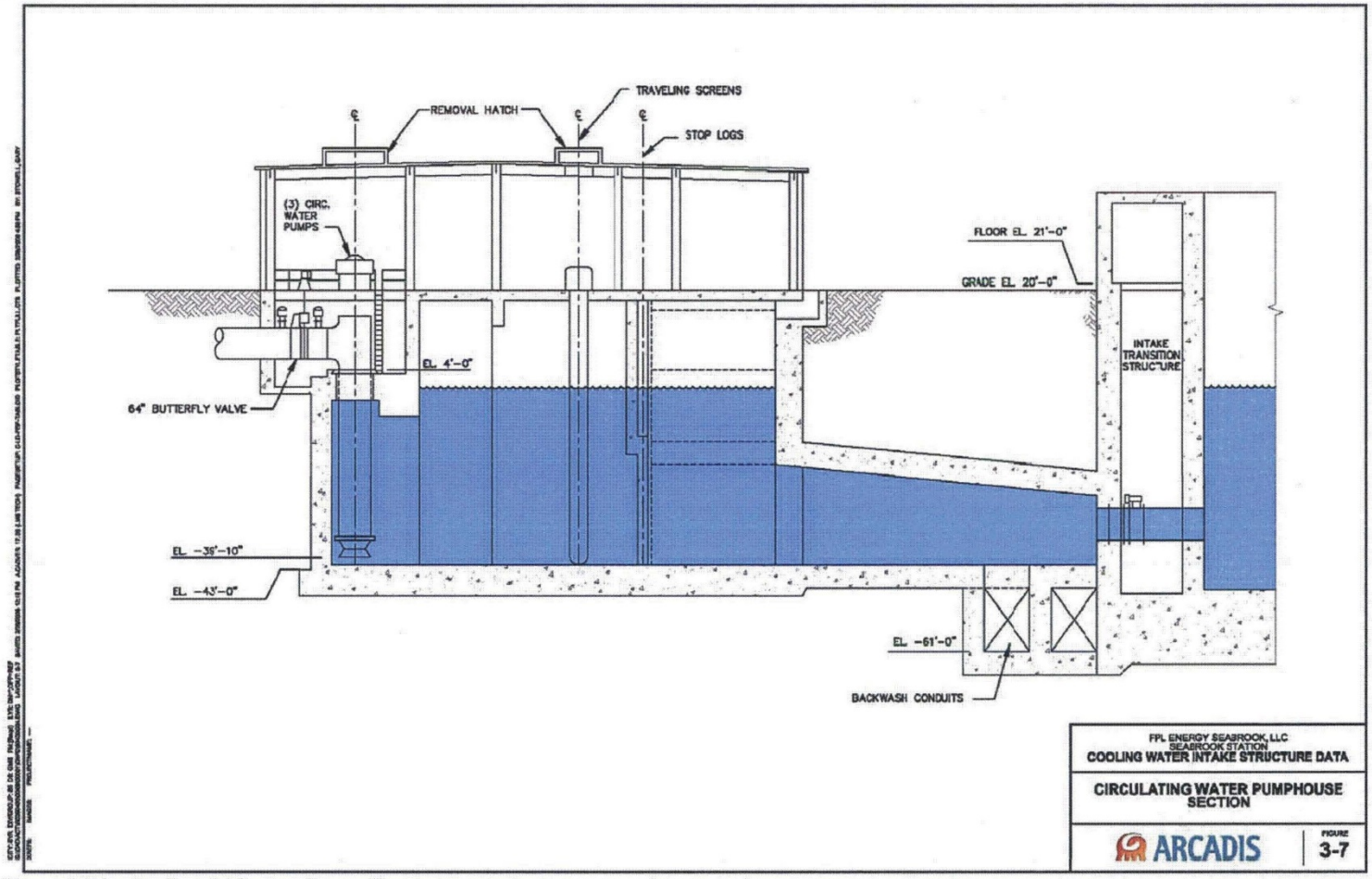
Source: Normandeau and ARCADIS 2008, Figure 3-13

Figure 4. Profile of Seabrook Intake Tunnel and Shafts



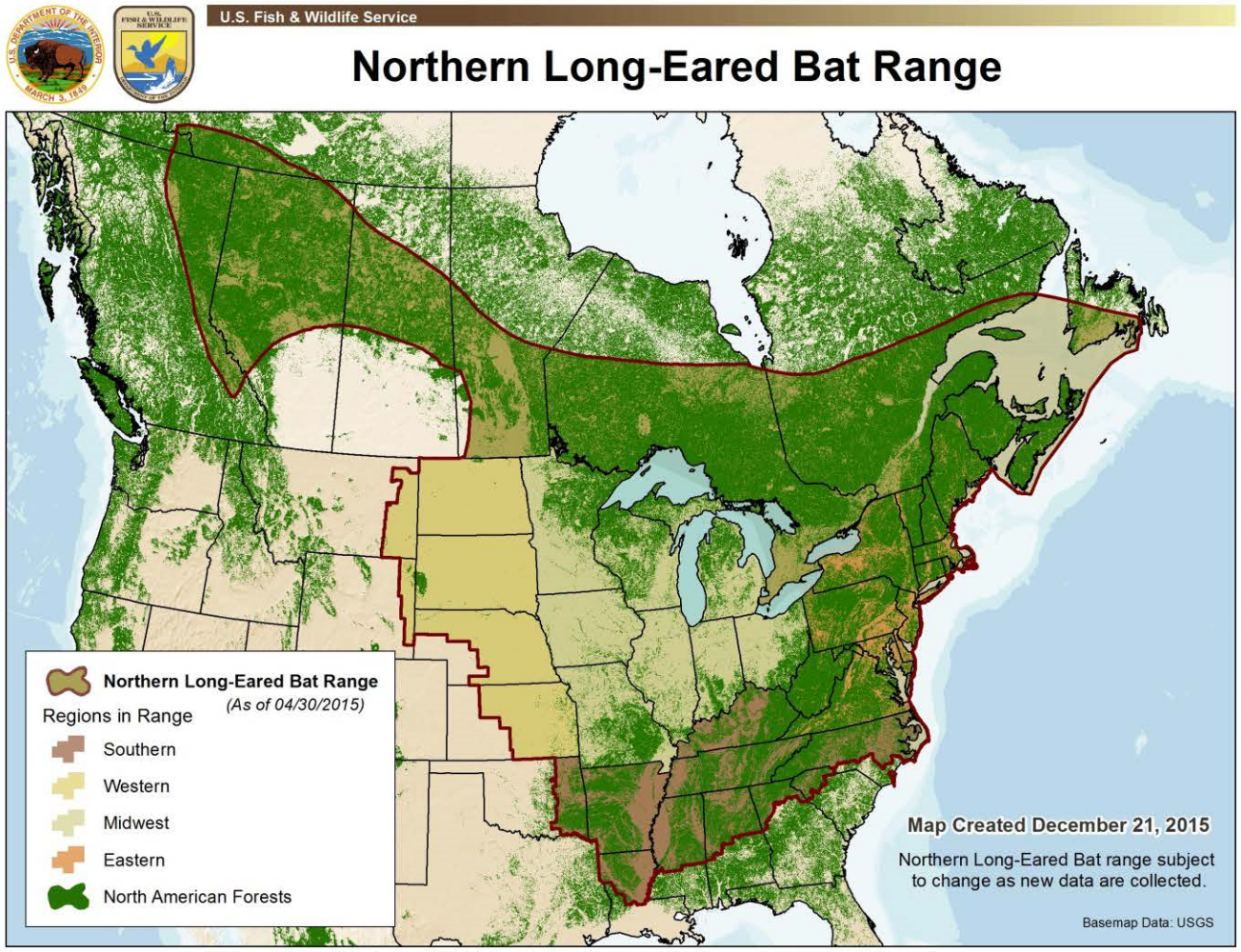
Source: Normandeau and ARCADIS 2008, Figure 3-14

Figure 5. Seabrook Circulating Water Pumphouse



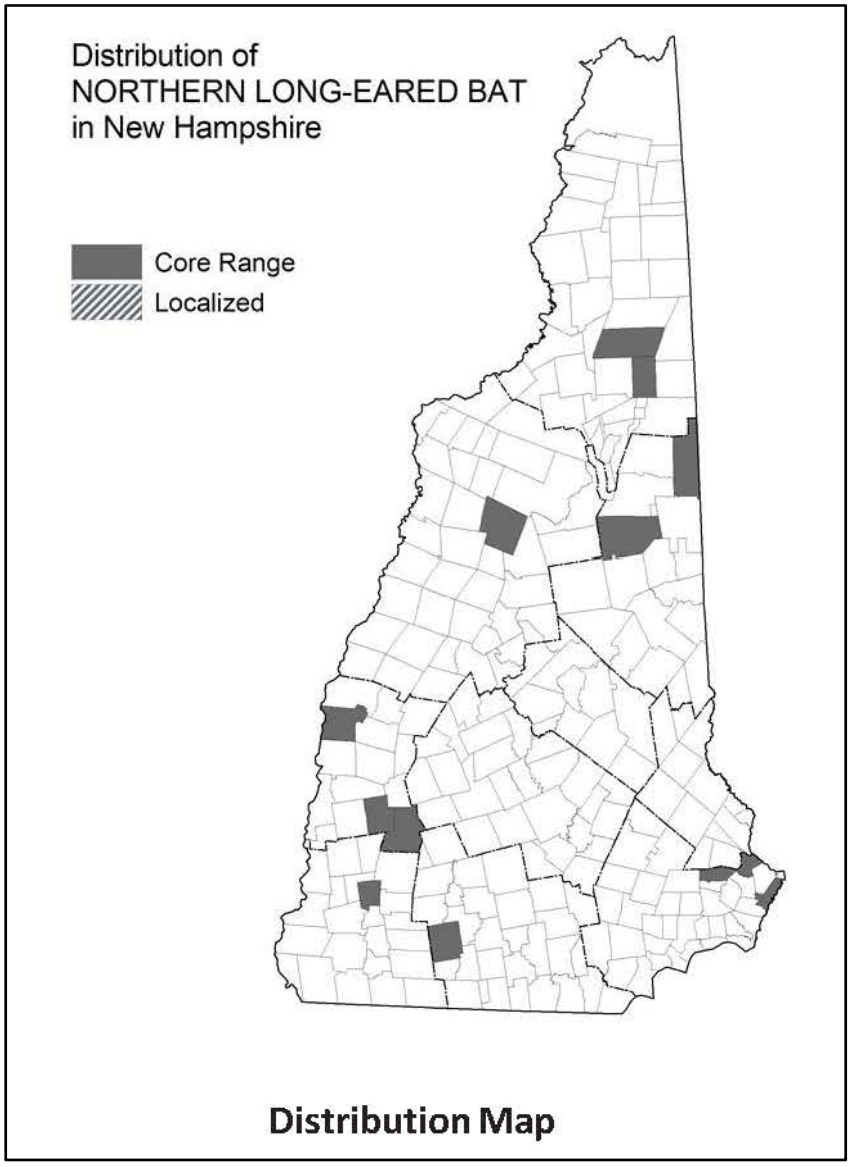
Source: Normandeau and ARCADIS 2008, Figure 3-16

Figure 6. Northern Long-Eared Bat Range



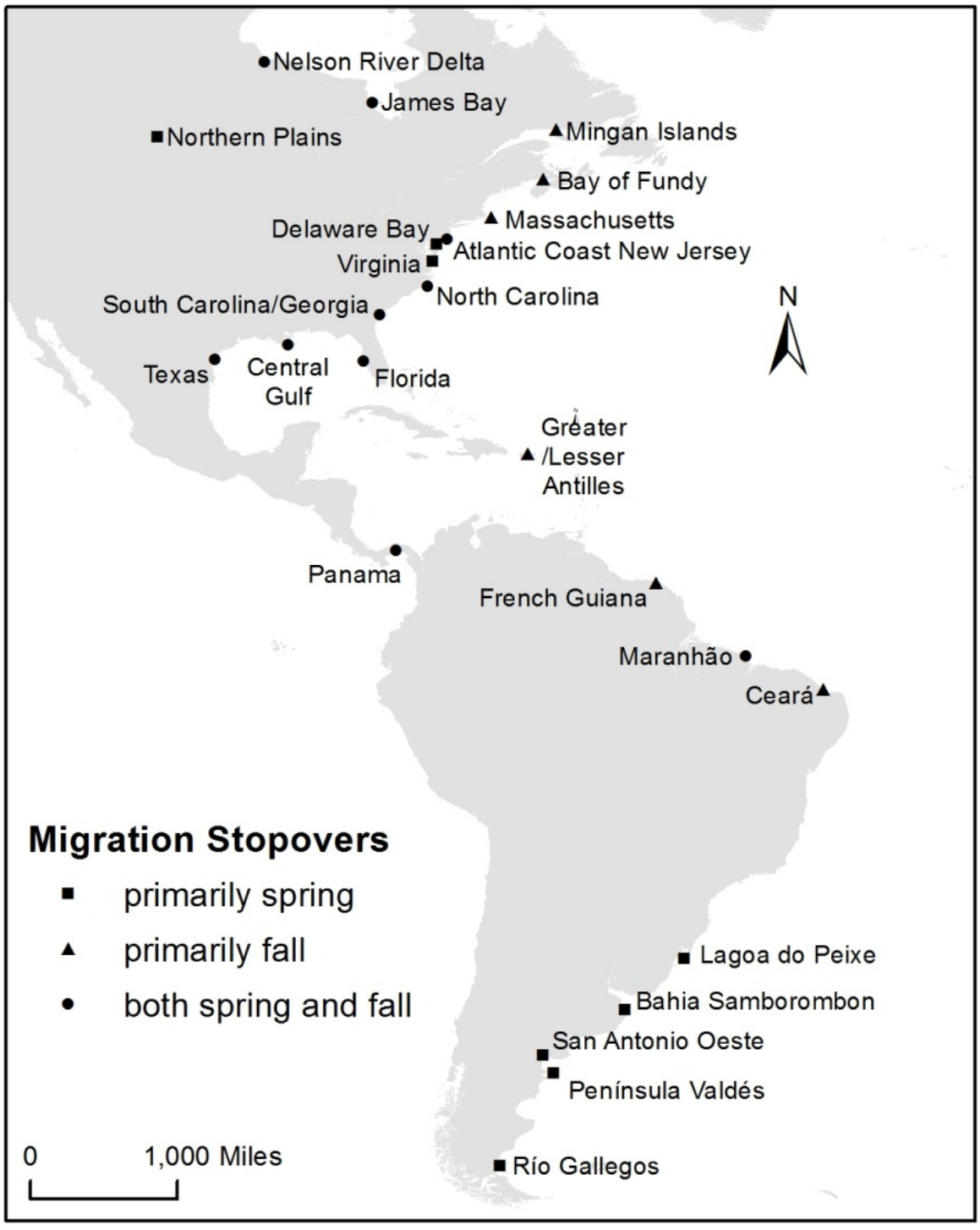
Source: FWS 2016, Figure 2.

Figure 7. Distribution of Northern Long-Eared Bat in New Hampshire



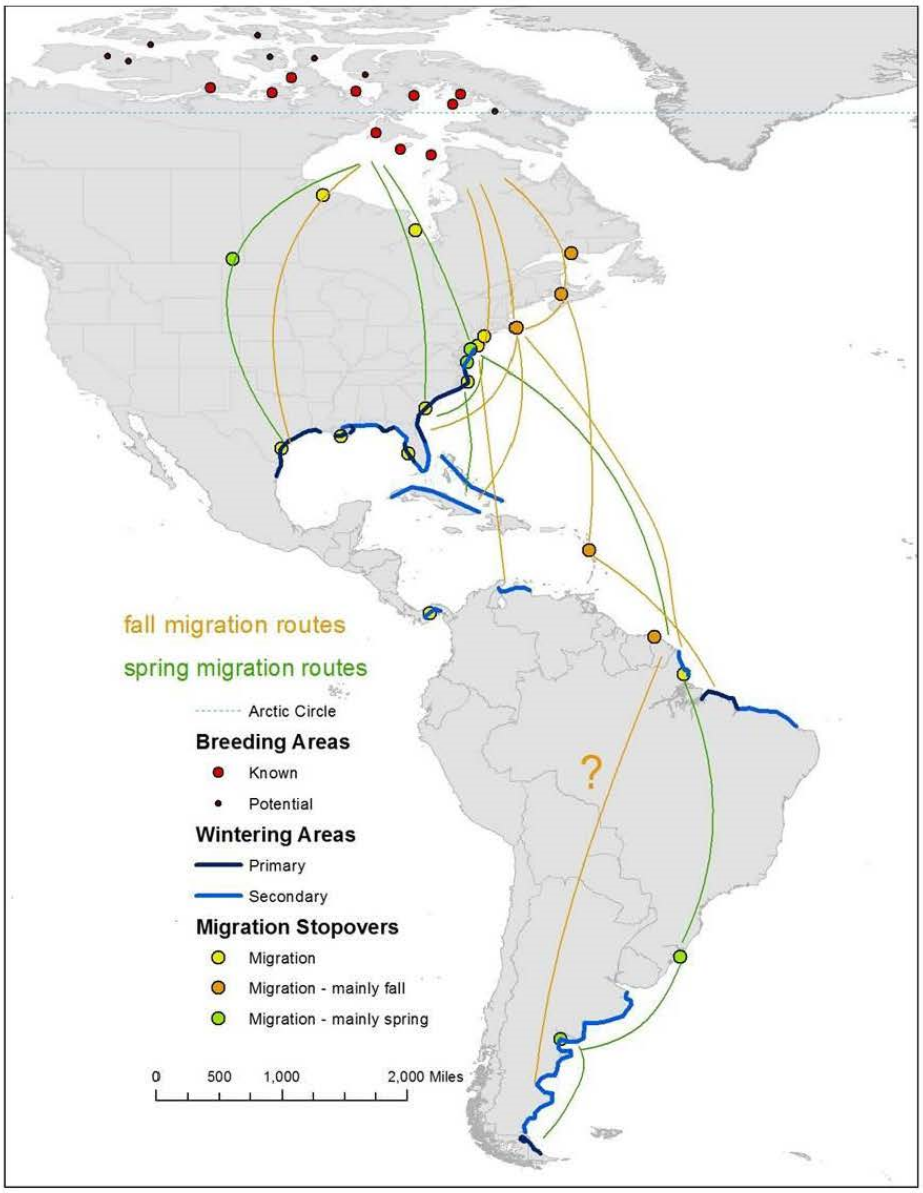
Source: NHFGD 2015

Figure 8. Known Red Knot Migration Stopovers



Source: FWS 2013

Figure 9. Red Knot Migration Routes



Source: FWS 2018b

Appendix B. Endangered Species Act Section 7 Consultation History

The U.S. Nuclear Regulatory Commission (NRC) staff consulted with the U.S. Fish and Wildlife Service (FWS) under Section 7 of the Endangered Species Act of 1973, as amended (ESA), related to Seabrook Station, Unit 1 (Seabrook) during its environmental review of NextEra Energy Seabrook, LLC's license renewal application. During the consultation, the NRC staff considered two federally listed species: the piping plover (*Charadrius melodus*) and the roseate tern (*Sterna dougalli dougalli*). The NRC (2015) staff determined that, although these species are known to occur along Atlantic coast beaches east of the Seabrook site, their presence on or in the immediate vicinity of the site is unlikely.

In correspondence to the NRC, the FWS (2010) concluded that the proposed license renewal of Seabrook is not likely to adversely affect these federally listed species. The NRC staff has not identified any new information that would call into question these conclusions. Sections 2.2.8 and 4.8.2 of the NUREG–1437, Supplement 46, *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants Regarding Seabrook Station, Final Report*, discuss the piping plover and the roseate tern and the NRC's communications with the FWS pursuant to determining potential effects on these species. Table B–1 below lists the relevant communications related to this consultation. The FWS's 2010 concurrence letter is also reproduced on the following page.

Table B-1. Correspondence Related to ESA Section 7 Consultation for Seabrook License Renewal

Date	Sender and Recipient	Description	ADAMS Accession No.[(a)]
July 16, 2010	B. Pham (NRC) to M. Moriarty (FWS)	Request for list of protected species for Seabrook license renewal	ML101790278
September 1, 2010	T. Chapman (FWS) to B. Pham (NRC)	Reply to request for list of protected species for Seabrook license renewal	ML102630180
August 2, 2011	D. Wrona (NRC) to T. Chapman (FWS)	Availability of the draft supplemental environmental impact statement for Seabrook license renewal	ML11131A004
October 25, 2011	A. Raddant (DOI) to C. Bladey (NRC)	Comments on draft supplemental environmental impact statement for Seabrook license renewal	ML11301A099
August 3, 2015	D. Wrona (NRC) to M. Miller and T. Chapman (FWS)	Availability of the final supplemental environmental impact statement for Seabrook license renewal	ML14260A450

[(a)] These documents can be accessed through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://adams.nrc.gov/wba/.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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http://www.fws.gov/newengland

September 1, 2010

Mr. Bo Pham
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Pham:

We are in receipt of your July 16, 2010 letter regarding the license renewal application for the Seabrook Station (Station), Unit 1, Seabrook, New Hampshire. The following comments are provided in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543).

The federally-threatened piping plover (*Charadrius melodus*) and federally-endangered roseate tern (*Sterna dougallii*) are known to occur along the coastal beaches and oceanic waters located approximately 2.8 miles east of the Station. According to our records, none of the above-listed species are known to frequent the immediate vicinity of the Station and, therefore, the presence of these species near the power station is unlikely. Furthermore, we are not aware of any instance where these species are being adversely affected through the existing operation of the Station.

Since no expansion of existing facilities is planned and no additional land disturbance is anticipated, we conclude that the license renewal for the Station is not likely to adversely affect federally-listed species subject to the jurisdiction of the U.S. Fish and Wildlife Service, and that formal consultation with us is not required.

Thank you for your coordination. Please contact Mr. Anthony Tur at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office