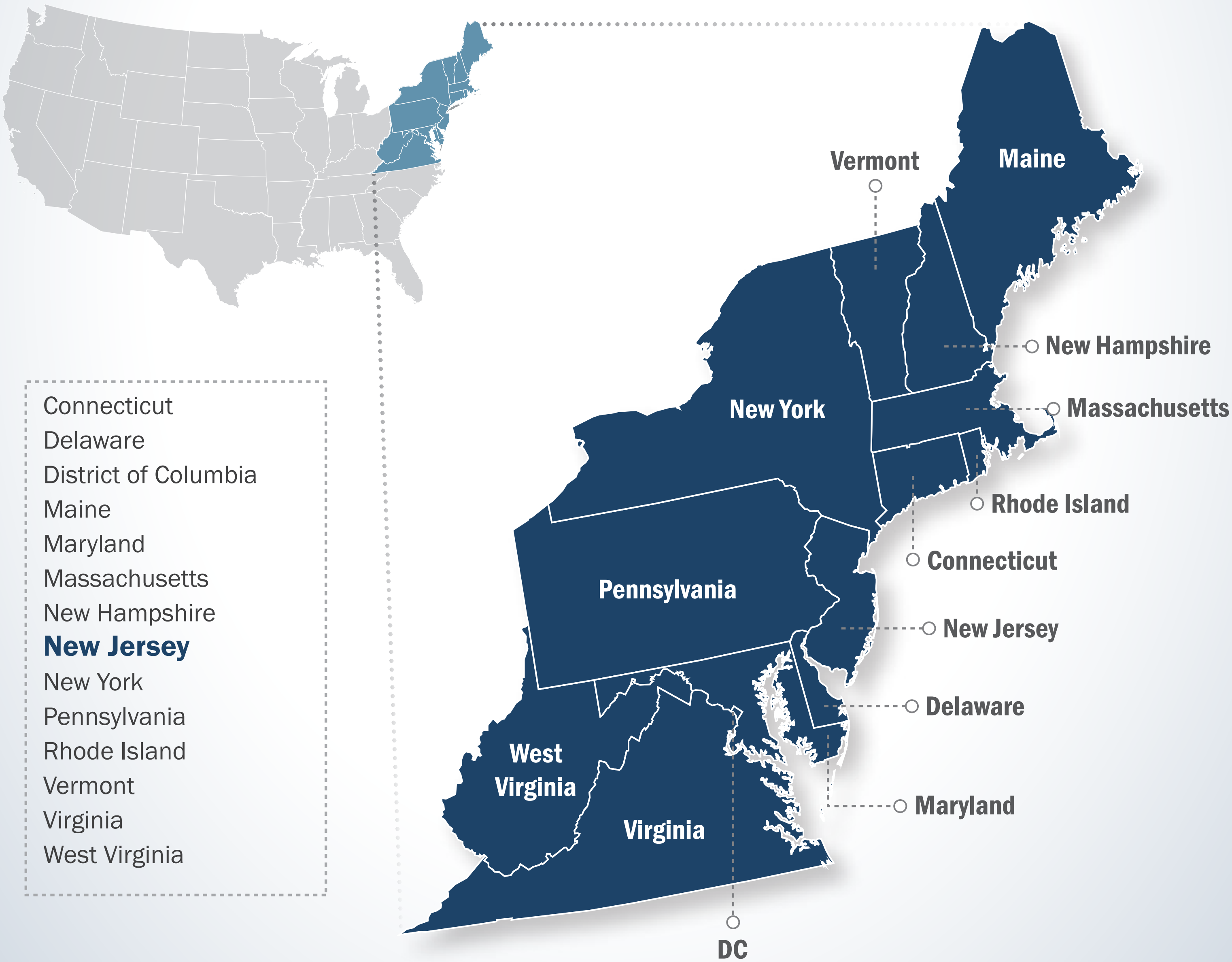
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 8 - CHAPTER 10



- Connecticut
- Delaware
- District of Columbia
- Maine
- Maryland
- Massachusetts
- New Hampshire
- **New Jersey**
- New York
- Pennsylvania
- Rhode Island
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- Virginia
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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 8 - CHAPTER 10

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Cooperating Agencies
Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

April 2016

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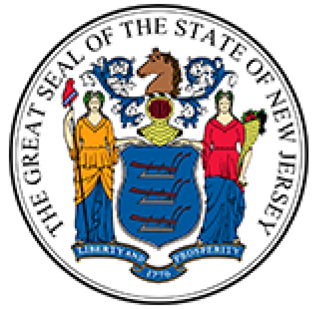


New Jersey was colonized by Dutch settlers in the early 17th century (State of New Jersey, 2015a). As one of the original 13 states to declare independence from Britain in 1776, the Battle of Trenton occurred in New Jersey, considered the turning point in the Revolutionary War (State of New Jersey, 2015a). Located in the northeastern region of the United States, New Jersey is bordered by New York in the north, Pennsylvania and Delaware to the west, and the Atlantic Ocean to the south and east. This chapter provides details about the existing environment of New Jersey as it relates to the Proposed Action.

General facts about New Jersey are provided below:

- **State Nickname**: The Garden State
- **Land Area:** 8,723 square miles; **U.S. Rank**: 47 (U.S. Census Bureau, 2010)
- **Capital:** Trenton
- **Counties:** 21 (State of New Jersey, 2015a)
- **Estimated Population:** Over 8.9 million people; **U.S. Rank:** 11 (U.S. Census Bureau, 2015a)
- **Most Populated Cities:** Newark City and Jersey City (U.S. Census Bureau, 2015b)
- **Main Rivers:** Hudson River, Delaware River, and Raritan River
- **Bordering Waterbodies:** Atlantic Ocean, Delaware River, and Sandy Hook Bay
- **Mountain Ranges:** Portion of the Appalachian Mountains
- **Highest Point:** High Point (1,803 ft) (USGS, 2015a)

10.1 AFFECTED ENVIRONMENT

10.1.1 Infrastructure

10.1.1.1 Definition of the Resource

This section provides information on key New Jersey infrastructure resources that could potentially be affected by FirstNet projects. Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as “developed.” Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Section 10.1.1.3 provides an overview of New Jersey’s traffic and transportation infrastructure, including road and rail networks, airport facilities, and ports and harbors. New Jersey public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in the Act, including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in New Jersey are presented in more detail in Section 10.1.1.4. Section 10.1.1.5 describes New Jersey’s telecommunications resources. An overview of New Jersey utilities, such as power, water, and sewer, is presented in Section 10.1.1.6.

10.1.1.2 Specific Regulatory Considerations

Multiple New Jersey laws and regulations pertain to the state’s public utility and transportation infrastructure and its public safety community. Table 10.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state’s applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws, Regulations, and Executive Orders identifies applicable federal laws and regulations.

Table 10.1.1-1: Relevant New Jersey Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
New Jersey Statutes: Title 23, Fish and Game, Wild Birds, and Animals; Title 50, Shellfisheries; New Jersey Administrative Code: Title 7, Environmental Protection; Title 16, Transportation	New Jersey Department of Environmental Protection (NJDEP)	Protects and manages fish, birds, wildlife and endangered species; acquires, maintains, and preserves natural areas as a habitats for rare and vanishing species of plant and animal life; protects all forests, brush lands and marshes from damage by fire, insects, and disease

[1] “The term ‘public safety entity' means an entity that provides public safety services” (7 U.S.C. § 1401(26)).

State Law/Regulation	Regulatory Agency	Applicability
New Jersey Statutes: Title 13, Conservation and Development; Title 28, Historic Memorials, Monuments and Sites; New Jersey Administrative Code: Title 7, Environmental Protection	Historic Sites Council	Promotes the state's historic, architectural, archaeological, engineering and cultural heritage; formulates policies for the preservation, restoration, and presentation of all historic sites; acquires areas, properties, lands, or estates of historic interest or other unusual features; develops, improves, protects, manages, and administers all state forests, parks, recreation areas, historic sites, and natural areas
New Jersey Statutes, Title 53 State Police; Executive Order #39 (1954)/Executive Order #101 (1980), transferring Office of Emergency Management to the New Jersey (NJ) State Police; Executive Order #5 (2006), established Office of Homeland Security and Preparedness; New Jersey Administrative Code: Title 13, Law and Public Safety	New Jersey Office of Homeland Security and Preparedness (NJOHSP)	Administers, coordinates, leads, and supervises New Jersey's counter-terrorism and preparedness efforts across all levels of government, law enforcement, emergency management, non-profit organizations, and the private sector; conducts criminal investigations, enforces traffic laws, provides forensic laboratory services; protects life and property on coastal and inland waters; ensures emergency management
New Jersey Statutes: Title 48, Public Utilities; New Jersey Administrative Code: Title 1, Administrative Law; Title 14, Public Utilities; Title 16, Transportation	New Jersey Board of Public Utilities	Governs any entity that owns, operates, manages, or controls any railroad, street railway, traction railway, autobus, charter bus operation, or special bus operation; any canal, subway, pipeline, gas, electric, water, oil, or sewer system; any solid waste collection or disposal service; or any telephone or telegraph system; oversees water and wastewater utilities, including rates and service; handles telecommunications policy, implementation, and oversight of local telephone competition; regulates basic cable TV rates and quality
New Jersey Statutes: Title 6, Aviation; Title 27, Highways; Title 32, Interstate and Port Authorities and Commissions; New Jersey Administrative Code: Title 13, Law and Public Safety; Title 16, Transportation	New Jersey Department of Transportation (NJDOT)	Preserves, improves, and expands public transportation including the use of rail rights of way, highways, and public streets; coordinates plans and policies for the development of air commerce and air facilities; promotes the preservation, improvement, and expansion of freight railroads
New Jersey Statutes: Title 58, Water and Water Supply; New Jersey Administrative Code: Title 7, Environmental Protection	NJDEP; Water Policy and Supply Council	Manages the states' water supply, water resources, and water quality

Sources: (LexisNexis, 2015) (New Jersey Office of Legislative Services, 2015)

10.1.1.3 Transportation

This section describes the transportation infrastructure in New Jersey, including specific information related to the road networks, airport facilities, rail networks, harbors[2], and ports. The movement of vehicles is commonly referred to as traffic, as well as the circulation along roads. Roadways can range from multilane road networks with asphalt surfaces to unpaved gravel or private roads. The information regarding existing transportation systems in New Jersey are based on a review of maps, aerial photography, and federal and state data sources.

The NJDOT has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for local streets and roads. The NJDOT "is organized in order to apply the full resources of the State in a coordinated and integrated matter to solve or assist in the solution of the problems of all modes of transportation; to promote an efficient, fully integrated and balanced transportation system for the state; to prepare and implement comprehensive plans and programs for all modes of transportation development in the state; and to coordinate the transportation activities of state agencies, state-created public authorities, and other public agencies with transportation responsibilities within the state" (NJDOT, 2014a).

New Jersey has an extensive and complex transportation system across the entire state. The state's transportation network is comprised of:

- 39,255 miles of public roads, including over 2,900 miles in the National Highway System (NJDOT, 2014b) and 6,350 highway bridges (NJDOT, 2015a);
- 530 miles of passenger rail and 1,582 miles of freight rail tracks (NJDOT, 2015a);
- 320 aviation facilities, including airstrips and heliports (FAA, 2015a);
- 71 harbors (U.S. Harbors, 2015); and
- 3 major ports operated by the joint venture Port Authority of New York and New Jersey, which includes three facilities in the Port of New York and New Jersey complex: the third largest container port in the nation and decidedly the largest container port on the East Coast (NJDOT, 2015a).

Road Networks

As identified in Figure 10.1.1-1, the major urban centers of the state are Newark in the north and Camden in the west (U.S. Census Bureau, 2013). A secondary urban center is Atlantic City. New Jersey has four major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel to local towns is conducted mainly via interstates, state and county routes. Table 10.1.1-2 lists the interstates and their start/end points in New Jersey. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (DOT, 2015a).

[2] This PEIS defines "harbor" as a body of water deep enough to allow anchorage of a ship or boat.

Table 10.1.1-2: New Jersey Interstates

Interstate	Southern or Western Terminus in NJ	Northern or Eastern Terminus in NJ
I-76	PA line at Camden	Route 42 in Blackwood
I-78	PA line at Phillipsburg	NY line in the Holland Tunnel to New York City
I-80	PA line at Columbia	I-95 in Teaneck
I-95	DE line on the Delaware Memorial Bridge near Carneys Point	NY line on the George Washington Bridge to New York City

As part of the Interstate System, I-95 in New Jersey is also known as the New Jersey Turnpike. Another significant road in the state is the Garden State Parkway. The Turnpike and Parkway are managed by the New Jersey Turnpike Authority (NJTA) and its parent agency NJDOT. The NJTA "is dedicated to the safe and efficient movement of people and goods over two of the busiest toll roads in the United States – the New Jersey Turnpike and the Garden State Parkway. The Authority's highways are a critical link in the transportation network of the Northeast I-95 Corridor" (NJTA, 2015). The Turnpike is 148 miles stretching the length of the New Jersey from the Delaware state line to the New York state line and runs through the center of the state; the Parkway is 173 miles from Cape May to the New York state line and runs parallel to the shoreline for the entire length of the state.

In addition to the Interstate System, New Jersey has both National Scenic Byways and State Scenic Byways. Both National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities. Figure 10.1.1-1 illustrates the major transportation networks, including roadways, in New Jersey. Section 10.1.8, Visual Resources, describes the National and State Scenic Byways found in New Jersey from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's Federal Highway Administration. New Jersey has two National Scenic Byways:

- Delaware River National Scenic Byway: 32.8 miles in the historic Delaware River Valley from Frenchtown to Trenton and
- Millstone Valley National Scenic Byway: 27.5 miles in the Millstone River Valley in north central New Jersey from Kingston to Millstone (FHWA, 2015a)

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by NJDOT. New Jersey has five State Scenic Byways that crisscross the entire state (NJDOT, 2011):

- Bayshore Heritage Byway,
- Palisades Scenic Byway,
- Pine Barrens Byway,
- Warren Heritage Scenic Byway; and
- Upper Freehold Historic Farmland Byway.

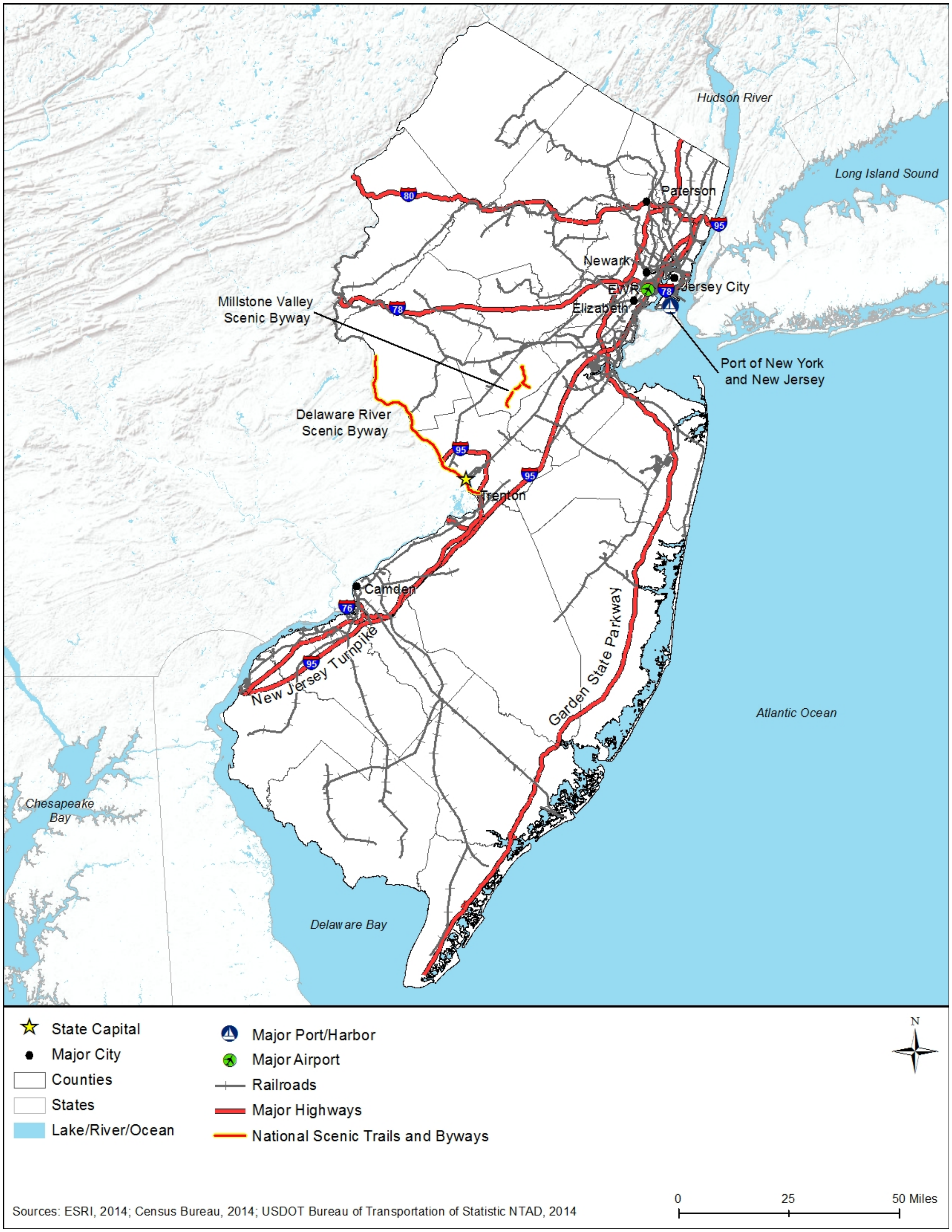


Figure 10.1.1-1: New Jersey Transportation Networks

Airports

Air service to the state is provided by a number of major international airports. Northern New Jersey is served by three major international airports, all managed by the Port Authority of New York and New Jersey:

- Newark Liberty International Airport (EWR) in Newark, New Jersey: In 2014, the airport moved over 35.6 million passengers and over 660,000 tons of cargo (PANYNJ, 2015a);
- John F. Kennedy International Airport (JFK) on Jamaica Bay in the southeastern section of the New Jersey City borough of Queens: In 2014, the airport moved over 53.2 million passengers and over 1.3 million tons of cargo (PANYNJ, 2015b); and
- LaGuardia Airport (LGA) borders Flushing Bay and Bowery Bay in the northwestern section of the New Jersey City borough of Queens: In 2014, the airport moved over 26.9 million passengers and over 7,000 tons of cargo (PANYNJ, 2015c).

Southern New Jersey is served by Philadelphia International Airport (PHL), which is owned and operated by the City of Philadelphia in Pennsylvania. NJDOT has oversight of the state's 320 airports (NJDOT, 2006). Figure 10.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 10.1.7.9, Airspace, provides greater detail on airports and airspace in New Jersey.

Rail Networks

New Jersey is connected to an extensive network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Amtrak provides intercity passenger rail service connecting major metropolitan areas in New Jersey with cities in the northeast and throughout the country. New Jersey Transit (NJ Transit) is a state run agency that provides commuter rail services throughout the state; it serves New York's Penn Station and operates into New York State through an agreement with Metro-North. In addition, 19 freight railroads operate in New Jersey (NJDOT, 2015a). Figure 10.1.1-1 illustrates the major transportation networks, including rail lines, in New Jersey.

Amtrak runs nine lines throughout New Jersey, including the Acela Express and Northeast Regional, which is a popular line, with routes running from Washington, DC to Boston in 6 hours 40 minutes and 7 hours 50 minutes, respectively. All the long-distance Amtrak services stop in Newark and Trenton; some of the regional services also stop at Metropark, Newark Airport, New Brunswick, and Princeton Junction. Table 10.1.1-3 provides a complete list of Amtrak lines that run through New Jersey.

Table 10.1.1-3: Amtrak Train Routes Serving New Jersey

Route	Starting Point	Ending Point	Length of Trip	Cities Served in New Jersey
Acela Express	Boston, MA	Washington, DC	6 hours 40 minutes	Newark, Trenton
Cardinal/Hoosier State	New York, NY	Chicago, IL	26 hours 30 minutes	Newark, Trenton
Carolinian/Piedmont	New York, NY	Charlotte, NC	13 hours 30 minutes	Newark, Trenton
Crescent	New York, NY	New Orleans, LA	30 hours	Newark, Trenton

Route	Starting Point	Ending Point	Length of Trip	Cities Served in New Jersey
Keystone	New York, NY	Harrisburg, PA	3 hours 50 minutes	Newark, Princeton Junction, Trenton
Northeast Regional	Boston, MA	Virginia Beach, VA	12 hours 30 minutes	Newark, Princeton Junction, Trenton
Pennsylvanian	New Jersey, NY	Pittsburgh, PA	9 hours 20 minutes	Newark, Trenton
Silver Service/Palmetto	New Jersey, NY	Tampa/Miami, FL	28+ hours	Newark, Trenton
Vermonter	St. Albans, VT	Washington, DC	13 hours 45 minutes	Newark, Trenton

Sources: (Amtrak, 2015a) (Amtrak, 2015b)

NJ Transit is the third largest regional rail service provider in the nation. It operates over 530 miles of track and 162 stations across its service area of 5,325 miles (NJDOT, 2015a). Nine NJ Transit lines are entirely within New Jersey: Northeast Corridor, North Jersey Coast Line, Raritan Valley Line, Atlantic City Rail Line, Morris and Essex (Morristown) Line, Morris and Essex (Gladstone) Line, Montclair-Boonton Line, Main Line, and Bergen County Line. NJ Transit also operates two commuter rail lines into New York State under a contract with Metro-North Railroad, which is part of the Metropolitan Transportation Authority. Both of these lines originate in New Jersey and terminate in New York: the Port Jervis Line and Pascack Valley Line. The entire NJ Transit system has a total ridership of over 70 million passengers per year (NJDOT, 2015a).

The Southeastern Pennsylvania Transportation Authority (SEPTA) is a regional rail service between Philadelphia and the surrounding suburbs. SEPTA runs a total of 13 lines into Center City Philadelphia; two of those terminate in New Jersey. The Trenton line is the fourth busiest regional rail route for SEPTA; it is 36.4 miles long one way and has a daily average ridership of 12,263 (SEPTA, 2015). The West Trenton Line is the third busiest regional rail route for SEPTA; it is 34.7 miles long one way and has a daily average ridership of 12,711 (SEPTA, 2015).

Up to 20 freight railroads operate in New Jersey. Freight volumes in New Jersey are expected to grow from 715 million tons in 2007 to 1.2 billion tons in 2035 (NJDOT, 2015a). The majority of the freight rail cargo that travels through the state terminates in New Jersey: in 2007, 53 percent of the freight was inbound, whereas only 27 percent was outbound (NJDOT, 2015a).

Harbors and Ports

The states of New Jersey and New York share the Port of New York and New Jersey (PANYNJ), which sits at the mouth of the Hudson River, as depicted in Figure 10.1.1-1. This major shipping port is composed of six marine terminals, three of which are located in New Jersey, including Port Newark, the Elizabeth-Port Authority Marine Terminal, and Port Jersey (PANYNJ, 2015d). ExpressRail, a dedicated rail system at the Port of New York (NY) and NJ, has facilities at both the Newark and Elizabeth-Port Marine Terminals. These facilities connect to regional rail lines, allowing for easy transport of cargo over land from the coastal ports (PANYNJ, 2015e). All three of the terminals handle container cargo, with parts of Port Jersey equipped to take heavy lift and roll-on/roll-off cargo, such as wheeled vehicles (PANYNJ, 2015f). According to the

U.S. Census Bureau, in 2013, Port Newark imported $135.2 billion in cargo and exported $11.6 billion (U.S. Census Bureau, 2015c).

Additionally, the Port Authority of New York and New Jersey operates a number of commuter ferries. Three of these travel between points in New Jersey, as well as across the Hudson River to Manhattan. (PANYNJ, 2015g)

The U.S. Census Bureau also lists four other New Jersey ports that participated in overseas trade in 2013. All of these are operated by private companies, unlike the Port of New Jersey, whose port authority is a joint venture between the U.S. states of New York and New Jersey (PANYNJ, 2015h). The most active of these were Perth Amboy and Paulsboro. Perth Amboy imported $3.42 million in cargo and exported $1.47 million, weighing 3.8 million tons and 1.7 million tons respectively. The Port of Paulsboro, located across the Delaware River from Philadelphia, was responsible for the import of $4.86 billion worth of cargo, weighing 6,988 tons. It also exported $830.6 million in cargo, weighing 1.1 million tons (U.S. Census Bureau, 2015c).

10.1.1.4 Public Safety Services

New Jersey public safety services generally consist of public safety infrastructure and first responder personnel throughout the state. The general abundance and distribution of public safety services may roughly follow key state demographic indicators (U.S. Census Bureau, 2015c). Table 10.1.1-4 presents New Jersey's key demographics including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 10.1.9, Socioeconomics.

Table 10.1.1-4: Key New Jersey Indicators

New Jersey Indicators	
Estimated Population (2014)	8,938,175
Land Area (square miles) (2010)	8,723
Population Density (persons per sq. mile) (2010)	1,195
Municipal Governments (2013)	324
Cities and Towns (2007)	543
Counties (2015)	21

Sources: (U.S. Census Bureau, 2010) (U.S. Census Bureau, 2015a) (New Jersey On-Line, 2010) (National League of Cities, 2007)

Table 10.1.1-5 presents New Jersey's public safety infrastructure, including fire and police stations. Table 10.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 10.1.1-5: Public Safety Infrastructure in New Jersey by Type

Infrastructure Type	Number
Fire and Rescue Stations	1,992
Law Enforcement Agencies	497
Fire Departments	1,284

Source: (FEMA, 2015a)

Table 10.1.1-6: First Responder Personnel in New Jersey by Type

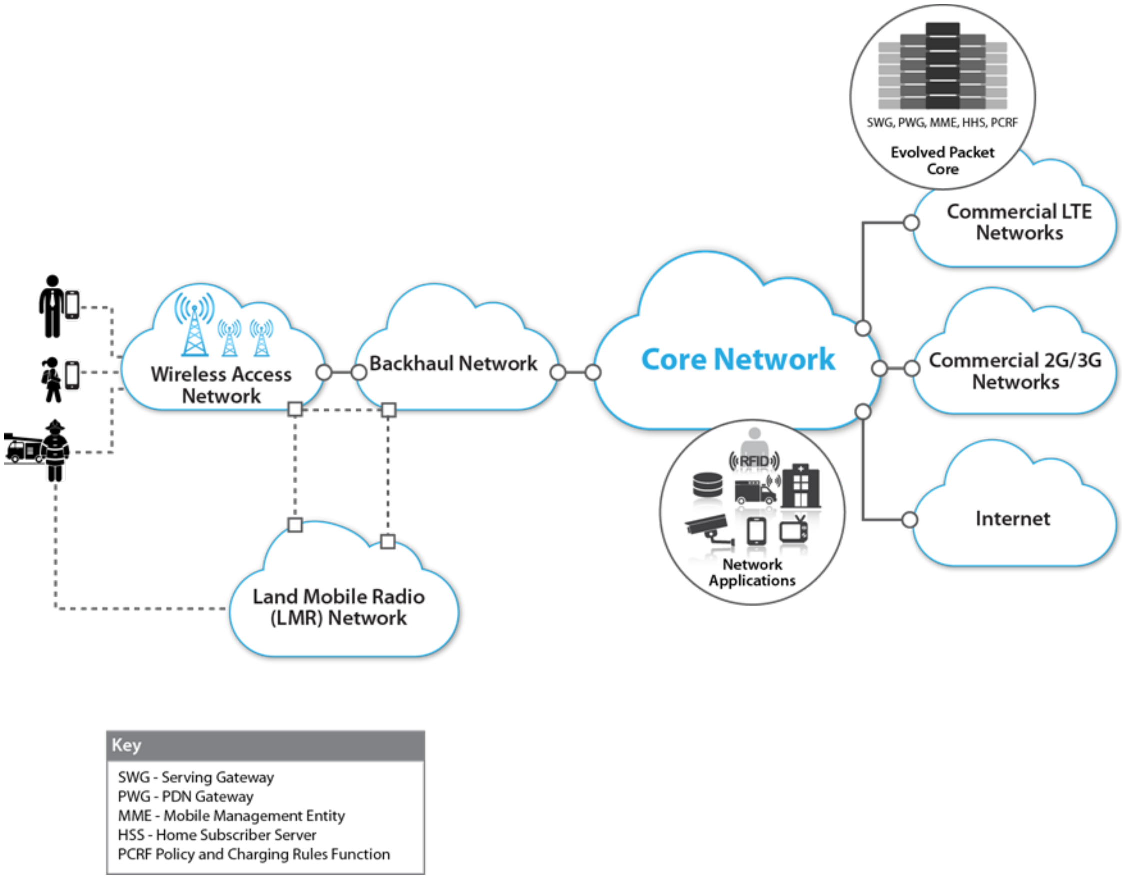
First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	4,000
Fire and Rescue Personnel	37,823
Law Enforcement Personnel	82,604
Emergency Medical Technicians and Paramedics	7,670

Sources: (FEMA, 2015a) (BLS, 2015a)

10.1.1.5 Telecommunications Resources

Telecommunication resources in New Jersey can be divided into two primary categories: specific public safety communications infrastructure and commercial telecommunications infrastructure (FCC, 2015a) (BLS, 2016). There is no central repository of information for either category; therefore, the following information and data are combined from a variety of sources, as referenced.

In general, the deployment of telecommunications resources in Connecticut is widespread and similar to other states in the U.S. However, some areas of the state, such as the Adirondacks in the northern part of the state, have limited coverage. Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable, fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 10.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a long-term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).



Prepared by: Booz Allen Hamilton

Figure 10.1.1-2: Wireless Network Configuration

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as long-term evolution (LTE) (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and at the state level, including in New Jersey.

There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

- Incompatible and aging communications equipment,
- Limited and fragmented funding,
- Limited and fragmented planning,
- A lack of coordination and cooperation, and
- Limited and fragmented radio spectrum.

To help enable the public safety community to incorporate disparate Land Mobile Radio networks into a nationwide public safety LTE broadband network, the U.S. Department of Commerce (DOC) Public Safety Communications Research Program (PSCR) – Boulder Laboratories, in 2015, prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years (PSCR, 2015).

Public safety communications in New Jersey are similar to those in other states and consist of a mix of older analog across Very High Frequency (VHF)[3] and Ultra High Frequency (UHF)[4] frequencies and digital narrowband (Project 25 or P-25) networks. These are supplemented by newer wireless digital capabilities as well as the deployment of upgraded microwave and fiber tower interconnection and aggregation network capacity to support the introduction of new data, video, and multimedia services.

New Jersey's public safety and emergency communications networks operate across a diverse set of channels and licensed wireless frequencies including: VHF, UHF, 700 Megahertz (MHz), and 800 MHz. In addition, New Jersey is currently classified as one of the Urban Area Security Initiative (UASI) areas which includes seven counties in New Jersey as well as the core cities of Newark and Jersey cities.

Multiple organizations and entities within the State of New Jersey oversee and have operational responsibility for the public safety narrowband and broadband networks. The Office of Emergency Telecommunications Services within the Office of Information Technology oversees Public Safety Answering Point (PSAP)/9-1-1, Next-generation 9-1-1 services, and P-25 narrowband digital services and interoperability modernization. The New Jersey State Police's Emergency Management section's Communications Bureau, within the Homeland Security Branch of the State Police, has accountability for 23 800 MHz tower sites and facilities including maintenance of radio channel programming, as well as general radio electronics maintenance. JerseyNet, the Broadband Technologies Opportunities Program (BTOP) 700 MHz project, is managed within the state's Homeland Security Branch within the Emergency Management section.

[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).
[4] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

Statewide Networks

State Police Emergency Network (SPEN) is a four-channel emergency communication network. SPEN Channel 1 is the primary interdepartmental channel used between State Police units. Figure 10.1.1-3 presents the current placement of the State Police Network towers.

Figure 10.1.1-3: State Police Radio Tower Sites

Source: (RadioReference.com, 2015a)

The State Police in New Jersey are organized and deployed around five troops: South (A); North (B); Central (C); Turnpike and E Parkway (D). Figure 10.1.1-4 presents the New Jersey Troop area responsibilities. The State Police use a trunked radio system[5] operated across the first three troops/zones with Troops D and E allocated across the first three zones. The majority of state police traffic occurs over these trunked channels, with the New Jersey State Police rarely using conventional public safety channels.

[5] A trunked radio system is a complex type of computer-controlled two-way radio system that allows sharing of relatively few radio frequency channels among a large group of users.

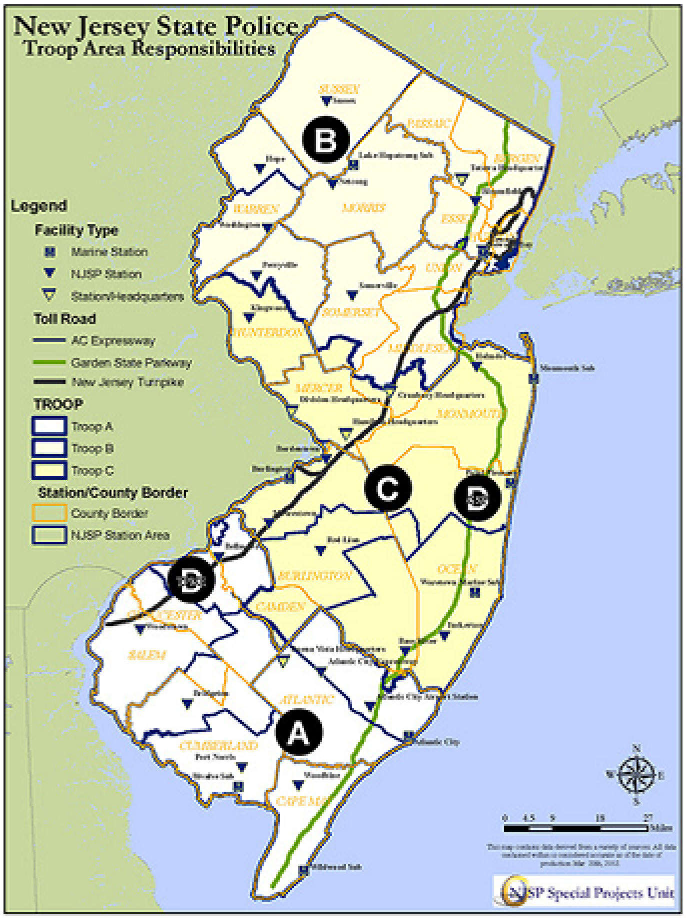


Figure 10.1.1-4: State Police Troop Area Responsibilities

Source: (New Jersey State Police Special Projects Unit, 2015)

New Jersey has one statewide VHF fire channel, the Statewide Fire Intersystem, which is used mostly in southern New Jersey and for mutual aid situations. (Robbins, 2014)

There are four Joint Emergency Medical System (JEMS) wireless channels for Emergency Medical Services (EMS) use in New Jersey operating in the VHF band (153-174 MHz). JEMS Channel 1, for example, is the primary EMS dispatch channel used by counties and may or may not be used for basic life support needs. This EMS system in New Jersey is used to dispatch ambulances and to connect the hospital-bound Emergency Room with Emergency Medical Technicians (EMT). Since May of 1976, an UHF telemetry system has been used by the Mobile Intensive Care Units (MICU). In 1998, the New Jersey State Police, in cooperation with the regional communications centers, deployed a statewide 800MHz radio system, the Interdepartmental radio network. This allows all regional communication centers to communicate seamlessly across the state. (NYOEM, 2006)

According to the State of New Jersey's Office of Emergency Telecommunications Services (OETS): "In New Jersey each municipality is required to have a single PSAP answer all of its 9-1-1 calls. In some areas this PSAP will also dispatch emergency services such as Police, Fire and EMS. In others, the PSAP will transfer or relay these calls so that these services may be dispatched by secondary agencies know as Public Safety Dispatch Points (PSDP)" (State of New Jersey, 2015b). PSAPs are operated by licensed dispatchers at 9-1-1 PSAP centers co-located at public safety county, police, or township facility locations.

The New Jersey P-25 network is designed to enable interoperability among various local, county, state, and federal public safety entities, and is accessible via portable radios inside the UASI Region. The New Jersey UASI Region encompasses Bergen, Passaic, Morris, Hudson, Essex, Union, and Middlesex Counties as well as the core cities of Newark and Jersey City. The lead state agency is the New Jersey Attorney General's Office (USVA, 2015). Mobile radios are needed to access the network outside the UASI region. Regardless of location or equipment, the network has 95 percent coverage (New Jersey Office of Information Technology, 2014). In order to achieve interoperability and enable digital service delivery capability, New Jersey has implemented P-25 wireless infrastructure and radio handsets as part of the New Jersey Interoperability Communications Service (NJICS). NJICS is a 700 MHz Narrowband P-25 network serving a wide range of public safety user groups including: State Police, Interagency Communications, Medical Talk Groups, the NJ Task Force, and Regional Public Safety Talk Groups (RadioReference.com, 2015b).

Figure 10.1.1-5 presents the locations of the NJICS infrastructure.

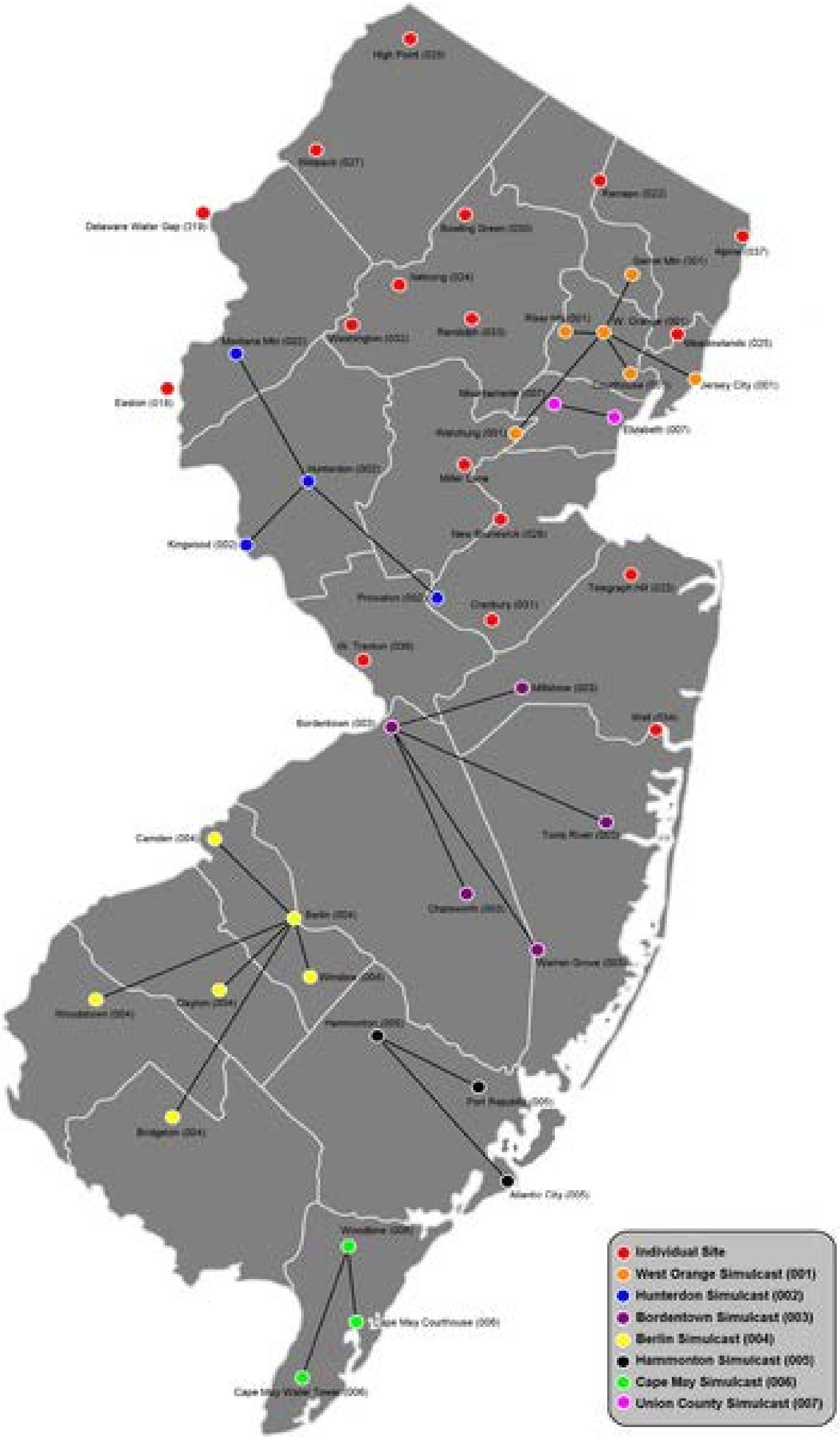


Figure 10.1.1-5: New Jersey Interoperability Communications

Source: (NJICS, 2015)

700 MHz Broadband Network (JerseyNet)

Currently, the NJOHSP is designed as the principal state agency for leading and coordinating New Jersey's counterterrorism and cybersecurity efforts and plays a leading role in building resiliency throughout the state (NJOHSP, 2015a). New Jersey was selected as one of seven BTOP Public Safety grant recipients and has elected to deploy its funds to enable a regional deployables broadband 700 MHz network using a combination of Cell on Wheels (COWs) and System of Wheels (SOWs) which will be supplemented by satellite communications – known as JerseyNet (NJOHSP, 2015b). As noted by NJOHSP, "New Jersey State was awarded $39 million in BTOP funds for its public-safety LTE network in 2010. The state has a 20 percent match, bringing the state's public-safety LTE fund to nearly $50 million" (NJOHSP, 2015c). The JerseyNet BTOP project is targeting three major areas of its state: (1) Northern: Newark to Jersey City; Route 21 Corridor; (2) Southern; Camden; and (3) Southern; Atlantic City. See Figure 10.1.1-6 for the network design.

Figure 10.1.1-6: BTOP Network Design

Source: (NJOHSP, 2015b)

For the Route 21 Corridor, 14 deployables will be required to achieve coverage (NJOHSP, 2015b). See Figure 10.1.1-7 for the Route 21 coverage area.

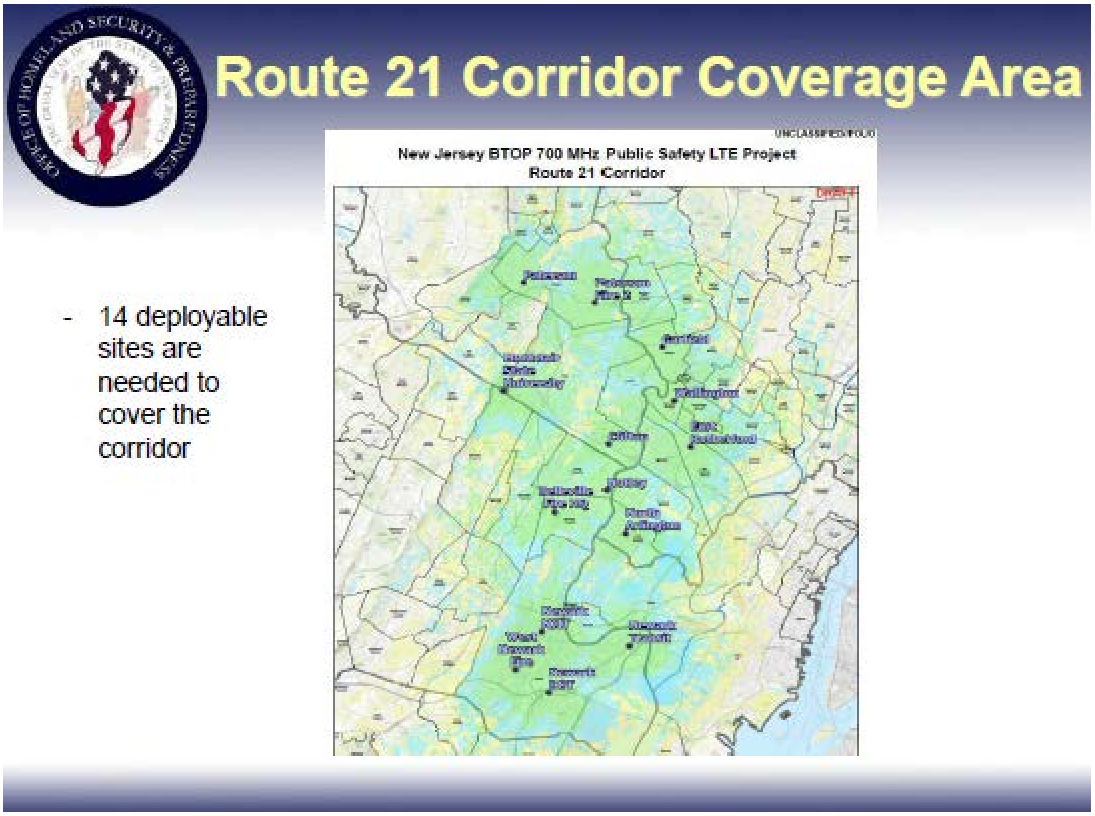


Figure 10.1.1-7: Route 21 Coverage Area

Source: (NJOHSP, 2015b)

Commercial Telecommunications Infrastructure

New Jersey's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC, 2014a) (FCC, 2014b). The following sub-sections present information on New Jersey's commercial telecommunications infrastructure, including information on the number of carriers and technologies deployed; geographic coverage; voice, Internet access, and wireless subscribers; and the quantity and location of telecommunications towers, fiber optic plant, and data centers.

Carriers, Coverage, and Subscribers

As described earlier, New Jersey's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks. Table 10.1.1-7 presents the number of providers of switched access[6] lines, Internet access[7], and mobile wireless services including coverage.

[6] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2014b).

[7] Internet access includes DSL, cable modem, fiber, satellite, and fixed wireless providers.

Table 10.1.1-7: Telecommunications Access Providers and Coverage in New Jersey as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access line	173	99% of households
Internet access	54	80% of households
Mobile Wireless	5	100% of population

Sources: (FCC, 2014a) (FCC, 2014b) (NTIA, 2014)

Table 10.1.1-8 shows the wireless providers in New Jersey along with their geographic coverage. The following four maps, Figure 10.1.1-8, Figure 10.1.1-9, Figure 10.1.1-10 and Figure 10.1.1-11, show: the combined coverage for the top two providers, AT&T and Verizon Wireless (each of which covers the entire state); Sprint's coverage and T-Mobile's coverage; Cricket's coverage; and other wireless providers' coverage, respectively.

Table 10.1.1-8: Wireless Telecommunications Coverage by Providers in New Jersey

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	100.00%
Verizon Wireless	100.00%
Sprint	90.08%
T-Mobile	80.49%
Cricket Communications, Inc.	29.25%
Other	1.12%

Source: (NTIA, 2014)

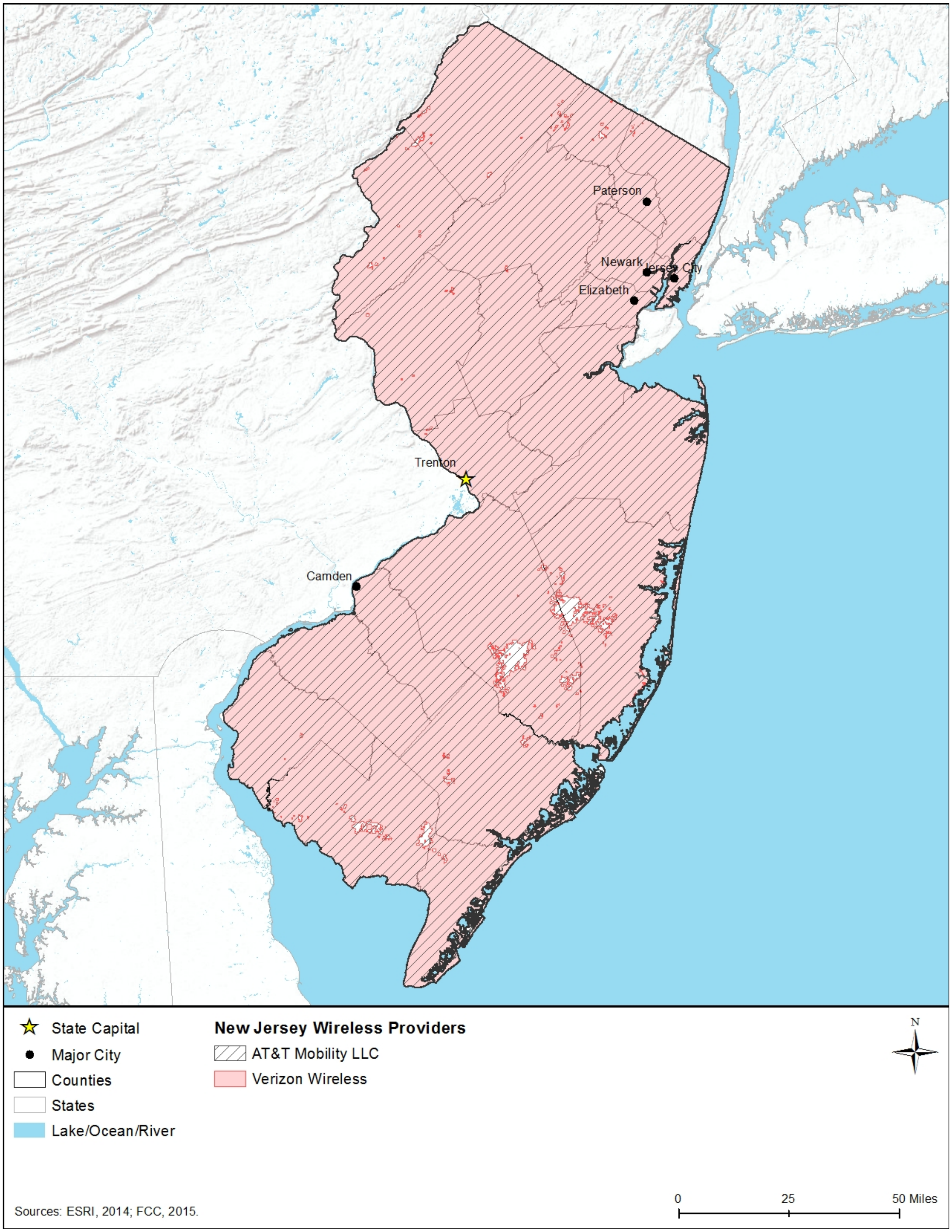


Figure 10.1.1-8: AT&T and Verizon Wireless Availability in New Jersey

Source: (NTIA, 2014)

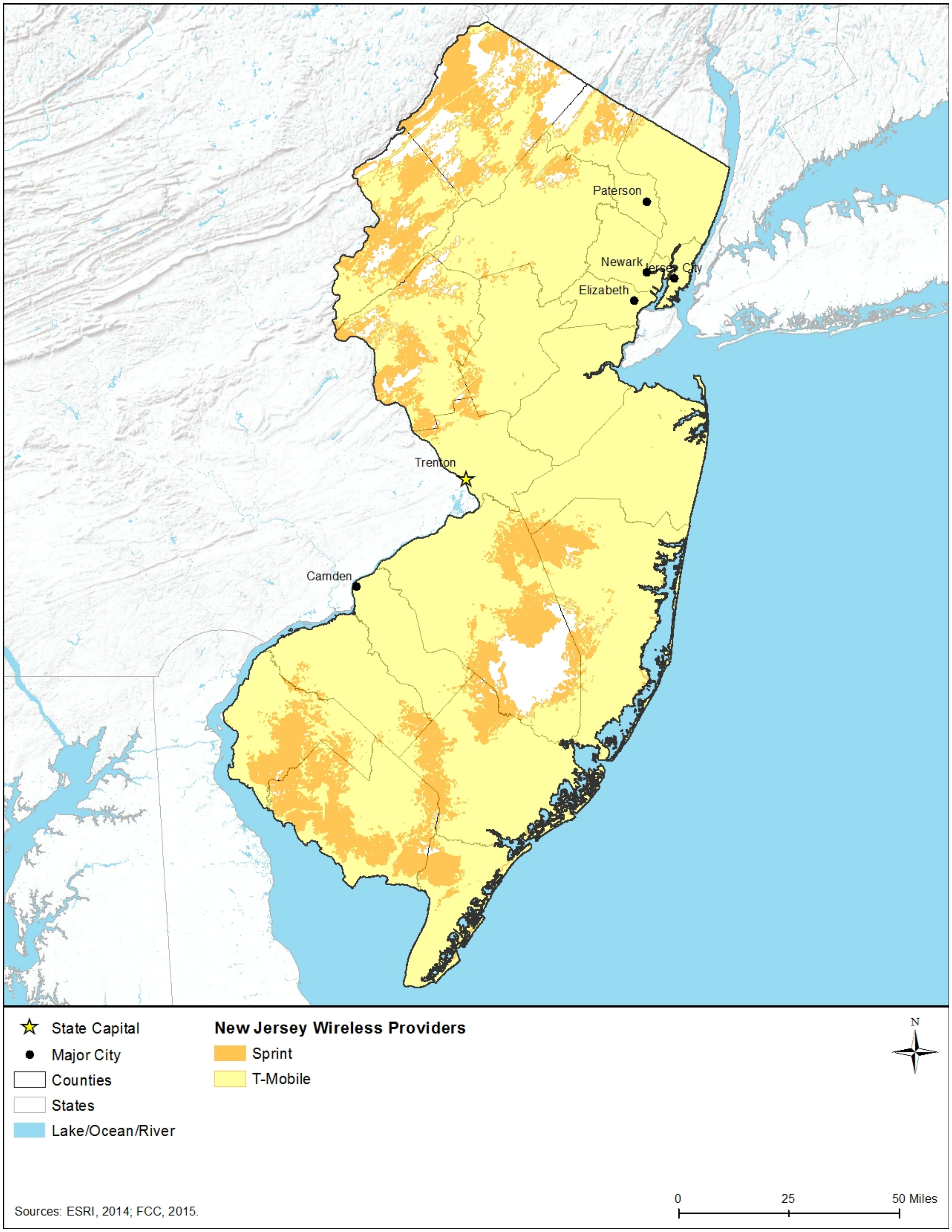


Figure 10.1.1-9: Sprint Wireless and T-Mobile Availability in New Jersey

Source: (NTIA, 2014)

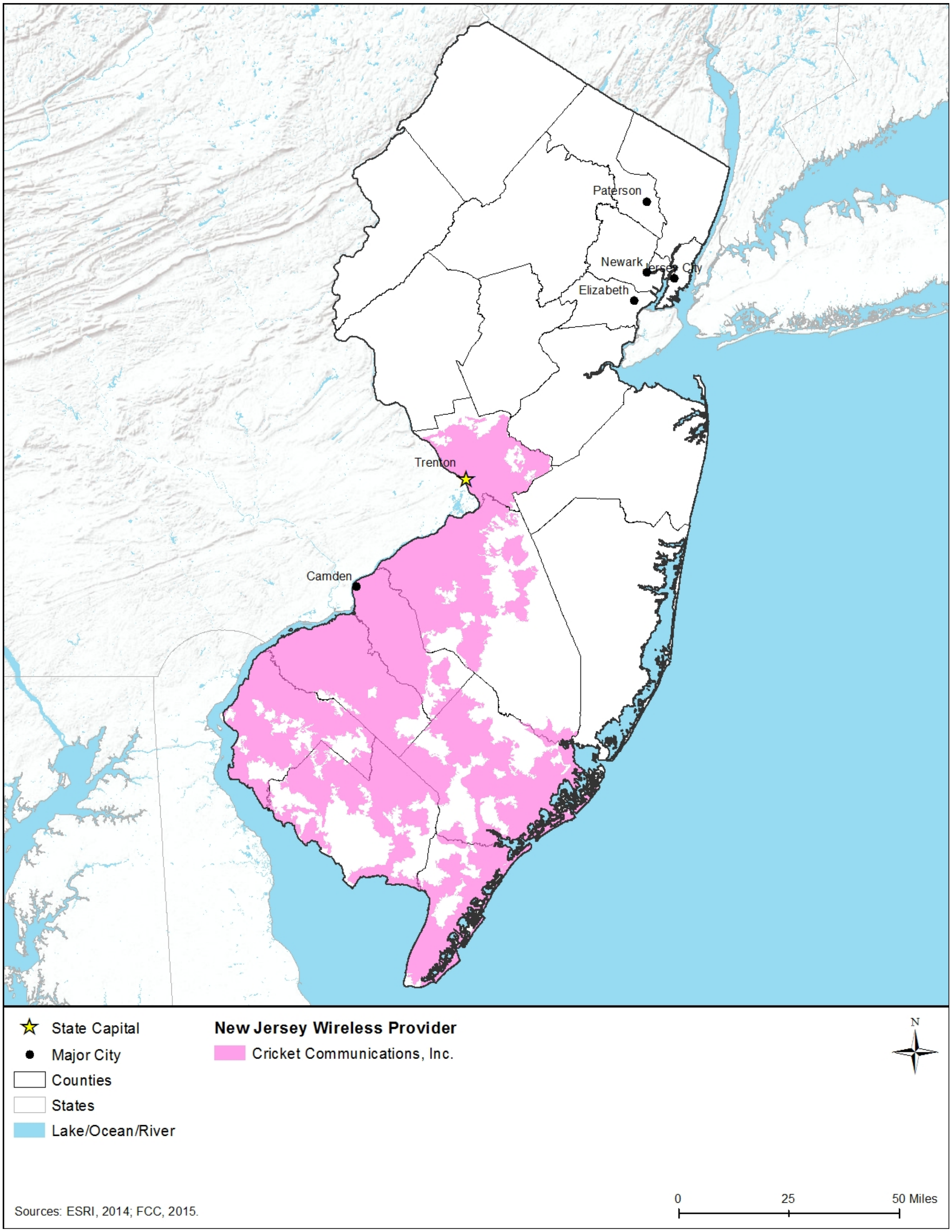


Figure 10.1.1-10: Cricket Wireless Availability in New Jersey

Source: (NTIA, 2014)

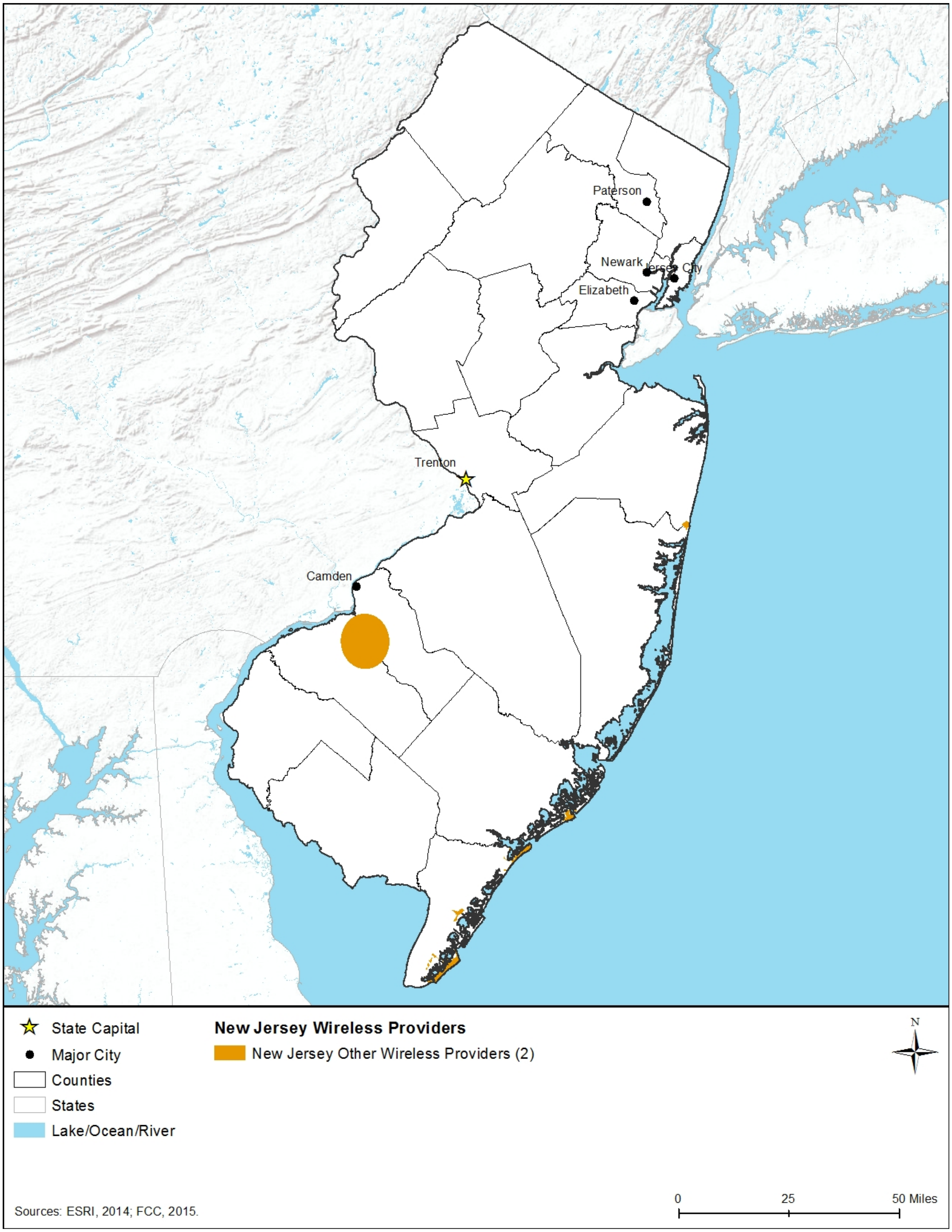


Figure 10.1.1-11: Other Wireless Providers in New Jersey

Source: (NTIA, 2014)

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 10.1.1-12 presents representative examples of each of these categories or types of towers.

Monopole
100 – 200 feet
Source: *http://laps.noaa.gov/birk/laps_intranet/site_photos/Monarch/tower.jpg*

Lattice
200 – 400 feet
Source: Personal Picture

Guyed
200 – 2,000 feet
Source: *http://www.esrl.noaa.gov/gmd/ccgg/insitu/*

Figure 10.1.1-12: Types of Towers

Telecommunications tower infrastructure can be found throughout New Jersey State, although tower infrastructure is concentrated in the higher and more densely populated areas of Jersey City, Elizabeth, and Newark and along the eastern shore (USFS, 2009a). Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016b).[8] Table 10.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in the state of New Jersey. Figure 10.1.1-13 shows the location of those 732 structures, as of June 2015.

[8] An antenna structure must be registered with the FCC if the antenna structure is taller than 200 feet above ground level or may interfere with the flight path of a nearby airport.

Table 10.1.1-9: Number of Commercial Towers in New Jersey by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	49	100ft and over	0
75ft – 100ft	70	75ft – 100ft	0
50ft – 75ft	183	50ft – 75ft	4
25ft – 50ft	236	25ft – 50ft	61
25ft and below	36	25ft and below	4
Subtotal	**574**	**Subtotal**	**69**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	6	100ft and over	2
75ft – 100ft	6	75ft – 100ft	0
50ft – 75ft	9	50ft – 75ft	1
25ft – 50ft	5	25ft – 50ft	2
25ft and below	0	25ft and below	6
Subtotal	**26**	**Subtotal**	**11**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	4	100ft and over	0
75ft – 100ft	10	75ft – 100ft	0
50ft – 75ft	16	50ft – 75ft	0
25ft – 50ft	11	25ft – 50ft	0
25ft and below	2	25ft and below	0
Subtotal	**43**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	9		
Subtotal	**9**		
Total All Tower Structures		**732**	

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (FCC, 2013a)

[b] Free standing or guyed structure used for communication purposes (FCC, 2013a)

[c] Multiple constructed structures per antenna registration (FCC, 2013a)

[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2013a)

Source: (FCC, 2015)

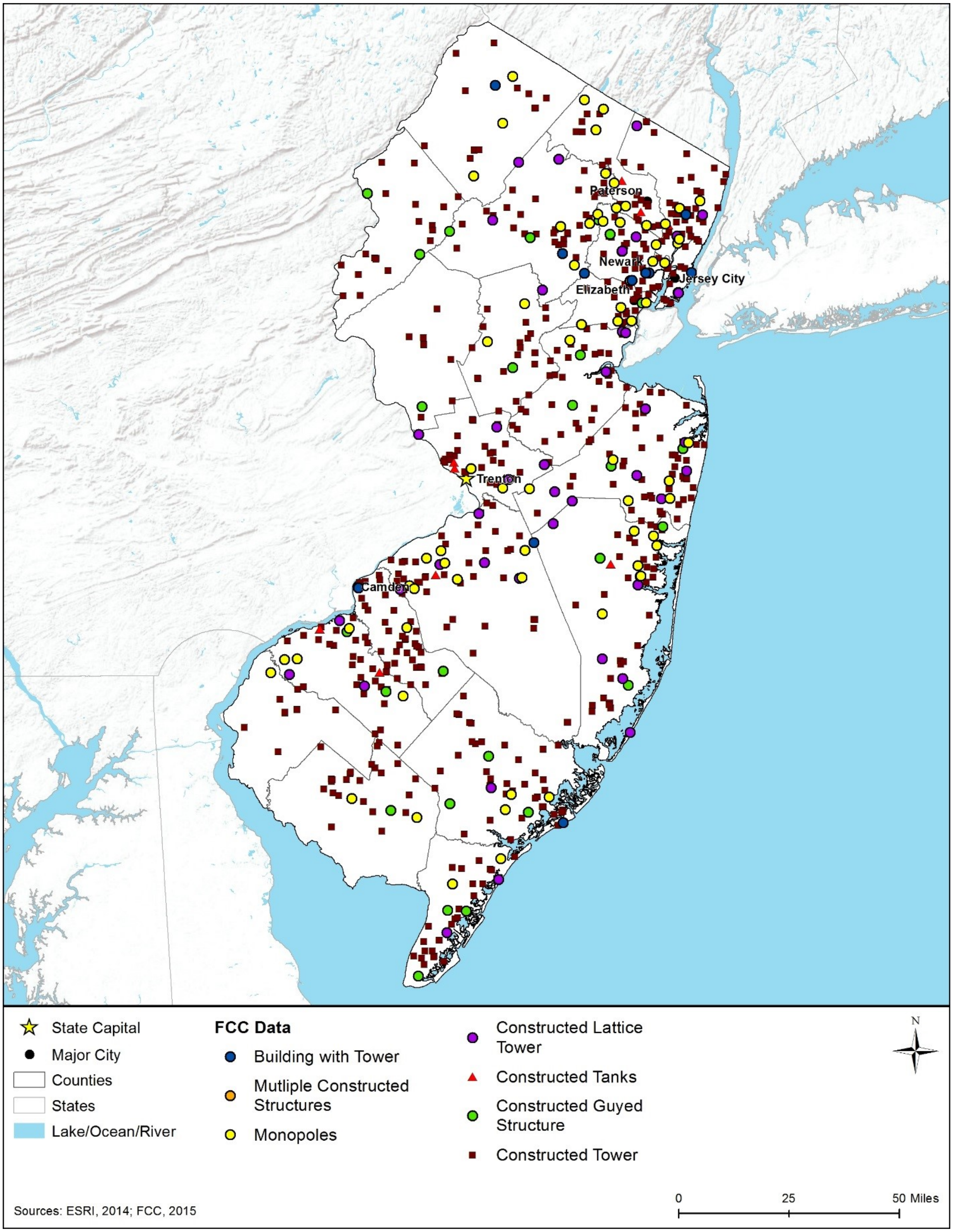
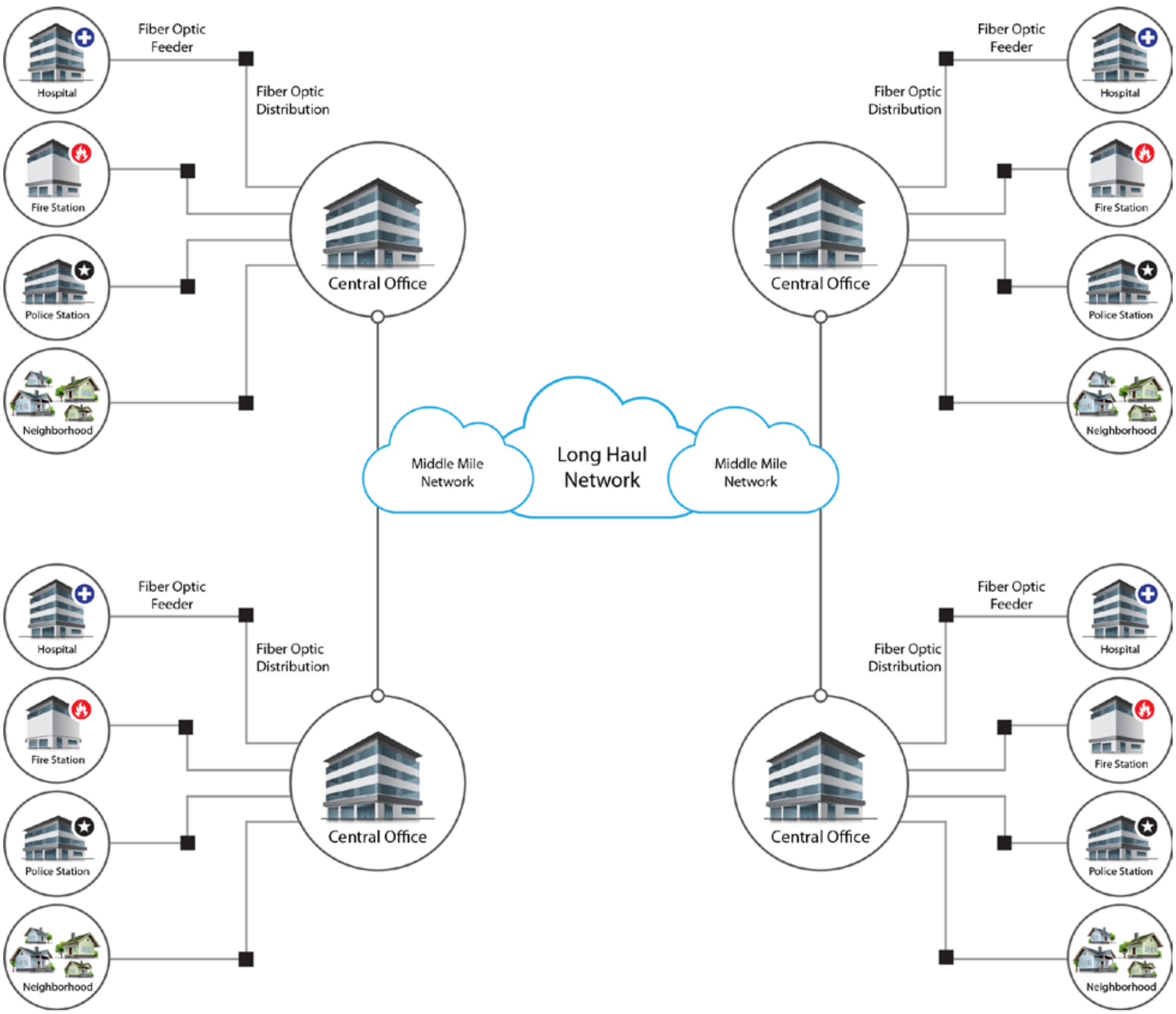


Figure 10.1.1-13: FCC Tower Structure Locations in New Jersey

Source: (FCC, 2015)

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 10.1.1-14. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Prepared by: Booz Allen Hamilton

Figure 10.1.1-14: Typical Fiber Optic Network in New Jersey

Last Mile Fiber Assets

In New Jersey, fiber access networks are concentrated in the highest population centers as shown in the figures below. In New Jersey there are 23 fiber providers that offer service in the state, as listed in Table 10.1.1-10. Figure 10.1.1-15 shows coverage for all providers but Verizon, Comcast, Cablevision, and Century Link, whose coverage areas are depicted in Figure 10.1.1-16, Figure 10.1.1-17, and Figure 10.1.1-18, respectively.

Table 10.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Verizon	62.39%
Comcast	47.42%
MegaPath Corporation	31.46%
CABLEVISION/LIGHTPATH	24.73%
CenturyLink	12.82%
Service Electric Broadband Cable	7.54%
Service Electric Cable TV of Hunterdon, Inc.	1.96%
Level 3 Communications, LLC	0.96%
Monmouth Telephone & Telegraph	0.95%
NetCarrier Telecom, Inc.	0.80%
XOCSI	0.69%
Access One, Inc.	0.58%
Warwick Online	0.57%
Xchange Telecom	0.54%
Time Warner Cable	0.30%
Light Tower Fiber LLC	0.22%
TW Telecom of New Jersey	0.12%
Zayo Group, LLC	0.06%
Cogent Communications, Inc.	0.03%
Fibertech	0.02%
Meriplex Communications, Ltd.	0.02%
GOES Telecom	0.01%

Source: (NTIA, 2014)

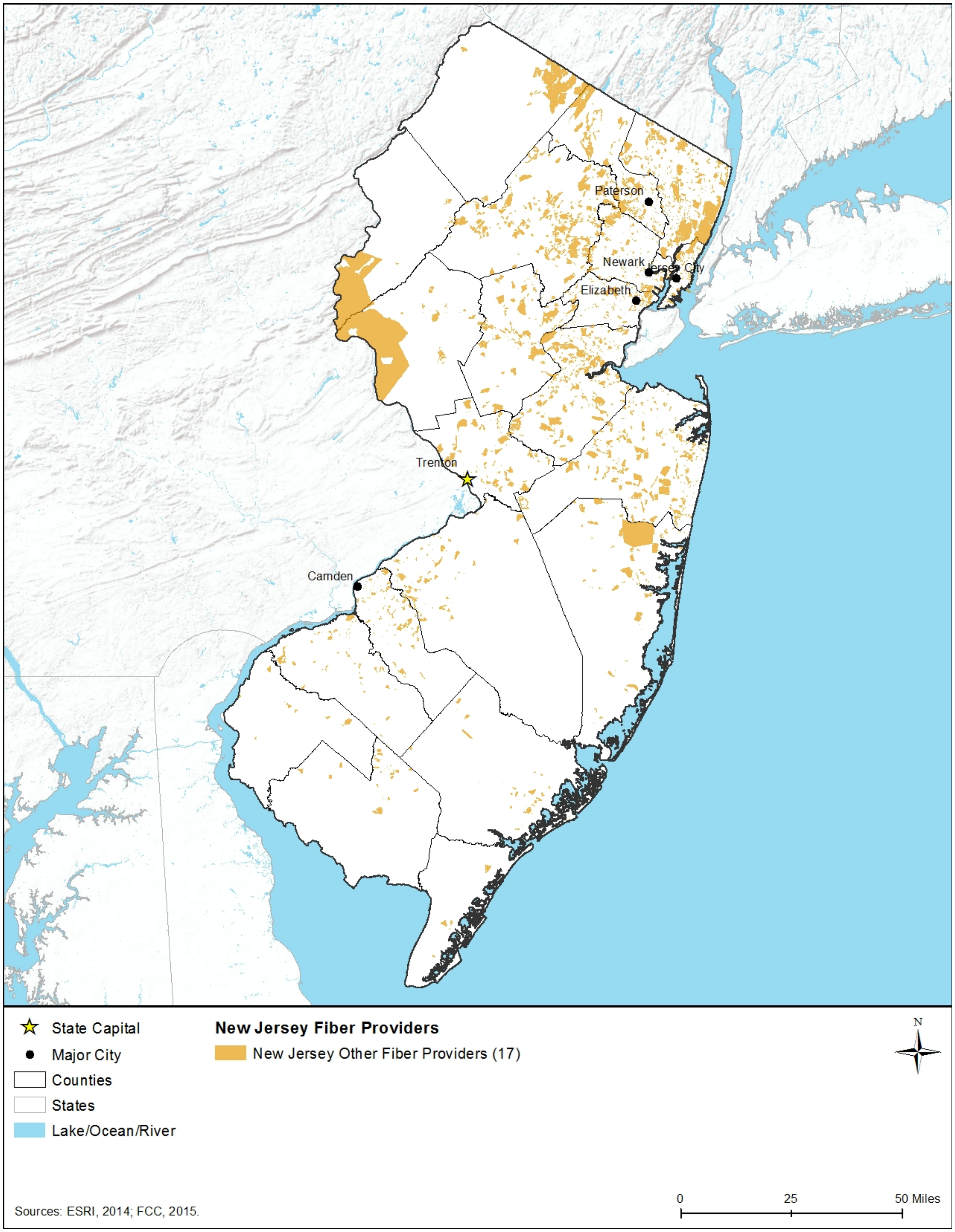


Figure 10.1.1-15: Fiber Availability in New Jersey for All Providers but Verizon, Comcast, Cablevision, and Century Link

Source: (NTIA, 2014)

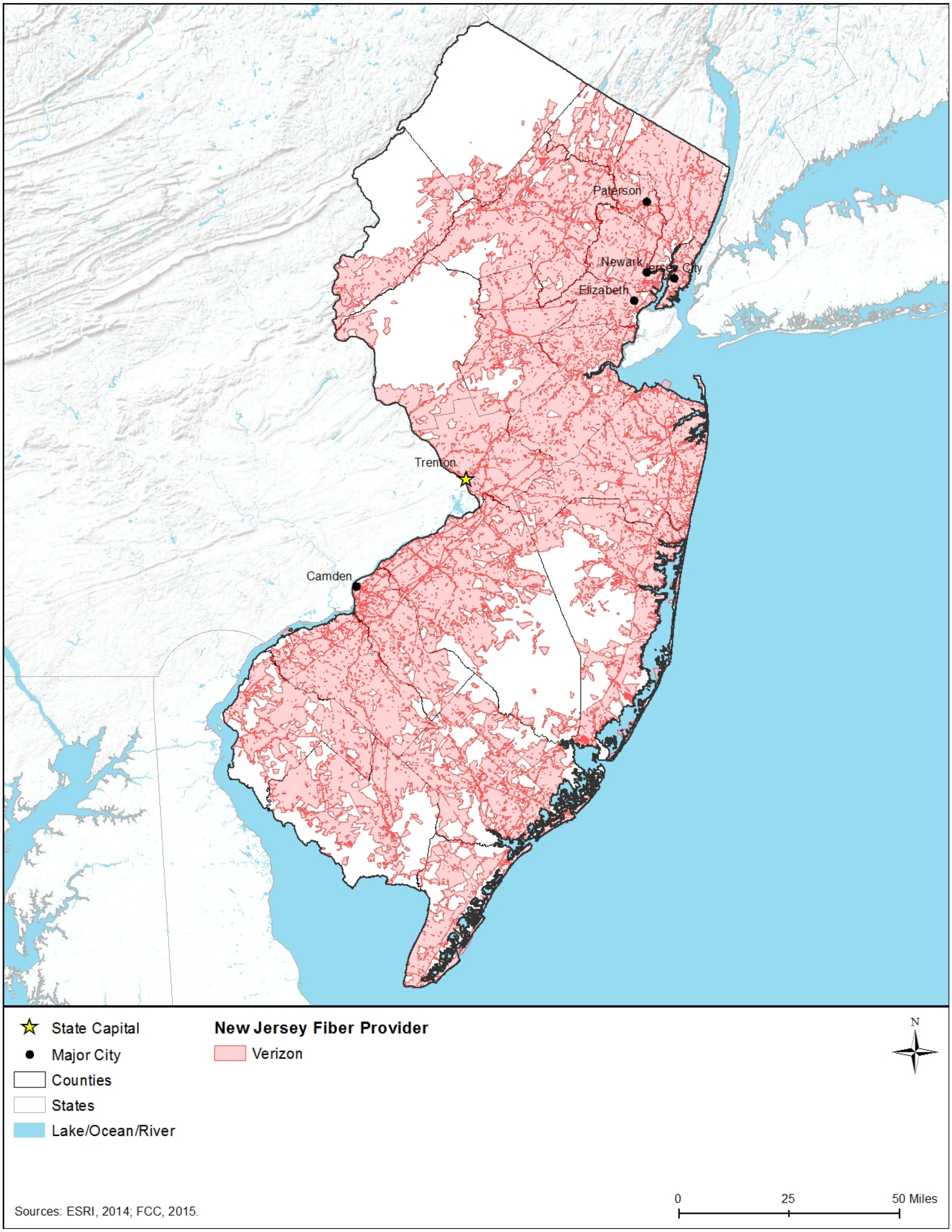


Figure 10.1.1-16: Verizon Fiber Availability in New Jersey

Source: (NTIA, 2014)

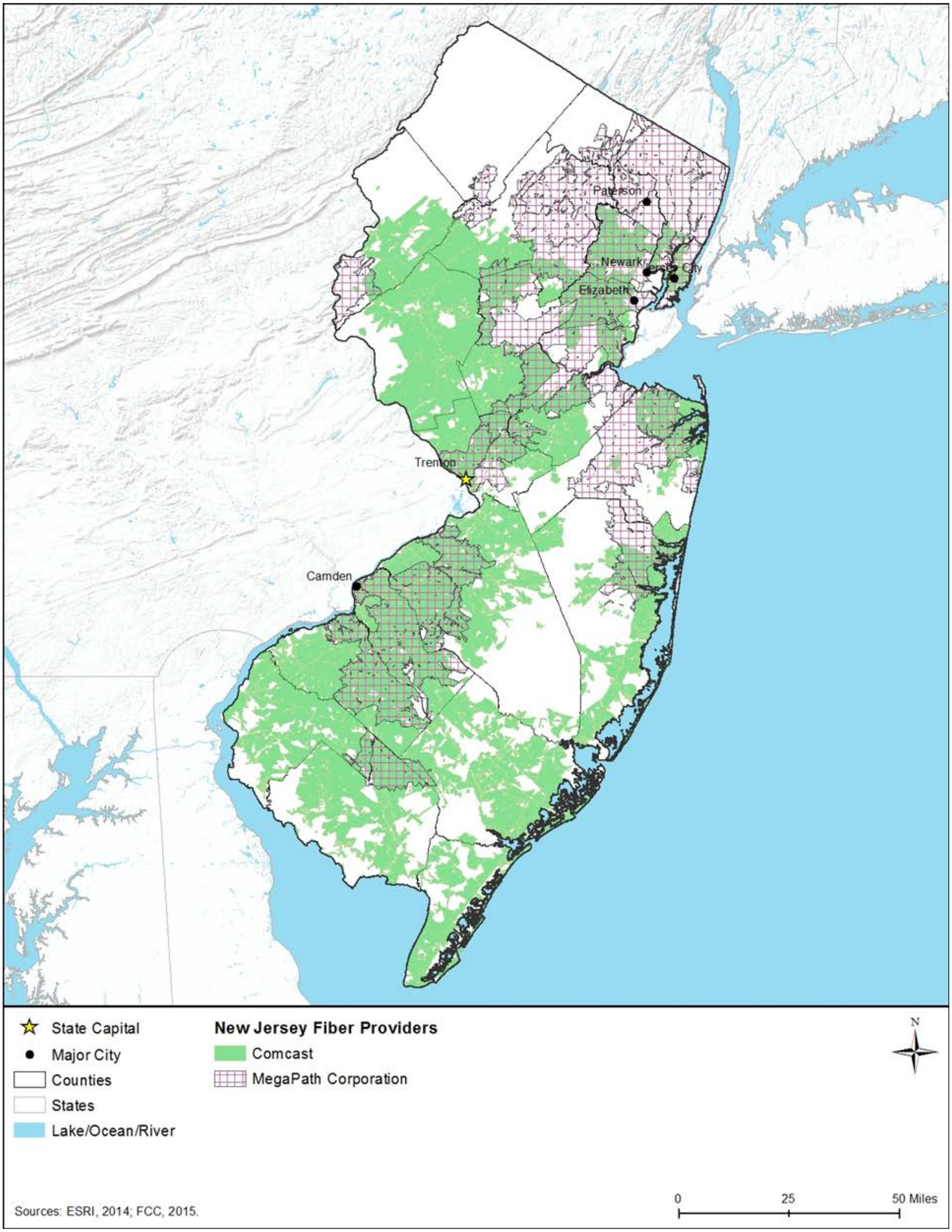


Figure 10.1.1-17: Comcast and MegaPath Corporation Fiber Availability in New Jersey

Source: (NTIA, 2014)

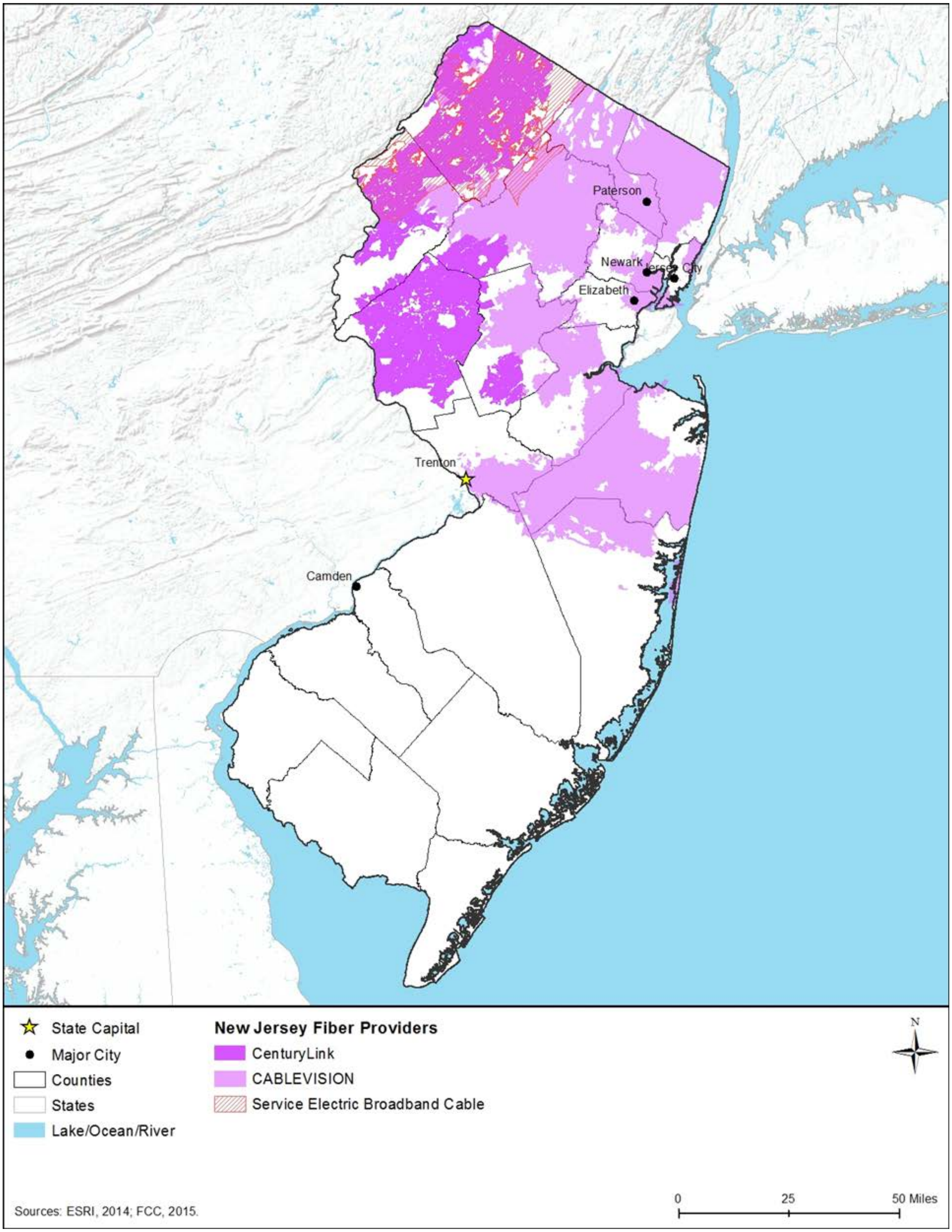


Figure 10.1.1-18: CenturyLink and Cablevision Fiber Availability in New Jersey

Source: (NTIA, 2014)

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among and between telecommunications carriers and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013).

10.1.1.6 Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and sewage. Section 10.1.4, Water Resources, describes the potable water sources in the state.

Electricity

New Jersey's electricity companies are overseen by the Board of Public Utilities. This organization also oversees the regulation of natural gas, water, cable and other telecommunications (BPU, 2015a). New Jersey is divided into four areas, based on the company transmission and distribution. Each of these four areas contains a number of other electric companies that generate or supply electricity. The territory of Atlantic City Electric Service contains eighty three electric companies, serving residential, commercial, and industrial customers (BPU, 2014a). JCP&L contains eighty five electric companies within its territory (BPU, 2014b). The electric company Orange and Rockland Electric has territory including 61 electric companies (BPU, 2014c). Likewise, PSE&G contains ninety eight electric companies in its territory (BPU, 2014d). Out of the 397 trillion British Thermal Units (BTUs) of energy New Jersey produced in 2012, 347 trillion BTUs came from nuclear power.[9] The remaining 50 trillion BTUs came from renewable energy sources. The following year, New Jersey had the tenth highest electricity prices in the nation. By 2021, the state plans to have over 20 percent of its electricity sales come from renewable energy sources such as solar and offshore wind (EIA, 2015a).

Water

The New Jersey Board of Public Utilities also oversees water utilities, through its Division of Water. The Division of Water oversees utility service rates, infrastructure needs, reliability of the water supply, water reuse, aquifer depletion, and other related areas (BPU, 2015b). The Division regulates a total of 27 water companies throughout the state. Eight of these are regulated by the Division only in terms of service and reliability, but not their rates (BPU, 2015c). In addition, the NJDEP has a Division of Water Supply and Geoscience, which monitors the safety and reliability of water supplies. This Division regulates the diversions and

[9] One British Thermal Unit (BTU) is defined as "The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit)" (EIA, 2015b).

infrastructure of water used for drinking, industry, and irrigation. Part of their mission involves the long term planning of water availability to minimize the strain due to water shortages or emergencies (DWSG, 2015).

Wastewater

New Jersey's Board of Public Utilities, Division of Water, also oversees the state's wastewater treatment facilities. It maintains wastewater infrastructure and handles the terms of service and management contracts. The Division of Water regulates 14 wastewater companies across the state (BPU, 2015b). Wastewater treatment system operators are licensed through the NJDEP Division of Licensing and Pesticides Operations. This entails several training courses, the passing of an exam, and the completion of several continuing education training courses if an operator wants to renew a license, which must be completed annually (NJDEP, 2015a).

Solid Waste Management

The disposal of solid waste in New Jersey is regulated by the NJDEP Division of Solid and Hazardous Waste (DSHW, 2015a). This Division handles nine types of solid waste: municipal, dry sewage sludge, bulky waste, construction and demolition waste, vegetative waste, animal and food processing waste, dry industrial waste, waste containing asbestos, and waste containing incinerator ash (DSHW, 2012). They manage recycling facilities that deal with multiple kinds of waste, including asphalt, concrete, brush, tires, wood, tree stumps and parts, and several others (DSHW, 2015b). They also manage 38 compost facilities where residents can compose leaves, grass, brush, and other organic materials. Nineteen of these facilities are both Class B and C (DSHW, 2015c).

10.1.2 Soils

10.1.2.1 Definition of the Resource

The Soil Science Society of America defines soil as:

(i) "The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants." (NRCS, 2015a)

(ii) "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." (NRCS, 2015a)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (University of Minnesota, 2001):

- *Parent Material*: The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.

- *Climate*: Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
- *Topography*: Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.
- *Biology*: The presence/absence of vegetation in soils affects the quantity of organic content of the soil.
- *Time*: Soil properties are dependent on the period over which other processes act on them.

10.1.2.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Appendix C. A list of applicable state laws and regulations is included in Table 10.1.2-1 below.

Table 10.1.2-1: Relevant New Jersey Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Soil Erosion and Sediment Control Act Chapter 251, P. L. 1975	New Jersey Department of Agriculture	Requires the submission of a Soil Erosion and Sediment Control Plan for almost all soil disturbances over 5,000 square feet.

Source: (New Jersey Department of Agriculture, 2015a)

10.1.2.3 Environmental Setting

New Jersey is composed of three Land Resource Region (LRR),[10] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Atlantic and Gulf Coast Lowland Forest and Crop Region,
- Northeastern Forage and Forest Region, and
- Northern Atlantic Slope Diversified Farming Region.

Within and among New Jersey's three LRRs are five Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of New Jersey's MLRAs are presented in Figure 10.1.2-1 and Table 10.1.2-2, respectively.

[10] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[11] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).

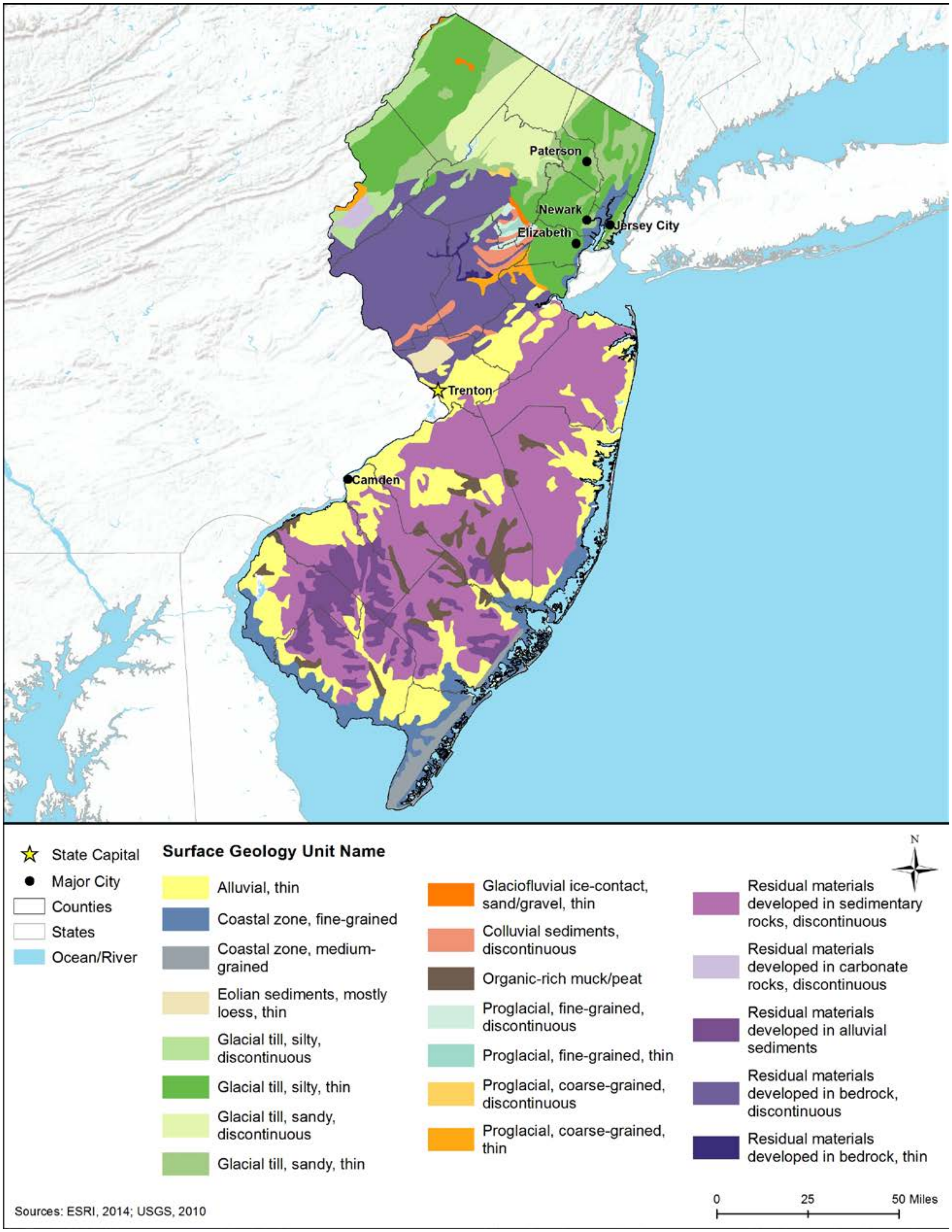


Figure 10.1.2-1: Locations of Major Land Resource Areas in New Jersey

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation and position on the landscape, biota[12] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[13] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[14] (discussed further in the subsections below).

Table 10.1.2-2: Characteristics of Major Land Resource Areas in New Jersey

MLRA Name	Region of State	Soil Characteristics
Northern Tidewater Area	Eastern New Jersey, along the Atlantic Ocean	Ultisols are the dominant soil order, with Entisols[15], Histosols[16], Spodosols[17], and Inceptisols[18] occurring to a lesser degree. Soils in this MLRA are very deep. They are very poorly drained to excessively drained, and generally loamy or sandy in the mineral horizons, with a strip of coastal beach dune sand extending along the Atlantic Ocean in most of the MLRA.
Northern Piedmont	Northwestern New Jersey	Dominant soil orders are Alfisols,[19] Inceptisols, and Ultisols[20]. The soils in this area are moderately deep to very deep, moderately well-drained to somewhat excessively drained, and loamy or loamy-skeletal.
Northern Coastal Plain	Central and southwest New Jersey, and includes the cities of Trenton and Camden	Ultisols are the dominant soil order in this MLRA, and soils in this area are very deep, excessively drained to very poorly drained, and primarily loamy or sandy.

[12] The flora and fauna of a region.
[13] Expansive soils are characterized by "the presence of swelling clay materials" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).
[15] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface" (NRCS, 2015b).
[16] Histosols: "Soils that have a high content of organic matter and no permafrost. Also known as bogs, moors, peats, or mucks, these soils are saturated year round and form in decomposed plant remains. If exposed to air and drained, the microbes will decompose and the soils can subside dramatically. They make up nearly 1% of the world's ice-free land surface" (NRCS, 2015b).
[17] Spodosols: "Soils formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in subsoil. They commonly occur in areas of coarse-textured deposits under forests of humid regions, tend to be acid and infertile, and make up nearly 4% of the world's ice-free land surface" (NRCS, 2015b).
[18] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates and make up nearly 17% of the world's ice-free land surface" (NRCS, 2015b).
[19] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10% of the world's ice-free land surface" (NRCS, 2015b).
[20] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8% of the world's ice-free land surface" (NRCS, 2015b).

New England and Eastern New York Upland, Southern Part	Northern New Jersey, and includes the cities of Patterson, Newark, Jersey City, and Elizabeth	Dominant soil orders in this MLRA include Entisols, Histosols, and Inceptisols, and the soils are generally very deep, somewhat excessively drained to poorly drained, and loamy or sandy.
Glaciated Allegheny Plateau and Catskill Mountains	Far northwestern New Jersey	Inceptisols are the dominant soil order in this MLRA, and soils in this area are shallow to very deep, well-drained to very poorly drained, and are loamy or loamy-skeletal.

Source: (NRCS, 2006)

10.1.2.4 Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy[21]; there are twelve soil orders in the world and they are characterized by both observed and inferred[22] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015c). The STATSGO2[23] soil database identifies eight different soil suborders in New Jersey (NRCS, 2015d). Figure 10.1.2-2 depicts the distribution of the soil suborders, and Table 10.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[21] A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013a)
[22] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015c).
[23] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

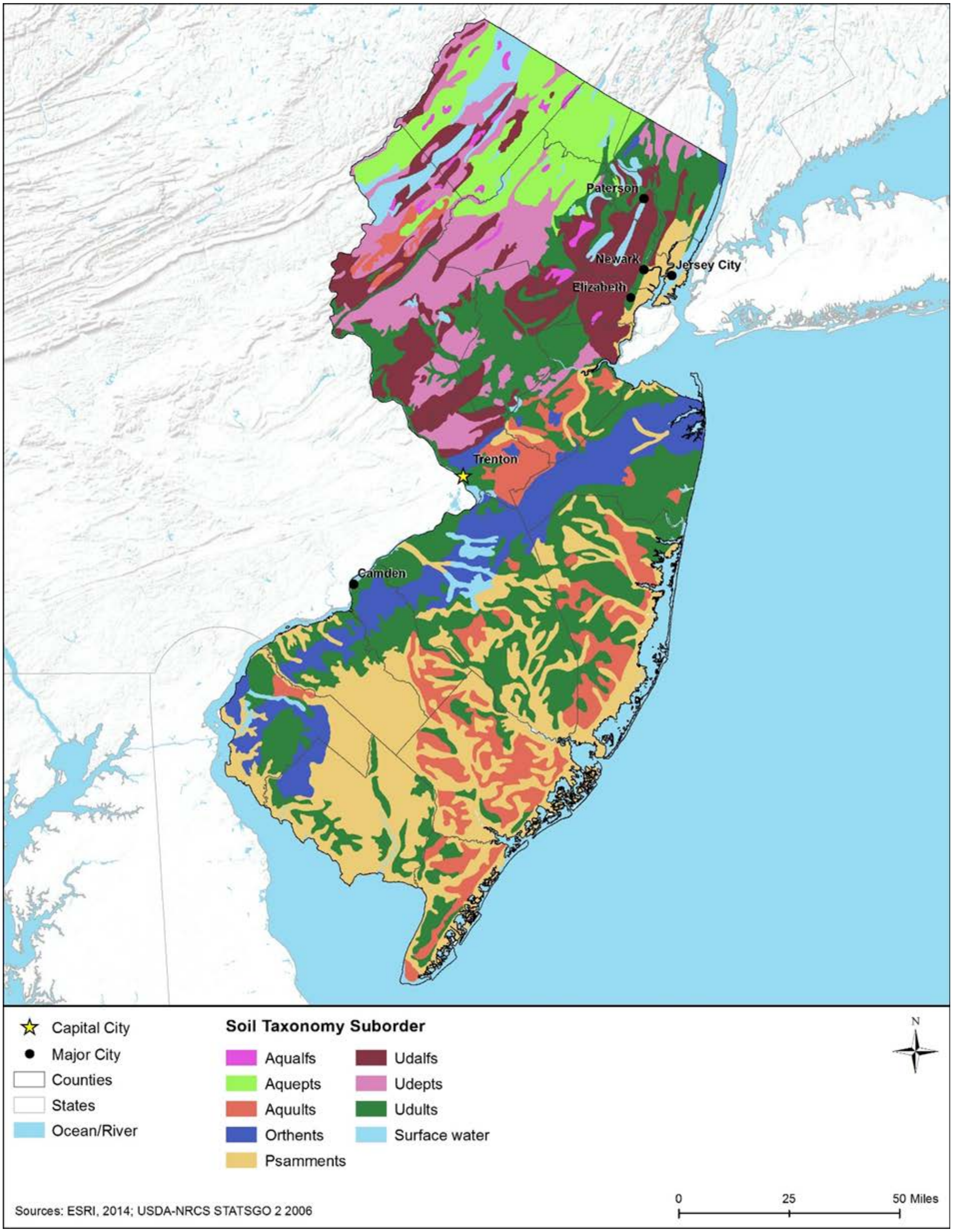


Figure 10.1.2-2: New Jersey Soil Taxonomy Suborders

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Table 10.1.2-3: Major Characteristics of Soil Suborders Found in New Jersey, as depicted in Figure 10.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[24]	Hydrologic Group	Runoff Potential	Permeability[25]	Erosion Potential	Compaction and Rutting Potential
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Clay Loam	0-3	Poorly drained	Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Channery loam, channery silt loam, gravelly loam, sandy loam, silt loam	0-15	Very poorly drained to somewhat poorly drained	No, Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Ultisols	Aquults	Aquults are found in wet areas where groundwater is very close to the surface during part of each year, usually in winter and spring. Their slopes are gentle, with many soils formerly and currently supporting forest vegetation.	Loam, silty clay loam	0-3	Poorly drained	Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Sandy clay, stratified cobbly coarse sand to very gravelly loamy fine sand	0-25	Well drained to excessively drained	No	A, C	Low, Medium	High, Low	Low to Medium, depending on slope	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Coarse sand, stratified sand to sandy loam	0-5	Excessively drained	No	A	Low	High	Low	Low
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Channery loam, clay, loam, silt loam, stratified very gravelly sand to very gravelly loamy coarse sand	0-15	Somewhat poorly drained to well drained	No	B, C	Medium	Moderate, Low	Medium to High, depending on slope	Low
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Channery loam, channery silt loam, fine sandy loam, gravelly fine sandy loam, gravelly loamy fine sand, gravelly sandy loam, silt loam, unweathered bedrock, very gravelly loam	0-60	Excessively drained to well drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have an udic moisture regime. Most of these soils currently support or formerly supported mixed forest vegetation, and many have been cleared and used as cropland (mostly with the use of soil amendments).	Channery loam, gravelly sandy clay loam, loamy fine sand, sand, sandy loam, silt loam, stratified gravelly loamy sand, stratified gravelly sand to sandy clay loam, stratified sand to gravelly sandy loam, stratified sand to sandy loam	0-15	Somewhat excessively drained to well drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low

Sources: (NRCS, 2015d) (NRCS, 1999)

[24] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (NRCS, 2015e).
[25] Based on Runoff Potential, described in Section 10.1.2.5.

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10.1.2.5 Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[26] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 10.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in New Jersey.

Group A. **Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[27] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Orthents, Psamments, Udepts, and Udults fall into this category in New Jersey.

Group B. **Silt loam or loam soils.** This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Aquepts, Udalfs, Udepts, and Udults fall into this category in New Jersey.

Group C. **Sandy clay loam soils.** This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University, 2015). This group has medium runoff potential. Aqualfs, Aquepts, Aquults, Orthents, Udalfs, Udepts, and Udults, fall into this category in New Jersey.

Group D. **Clay loam, silty clay loam, sandy clay, silty clay, or clay soils.** This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University, 2015). Aqualfs, Aquepts, and Aquults fall into this category in New Jersey.

10.1.2.6 Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 10.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in New Jersey. Soils with the highest erosion potential in New

[26] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.
[27] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time" (FEMA, 2010).

Jersey include those in the Aqualfs, Aquepts, Aquults, Udalfs, and Udepts suborders, which are found throughout northern and eastern areas of the state (Figure 10.1.2-2).

10.1.2.7 Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFWS, 2009). Other characteristics that factor into compaction and rutting risk include soil composition (i.e. low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than ten tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b) (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 10.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in New Jersey. Soils with the highest potential for compaction and rutting in New Jersey include those in the Aqualfs, Aquepts, and Aquults suborders, which are found throughout the state (Figure 10.1.2-2).

10.1.3 Geology

10.1.3.1 Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability. Several of these elements are discussed in other sections of this Draft Programmatic Environmental Impact Statement (PEIS), including Water Resources (Section 10.1.4), Human Health and Safety (Section 10.1.15), and Climate Change (Section 10.1.14).

This section covers the six aspects of geology most relevant to the Proposed Action and Alternatives:

- Section 10.4.3, Major Physiographic Regions and Provinces[28,29]
- Section 10.4.4, Surface Geology
- Section 10.4.5, Bedrock Geology[30]
- Section 10.4.6, Paleontological Resources[31]
- Section 10.4.7, Fossil Fuel and Mineral Resources
- Section 10.4.8, Potential Geologic Hazards[32]

10.1.3.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act (NHPA) and the Clean Water Act (CWA), are detailed in Appendix C. A list of applicable state laws and regulations is included in Table 10.1.3-1 below.

Table 10.1.3-1: Relevant New Jersey Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
New Jersey Administrative Code, State Park Service Code 7:2-2.10(c) Damage to property/tampering	New Jersey State Park Service	Cannot dig up, deface, or remove any soil, rock, historic or fossil materials or artifacts without written permission of the Director of the Division of Parks and Forestry or the Assistant Director of the Division for the State Park Service
New Jersey Building Code (2015)	New Jersey Department of Community Affairs	Provisions for earthquake-resistant design

Sources: (NJDEP, 2014a) (International Code Council, 2015)

10.1.3.3 Environmental Setting: Physiographic Regions and Provinces

The concept of physiographic regions was created in 1916 by geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation). Physiographic regions are areas of distinctive topography, geography, and geology. "Important physiographic differences between adjacent areas are, in a large proportion of cases, due to differences in the nature or structure of the underlying rocks." There are eight distinct physiographic regions in the continental United States: 1) Atlantic Plain, 2) Appalachian Highlands, 3) Interior Plains, 4) Interior Highlands, 5) Laurentian Upland, 6) Rocky Mountain System, 7) Intermontane Plateaus, and 8) Pacific Mountain System. Regions are further sub-

[28] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[29] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[30] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015b).
[31] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015c).
[32] Geologic Hazards: "Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements" (NPS, 2013).

divided into physiographic provinces based on differences observed on a more local scale. (Fenneman, 1916)

New Jersey has two major physiographic regions: Atlantic Plain and Appalachian Highlands (USGS, 2003a) *(*Figure 10.1.3-1). The locations of these regions are shown in Figure 10.1.3-1 and their general characteristics summarized in the following subsections.

Atlantic Plain Region

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. Sedimentary strata become thinner moving westward through the region, and thicken to several thousand feet thick along the coastline. Erosion from the nearby Appalachian Mountains, which began to form 480 to 440 million years ago (MYA), dislodged sediments, which were subsequently deposited by rivers to form the Atlantic Plain. The area is characterized by gentle topography and a transition zone between the land and sea often having marshes, lagoons, swamps, sand bars, and reefs. Deposits of coastal marine life over millions of years form the basis for rich fossil fuel reserves in the region. (NPS, 2015a)

The Atlantic Plain is the largest physiographic region in New Jersey, and includes the Coastal Plain physiographic province. The Atlantic Plain Region encompasses 4,667 square miles (about 60 percent of the state) and "includes all of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, Ocean, and Salem Counties, and parts of Mercer and Middlesex Counties." A broad, shallow depression runs along the Piedmont boundary from Raritan Bay to Trenton. Near Monmouth Junction, the trough is at about 80 feet above sea level (ASL) and operates as the drainage divide between the Delaware River and Atlantic Ocean. The maximum elevation of the Atlantic Plain Region (in New Jersey) is 391 feet ASL at Crawford Hill. (New Jersey Geological Survey, 2003)

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[33] created when the North American plates collided with the Eurasian and African plates more than 500 MYA. Once similar in height to the present-day Rocky Mountains,[34] the Appalachian Highlands have eroded considerably, and most peaks are now under 5,000 feet ASL. The current Appalachian Highlands Region is characterized by prime and unique farmlands and is rich in mineral resources. (USGS, 2003a)

As reported above, the Appalachian Highlands Region within New Jersey is composed of several physiographic provinces, including the Valley and Ridge, Highlands, and Piedmont (NJDEP, 2015b).

[33] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2014a).
[34] The Rocky Mountains exceed 14,000 feet above sea level (NPS, 2007a).

Valley and Ridge Province – At 536 square miles in area, New Jersey's Valley and Ridge Province is comprised of a significant portion of Sussex and Warren Counties. The Valley and Ridge province is "underlain by folded and faulted[35] sedimentary rocks of Cambrian to Middle Devonian age" (542 MYA to 374 MYA). At 1,803 feet ASL, High Point, NJ, is not only the highest locale in the Valley and Ridge Province, but also in the state. Valley elevations within the Kittatinny Valley, which is comprised of the eastern portion of the province, range from 400 to 600 feet ASL. Karst[36] topography exists in areas underlain by carbonate[37] sedimentary rocks. (New Jersey Geological Survey, 2003)

Highlands Province – New Jersey's Highlands Province covers about 980 square miles, including portions of Sussex, Warren, Hunterdon, Morris, Passaic, Bergen, and Somerset Counties. The Highlands Province is "about 10 miles wide at the Delaware River and 25 miles wide near the New York border," and is characterized by alternating rounded ridges and narrow valleys; rock types include "highly metamorphosed igneous[38] and sedimentary rocks of Middle Proterozoic age" (1,600 to 1,000 MYA). Throughout the province, maximum peak elevations decrease toward the south; Wawayanda Mountain is the highest spot in the province (1,496 feet ASL). Valley elevations range from 400 to 800 feet, with decreasing elevations moving toward the Delaware River. (New Jersey Geological Survey, 2003)

Piedmont Province – New Jersey's Piedmont Province covers about 1,600 square miles and includes all of Essex, Hudson, and Union Counties, and portions of Bergen, Hunterdon, Somerset, Mercer, Middlesex, Morris, and Passaic Counties. The Province is 30 miles wide at the Delaware River and narrows to 16 miles at the New York border. The Piedmont Province is largely composed of slightly folded and faulted Mesozoic sedimentary and igneous rocks. The Piedmont is a low rolling plain interspersed with occasional ridges, most of which are between 300 and 400 feet ASL. The boundary with the Coastal Plain Region follows "a line from Carteret through Princeton Junction to Trenton." The Fall Line[39] marks the intersection of the Coastal Plain Region and Piedmont Province and spans much of the East Coast. (New Jersey Geological Survey, 2003)

[35] Fault: "A fracture in the Earth along which one side has moved in relative to the other" (USGS, 2015d).
[36] Karst: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater" (USGS, 2015d).
[37] Carbonate Rock: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$)" (USGS, 2015d).
[38] Igneous Rock: "Rock that forms when hot, molten rock (magma) crystallizes and solidifies" (USGS, 2014b).
[39] Fall Line: "The boundary between the Piedmont and Coastal Plain Provinces" (Clearwater, Turgeon, Noble, & LaBranche, 2000).

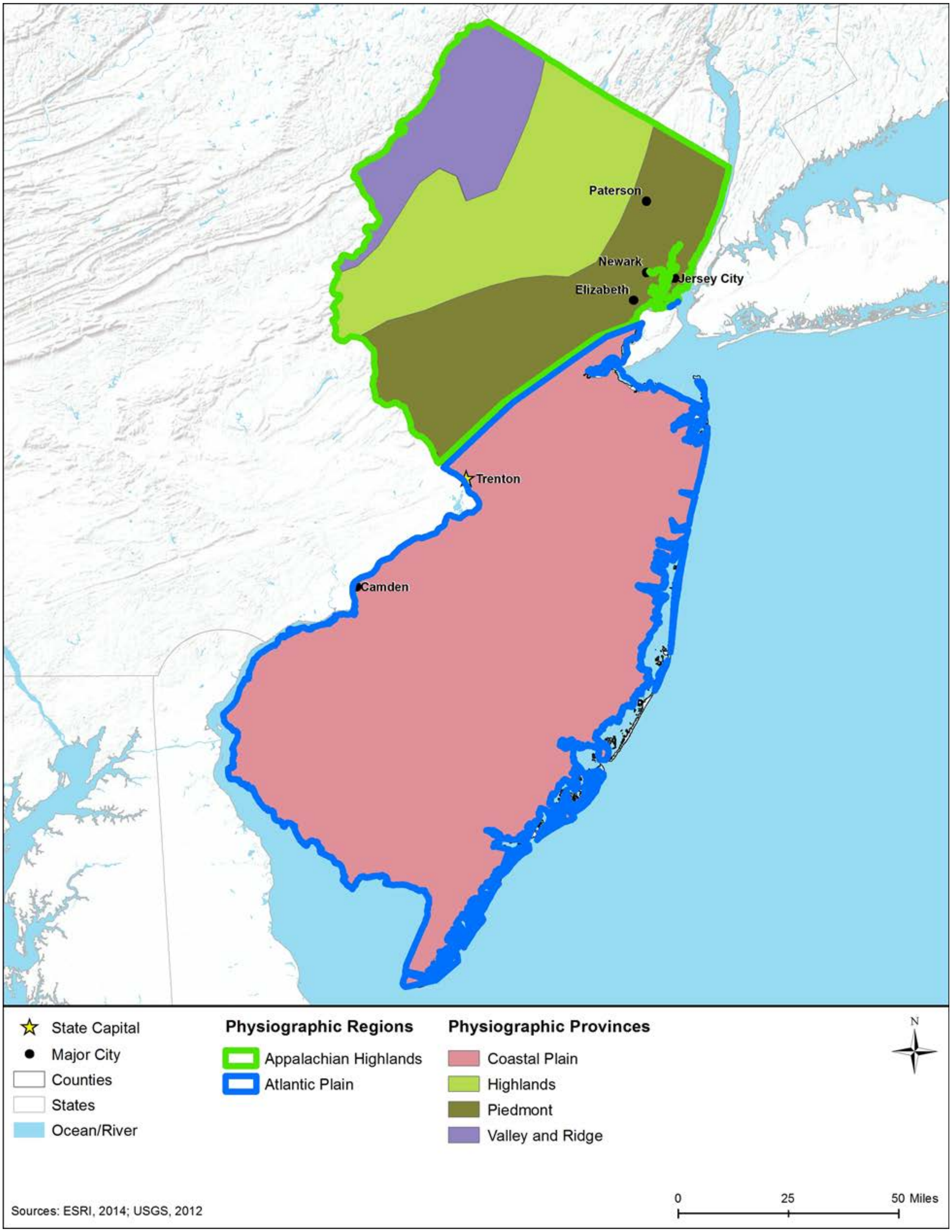

Figure 10.1.3-1: Physiographic Regions and Provinces of New Jersey

10.1.3.4 Surface Geology

Surficial geology is characterized by materials such as till,[40] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures,[41] subsidence,[42] and erosion. (Thompson, 2015)

Within the last 2M years, New Jersey has undergone three glaciations, with the most recent period of glaciation ending roughly 20,000 years ago. North of most recent glaciation's terminal moraine,[43] the landscape is covered with a mixture of sand, clay, and boulder deposits. South of the terminal moraine, the landscape contains sporadic till deposits that are encountered as far south as Somerville (NJDEP, 1999). Deposits from the pre-Illinoisan glaciation (approximately 800,000 years ago) extend into Hunterdon and Somerset Counties. The limit of the Wisconsinan glaciation (about 20,000 years ago) is further north and extends across Warren, Morris, Union, and Middlesex Counties, and continues eastward into New York (New Jersey Geological Survey, 1998a).

Figure 10.1.3-2 depicts a generalized illustration of the surface geology for New Jersey.

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[40] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013a).

[41] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.

[42] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a).

[43] Moraine: "A hill-like pile of rock rubble located on or deposited by a glacier. An end moraine forms at the terminus of a glacier. A terminal moraine is an end moraine at the farthest advance of the glacier. A lateral moraine forms along the sides of a glacier" (NPS, 2000)

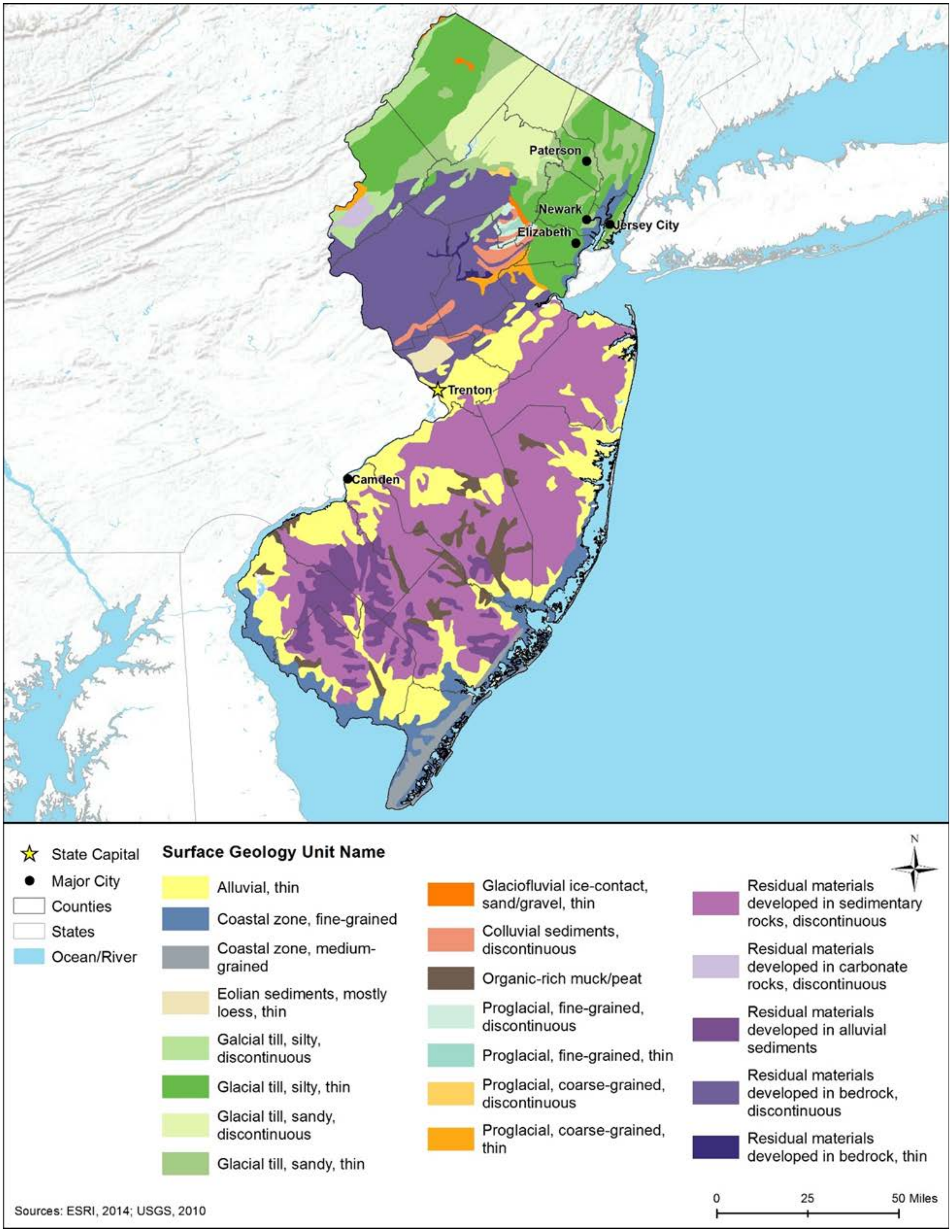

Figure 10.1.3-2: Generalized Surface Geology for New Jersey

10.1.3.5 Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015e) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[44] rock composition, and regional tectonism[45]. These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (USGS, 2013b).

Figure 10.1.3-3 shows the general bedrock geology for New Jersey. Bedrock geology varies across each of New Jersey's Physiographic Regions and Provinces; the bedrock geology of each area is summarized below. Additional New Jersey bedrock geology information is available from the U.S. Geological Survey and New Jersey Department of Environmental Protection (NJDEP, 2015c).

Coastal Plain Province

New Jersey's Coastal Plain Province (within the Atlantic Plain Region) lies southeast of a line between the cities of Carteret and Trenton. Along this boundary, the Coastal Plain's unconsolidated sediments, including sands, silts, and clays overlie the rocks of the Piedmont. These sediments range from 135 to 5.3 million years of age and dip toward the southeast; large areas of the Coastal Plain are covered by a veneer of younger sediments. Sediment thickness increases toward the southeast with depths reaching 4,500 feet near Atlantic City. All sediment layers throughout New Jersey trend northeast/southwest. While the topography of much of the Coastal Plain is flat, there are sporadic areas with greater elevation that are underlain by stronger bedrock. (NJDEP, 1999)

Piedmont Province

The Piedmont Province is underlain by slightly folded[46] and faulted sedimentary rocks ranging from 230 to 190 million years old. The province is characterized as a broad lowland interspersed with northeast-southwest trending ridges and uplands. The entire province sits on a "large, elongate crustal block that dropped downward in the initial stages of the opening of the Atlantic Ocean." During rifting, rock layers were tilted northwestward, folded, and impacted by several faults. Volcanic activity produced erosion-resistant basalts[47] and diabases that are incorporated into the sedimentary layers, and constitute elevated topographic features such as the Palisades, Rocky Hill, Sourland Mountain, and Cushetunk Mountain. The Piedmont Province's valleys are underlain by shale and sandstone. (NJDEP, 1999)

[44] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure" (NPS, 2000).
[45] Tectonicisms: “Structure forces affecting the deformation, uplift, and movement of the earth’s crust” (USGS, 2015f).
[46] Fold: "A bend or flexure produced in rock" (USGS, 2005).
[47] Basalt: "A dark, fine-grained, extrusive (volcanic) igneous rock with a low silica content (40 [percent] to 50 [percent]), but rich in iron, magnesium and calcium. Generally occurs in lava flows, but also as dikes. Basalt makes up most of the ocean floor and is the most abundant volcanic rock in the Earth’s crust" (NPS, 2000).

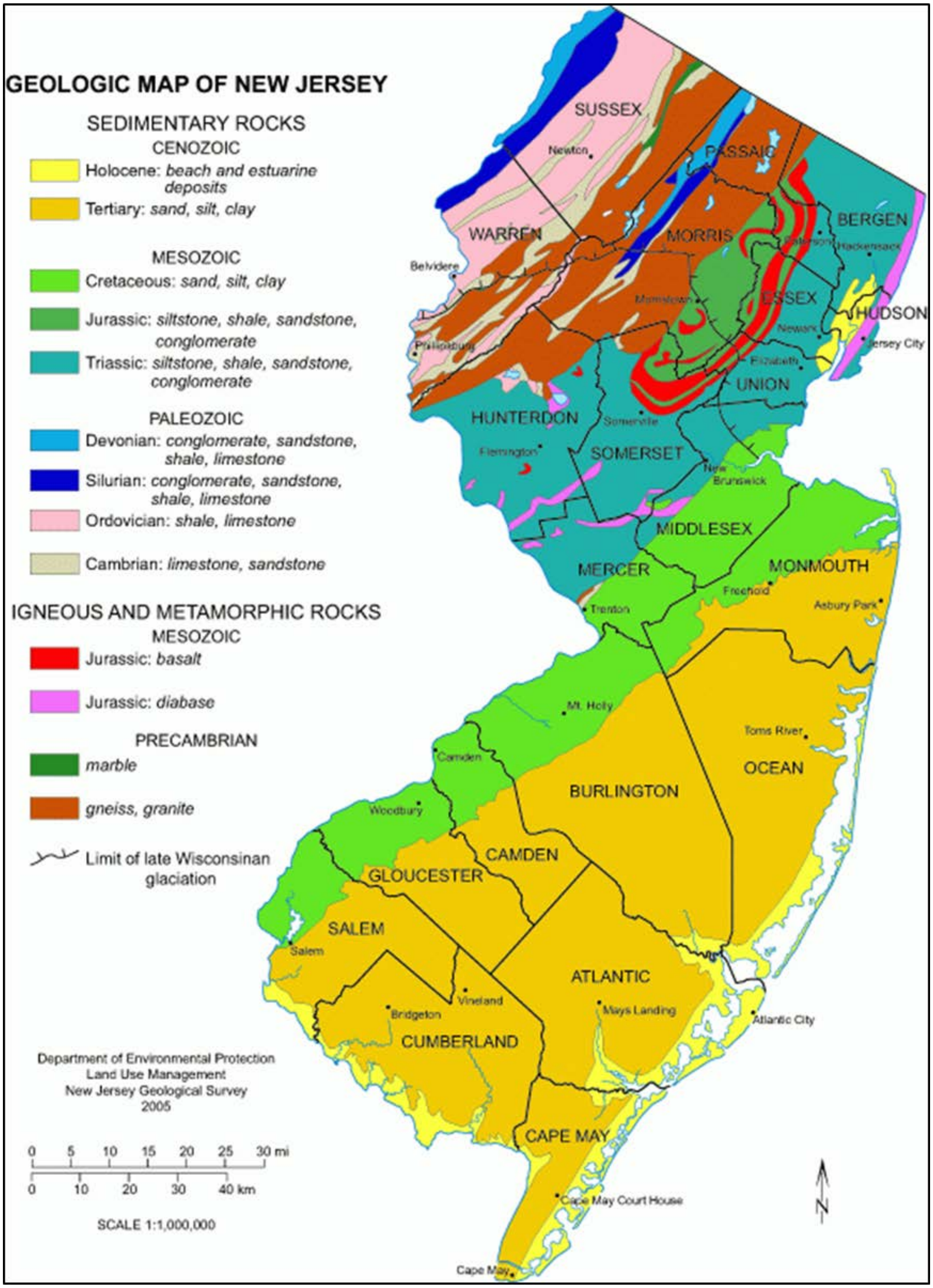

Figure 10.1.3-3: Generalized Bedrock Geology for New Jersey

Source: (New Jersey Geological Survey, 2005)

Highlands Province

Photo of Highlands Province (Norvin Green State Forest)

Source: (New Jersey Geological Survey, 2015a)

The bedrock of the Highlands Province is often referred to as the "Crystalline Appalachians," as a descriptor of the Province's dominant composition of crystalline igneous and metamorphic rock[48] (USGS, 2015g). New Jersey's Highlands Province formed between 1.3 billion years ago (BYA) and 750 MYA; these rocks are the oldest in New Jersey. Over 30 different types of rocks of this age are encountered within the Highlands Province, with granite[49] (igneous) and gneiss[50] (metamorphic) comprising 50 and 45 percent, respectively, of the underlying rock layers (by volume). These rocks are highly resistant to erosion (NJDEP, 1999).

The Highlands Province contains folds and faults that demonstrate that the area has historically been exposed to compressional stresses[51]. This seismic activity has produced earthquakes up to magnitude-3.0 on the Richter scale along the Ramapo Fault, which is the most active fault in the area (New Jersey Geological Survey, 2015a). Faults dip gently to the east throughout the Highlands Province (USGS, 2015h).

Valley and Ridge Province

The Valley and Ridge Province's bedrock contains layers sandstone, shale, and limestone that date from 542 to 359 MYA. These sedimentary rocks originally were deposited in marine and riverine environments, before they were compressed into northeast-southwest trending folds (NJDEP, 1999); the various mountain chains of the Valley and Ridge Province become progressively older toward the southeast. (New Jersey Geological Survey, 2012).

Susceptibility to erosion varies through Valley and Ridge Province depending on the strength of the bedrock. Throughout the province, there is a strong correlation between elevation and rock type, such that the bedrock geology becomes more resistant to erosion at higher elevations. More specifically, the Kittatinny Valley contains dolostones[52] and limestones.[53] Karst features are often found under these rocks. Kittatinny Mountain is "underlain by quartz-pebble

[48] Metamorphic Rocks: "Rocks that started out as some other type of rock, but have been substantially changed from their original form due to high heat and/or high pressure" (USGS, 2014c).
[49] Granite: "A coarse-grained intrusive igneous rock with at least 65 [percent] silica. Quartz, plagioclase feldspar and potassium feldspar make up most of the rock and give it a fairly light color. Granite has more potassium feldspar than plagioclase feldspar. Usually with biotite, but also may have hornblende" (NPS, 2000).
[50] Gneiss: "A coarse-grained, foliated metamorphic rock that commonly has alternating bands of light and dark-colored minerals" (NPS, 2000).
[51] The stress that squeezes something. It is the stress component perpendicular to a given surface, such as a fault plane, that results from forces applied perpendicular to the surface or from remote forces transmitted through the surrounding rock.
[52] Dolostone: "A sedimentary rock composed primarily of calcium-magnesium carbonate" (USGS, 2005).
[53] Limestone: "A sedimentary rock consisting mostly of calcium carbonate" (USGS, 2005).

conglomerate,[54] quartzite, red sandstone,[55] and shale," all of which are more resistant to erosion. The Delaware Valley area is characterized by multiple northeast trending valleys containing limestone, limey shale,[56] and shale, all of which are more susceptible to erosion. (New Jersey Geological Survey, 2012)

10.1.3.6 Paleontological Resources

Records of Cambrian Period (542 to 488 MYA) fossils in New Jersey from the Paleozoic Era (542 to 251 MYA) indicate the presence of a warm, shallow sea. Late during the Ordovician Period (488 to 444 MYA), deeper water conditions prevailed until warm, shallow seas again returned to northwest New Jersey starting in the Late Silurian Period (444 to 416 MYA) and into the Devonian Period (416 to 359 MYA). Triassic Period (251 to 200 MYA) sedimentary rocks preserve footprints and indicate the presence of bipedal dinosaurs during that time period. During the Cretaceous Period (146 to 66 MYA), most of northern New Jersey was above sea level; fossils of insects and leaves indicate low-lying swamps covered by vegetation, while dinosaur bones and tracks are also preserved. During much of the Cenozoic Era (66 MYA to present), marine life thrived in the seas of southern New Jersey. Fossil records indicate the waters were warmer than those off the coast today. Fossils from giant mammals are preserved from the Pleistocene Epoch (2.6 MYA to 11,700 years ago) and indicate the periodic presence of glaciers. Nearly all of the giant mammals disappeared by the end of the Pleistocene. (NJDEP, 2012a)

The northwest and southern parts of New Jersey have the greatest concentration of fossils within the state. Two of New Jersey's largest fossil sites are open to the public: Poricy Park and the Big Brook Park area (Figure 10.1.3-4). Cambrian fossils found in New Jersey include trilobites and stromatolites, whereas fossils from the Late Silurian Period and into the Devonian include trilobites, brachiopods, bryozoans, corals, and crinoids[57]. Fossils of Mesozoic Era reptiles and fish, as well as footprints from bipedal[58] dinosaurs, also have been found in New Jersey. Cretaceous fossils found in New Jersey include insects and leaves, dinosaur bones and tracks, extinct marine reptile sharks, and ammonites. The New Jersey state dinosaur, *Hadrosaurus foulkii*, lived during the late Cretaceous Period (NJDEP, 2015d). Cenozoic fossils include brachiopods[59], shark teeth, corals, echinoderms[60], and microscopic organisms. Pleistocene fossils of horses, mammoths, and mastodons have also been found in New Jersey. (NJDEP, 2012a)

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[54] Conglomerate: "A course-grained sedimentary rock composed of rounded fragments of pebbles, cobbles, or boulders cemented into a solid mass" (USGS, 2005).
[55] Sandstone: "A sedimentary rock composed of abundant rounded or angular fragments of sand set in a fine-grained matrix (silt or clay) and more or less firmly united by a cementing material" (USGS, 2005).
[56] Shale: "A fine-grained sedimentary rock, formed by the consolidation of clay, silt, or mud" (USGS, 2005).
[57] These organisms are examples of animals that have formed fossils through the process of mineralization, where calcium carbonate, calcium phosphate, or silica are deposited within the organism's skeletal remains.
[58] Using only two legs.
[59] Marine animals that have hard shells on the upper and lower surfaces.
[60] A marine invertebrate of the phylum Echinodermata, such as a starfish, sea urchin, or sea cucumber.

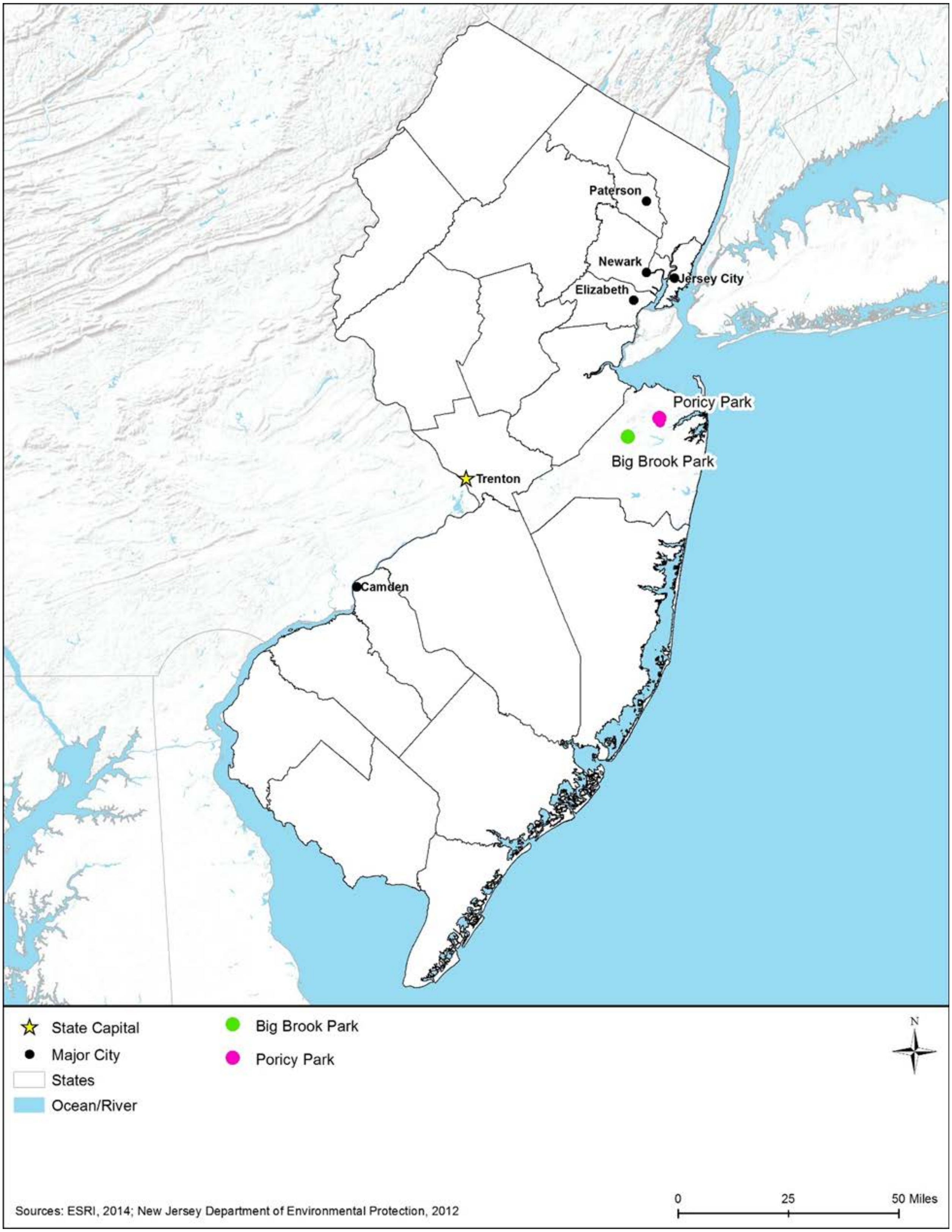


Figure 10.1.3-4: Monmouth County (NJ) Fossil Sites – Poricy Park and Big Brook Park

10.1.3.7 Fossil Fuel and Mineral Resources

Oil and Gas

While New Jersey is a major distribution center for petroleum products along the East Coast, there is no active crude oil or natural gas production within the state. For more information on the extensive network of oil and natural gas pipelines within New Jersey, refer to the discussion of New Jersey infrastructure (Section 10.1.1). (EIA, 2014a)

Minerals

As of 2014, New Jersey's annual mineral production was valued at $309M. New Jersey ranked 40th nationwide for mineral production; the state's leading mineral commodities (by value) were crushed stone, sand and gravel (construction), sand and gravel (industrial), greensand marl, and peat (USGS, 2016). As of 2009, New Jersey produced 11.1M metric tons of construction sand and gravel. New Jersey ranks 8th (out of 12 producing states) that produce peat; the state also holds the distinction as the only state that produces greensand marl (EIA, 2014a). Common clays, shale, gypsum, perlite, sulfur, and vermiculite are also produced and mined in New Jersey (NJDEP, 1996) (USGS, 2000b) (USGS, 2001) (USGS, 2003b). No new mines or quarries have opened in New Jersey since 1984 (EIA, 2014a).

10.1.3.8 Geologic Hazards

The three major geologic hazards of concern in New Jersey are earthquakes, landslides, and subsidence. Volcanoes do not occur in New Jersey and therefore do not present a hazard to the state (USGS, 2015i). The subsections below summarize current geologic hazards in New Jersey.

Earthquakes

Between 1973 and March 2012, there were three earthquakes of a magnitude-3.5 to 4.0 (on the Richter scale[61]) in New Jersey (USGS, 2014d). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade structures on the surface (USGS, 2012a).

> **Spotlight: New Jersey's Ramapo Fault**
>
> The Ramapo Fault, which separates the Piedmont and Highlands Physiographic Provinces, is one of New Jersey's most significant faults. Numerous earthquakes have been recorded within a 10 to 20 mile wide zone adjacent to, and west of, the actual fault. Since the 1970s and early 1980s, earthquake risk along the Ramapo Fault has received additional attention because of its proximity to the Indian Point (NY) Nuclear Power Generating Station. (Dombrowski Jr., 2015)

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes happen where

[61] A base-10 logarithmic scale that defines magnitude as the logarithm of the ratio of the amplitude of the seismic waves to an arbitrary, minor amplitude; used to measures earthquakes.

tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth." Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014e). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015). New Jersey is located far from any convergence boundaries, but is located in the middle of a tectonic plate (Kafka, A., 2014).

Figure 10.1.3-5 depicts the seismic risk throughout New Jersey. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration (PGA)) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with an acceleration in excess of 10% g.[62] (USGS, 2010)

Areas of greatest seismicity in New Jersey are concentrated in the northeast portions of the state. The largest earthquake ever recorded in New Jersey was a magnitude-5.3 quake that occurred in 1783 just west of New York City (USGS, 2014f). This earthquake was felt from New Hampshire south to near Philadelphia (NJDEP, 2015e). Earthquakes occurring in other parts of eastern North America also have impacted New Jersey. The strong earthquakes off Cape Ann (MA) in 1755, New Madrid (MO) area in 1811 and 1812, Riviere-Ouelle (Quebec, Canada) in 1860, Wilmington (DE) in 1871, New York City in 1884, and Charleston (SC) in 1886, all affected New Jersey (USGS, 2015j).

Earthquakes with an intensity 5.0-6.0 on the Richter scale have occurred in the Newark area in 1737, 1783, and 1884. The time spans between these earthquakes were 46 and 101 years. These recurrence intervals suggest that New Jersey might be overdue for a moderate earthquake like the one of 1884. (Dombrowski Jr., 2015)

[62] Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g (USGS, 2010).

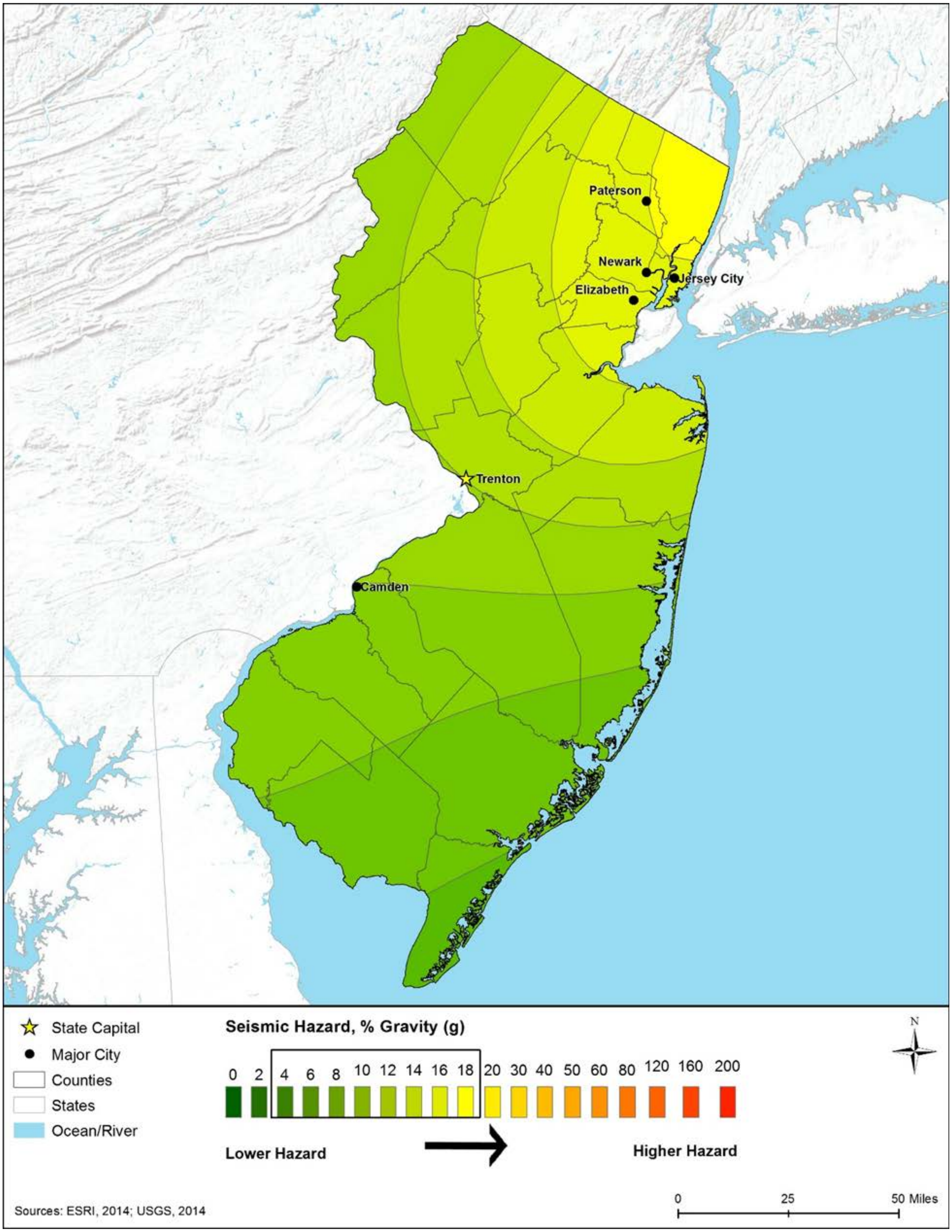


Figure 10.1.3-5: New Jersey 2014 Seismic Hazard Map

Landslides

New Jersey is prone to landslides in locations with steep to moderate slopes (New Jersey Geological Survey, 2015b). "The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures" (USGS, 2003c). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. (USGS, 2003c)

Landslides can be triggered by a single severe storm or earthquake, causing widespread damage in a short period. Most landslide events are triggered by water infiltration that decomposes and loosens rock and soil, lubricates frictional surfaces, adds weight to an incipient landslide, and imparts buoyancy to the individual particles. Intense rainfall, rapid snowmelt, freeze/thaw cycles, earthquakes, volcanic eruptions, and human alterations to the natural landscape can trigger mass land movements. Large landslides can dam rivers or streams, and cause both upstream and downstream flooding. (USGS, 2003c)

"Rock strength, orientation of rock layers and fractures, contrast in water content between surficial materials, and slope are the most important" considerations for evaluating where landslides tend to occur in New Jersey. Landslides in New Jersey often take place "where slopes have been undercut by stream, wave, or human action." A map of landslide incidence and susceptibility in New Jersey is included in Figure 10.1.3-6. (New Jersey Geological Survey, 2015b)

The Palisades are one of the most active landslide areas in New Jersey. Large rockslides are typical during the winter and spring months along high cliffs due to repeated freeze-thaw cycles, which displace rock fragments from bedrock surfaces. A December 2005 rockslide demolished 80 feet of the Alpine Approach Road, as well as a nearby cinderblock transformer shed. (New Jersey Geological Survey, 2015b)

Some landslides in New Jersey can be attributed to human-induced causes. In 1989, a 250 foot-wide slump landslide[63] occurred near a quarry in Bethlehem Township. About two acres of terrain failed and fell more than 60 feet, resulting in the destruction of a nearby road. (New Jersey Geological Survey, 2015b)

[63] A slump landslide is a form of mass wasting that occurs when a coherent mass of loosely consolidated materials or rock layers moves a short distance down a slope.

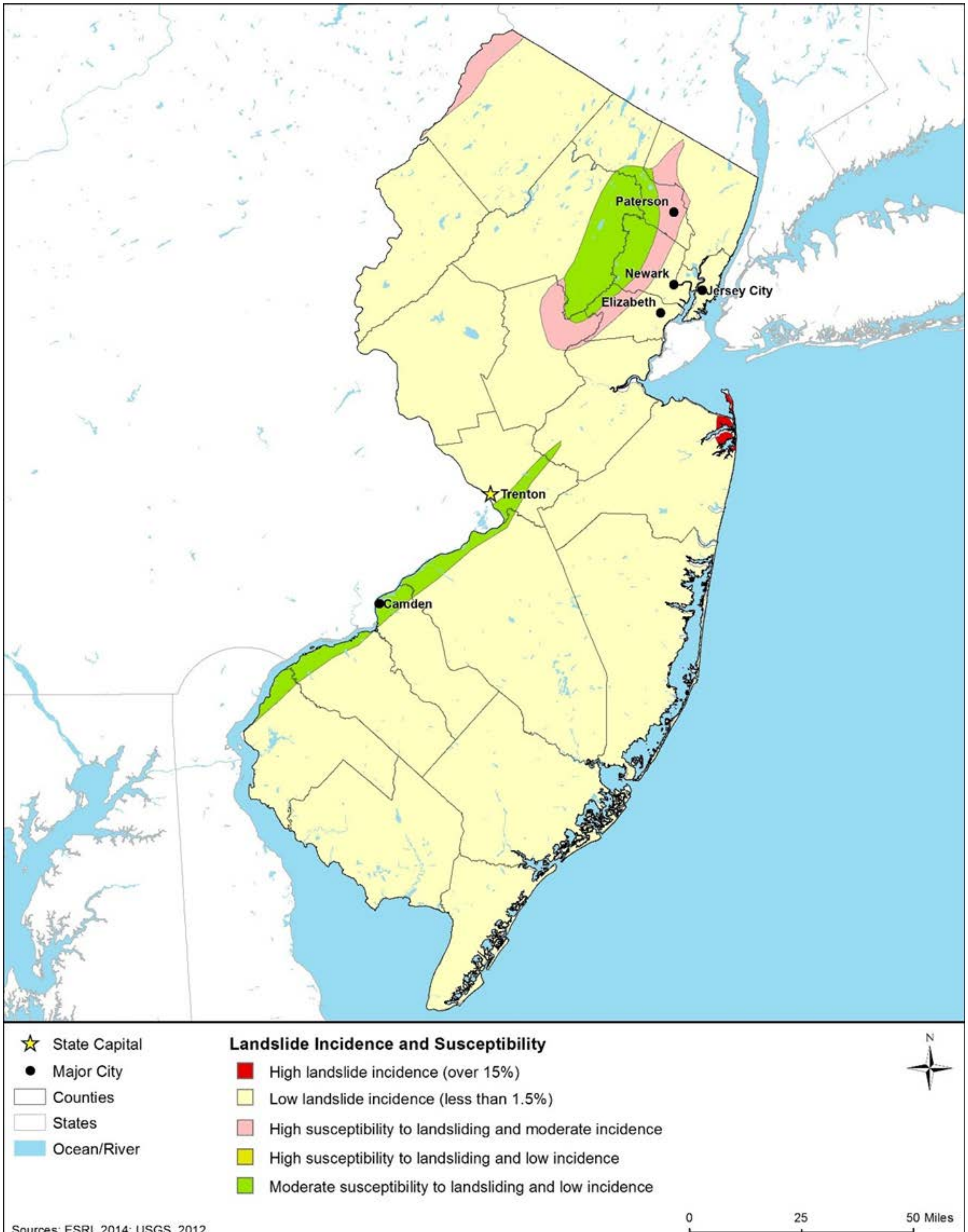


Figure 10.1.3-6: New Jersey Landslide Incidence and Susceptibility Hazard Map[64]

[64] Susceptibility hazards not indicated in Figure 0.1.3-6 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated (USGS, 2014g).

Spotlight: Bethlehem Township Landslide

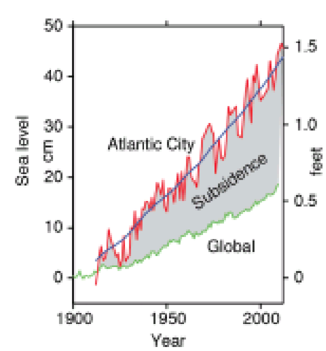
In 1989, a 250 foot-wide slump occurred when a slope adjacent to a quarry failed in Bethlehem Township, causing a nearby road to be destroyed and permanently closed. The ground surface dropped nearly 60 feet at the site due to the failure of 2 acres of terrain at the edge of the quarry. (New Jersey Geological Survey, 2015b)

Source: (USGS, 2013b)

Subsidence

In New Jersey, a significant cause of land subsidence is sediment compaction (New Jersey Geological Survey, 1998b). Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." The main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this permanent compression are seen in the lowering of the land surface elevation. (USGS, 2000a).

Figure 10.1.3-7: Sea Level Rise along the New Jersey Coast (1900-2000)



Source: (Miller, Kopp, Browning, & Horton, 2015)

Along portions of the New Jersey coast, sea level rise has risen at a rate of 3.8 mm/year (roughly twice the global average of 1.0 to 2.0 mm/year) in part due to sediment compaction (New Jersey Geological Survey, 1998b). Figure 10.1.3-7 depicts sea level rise in Atlantic City, NJ, during the 20th century, including sea level rise attributed to global sea level changes and local land subsidence.

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Changes in ground-surface elevation not only affect the integrity and operation of existing infrastructure, but also complicate vegetation and best management of land use. (USGS, 2013c)

10.1.4 Water Resources

10.1.4.1 Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 10.1.5). These resources can be grouped into watersheds which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health. (USGS, 2014h)

10.1.4.2 Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 10.1.4-1 summarizes the major New Jersey laws and permitting requirements relevant to the state's water resources.

Table 10.1.4-1. Relevant New Jersey Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Waterfront Development Law	New Jersey Department of Environmental Protection (NJDEP)	Applies to any development in a waterway that experiences tidal flow (e.g. docks, piers, jet ski ramps and boat lifts and many bulkhead construction or reconstruction projects). (NJDEP, 2015f)
Coastal Areas Facility Review Act (CAFRA)	NJDEP	Applies to any development on a beach or dune, or within a specific area of the mean high water line (the CAFRA zone) depending on number of developments. (NJDEP, 2015f)
Flood Hazard Area Control Act	NJDEP	Applies to development activities in flood hazard areas and adjacent to surface waters, such as vegetation removal, excavation, grading, or fill, and creation of impervious surfaces require a permit. (NJDEP, 2015g)

State Law/Regulation	Regulatory Agency	Applicability
New Jersey Pollutant Discharge Elimination System (NJPDES) program	NJDEP	Discharge of pollutants to surface and groundwater, discharge from an indirect user,[65] storage of any liquid or solid pollutant, in a manner designed to keep it from entering the waters of the State, discharge of pollutants into wells, or discharges of stormwater to surface water and groundwater, including discharges through storm sewers, as set forth in New Jersey Administrative Code (N.J.A.C.) 7:14A-24 and 25 require an NJPDES permit.

10.1.4.3 Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine and coastal waters. Within New Jersey's approximately 8,200 square miles, there "are 127 miles of coastline; 18,126 miles of rivers and streams; and 69,920 acres of lakes and ponds that are larger than 2 acres" (NJDEP, 2010a). These surface waters supply drinking water supply, provide aquatic habitat, and support recreation, agriculture, fishing, and industries across the state (NJDEP, 2010a).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and precipitation to a common outlet (e.g. reservoir, bay). New Jersey's waters (lakes, rivers, and streams) are divided into 20 major watershed management areas (Figure 10.1.4-1). For information and additional maps about each NJDEP watershed's location, size, and water quality, visit the NJDEP website at http://www.nj.gov/dep/watershedrestoration/ (NJDEP, 2015h).

The Upper Delaware Watershed is located within the mountains of northwestern New Jersey. The major drainage basins within the watershed flow in a southeasterly direction to the Delaware River. The Wallkill River Watershed is located in northern New Jersey with headwaters beginning at Lake Mohawk and flowing north into New York, emptying into the Hudson River. Along northern New Jersey, the Pompton, Pequannock, Wanaque, and Ramapo Watershed flows into the Pompton River, a major tributary to the Upper Passaic River. This watershed also contains Wanaque Reservoir, a major water supply and second largest reservoir in New Jersey. The Upper and Mid Passaic, Whippany, Rockaway Watershed drains north central New Jersey and contains extensive suburban development. This area relies on groundwater sources for its water supply. The Central Delaware Watershed runs along the west central border of New Jersey and drains to the Delaware River.

[65] Indirect User: a discharger that does not discharge directly into a surface waterbody such as a stream or river, but rather into a sanitary sewer system, or sewage treatment plant where water is treated and then discharged, usually to surface water (NJDEP, 2016a).

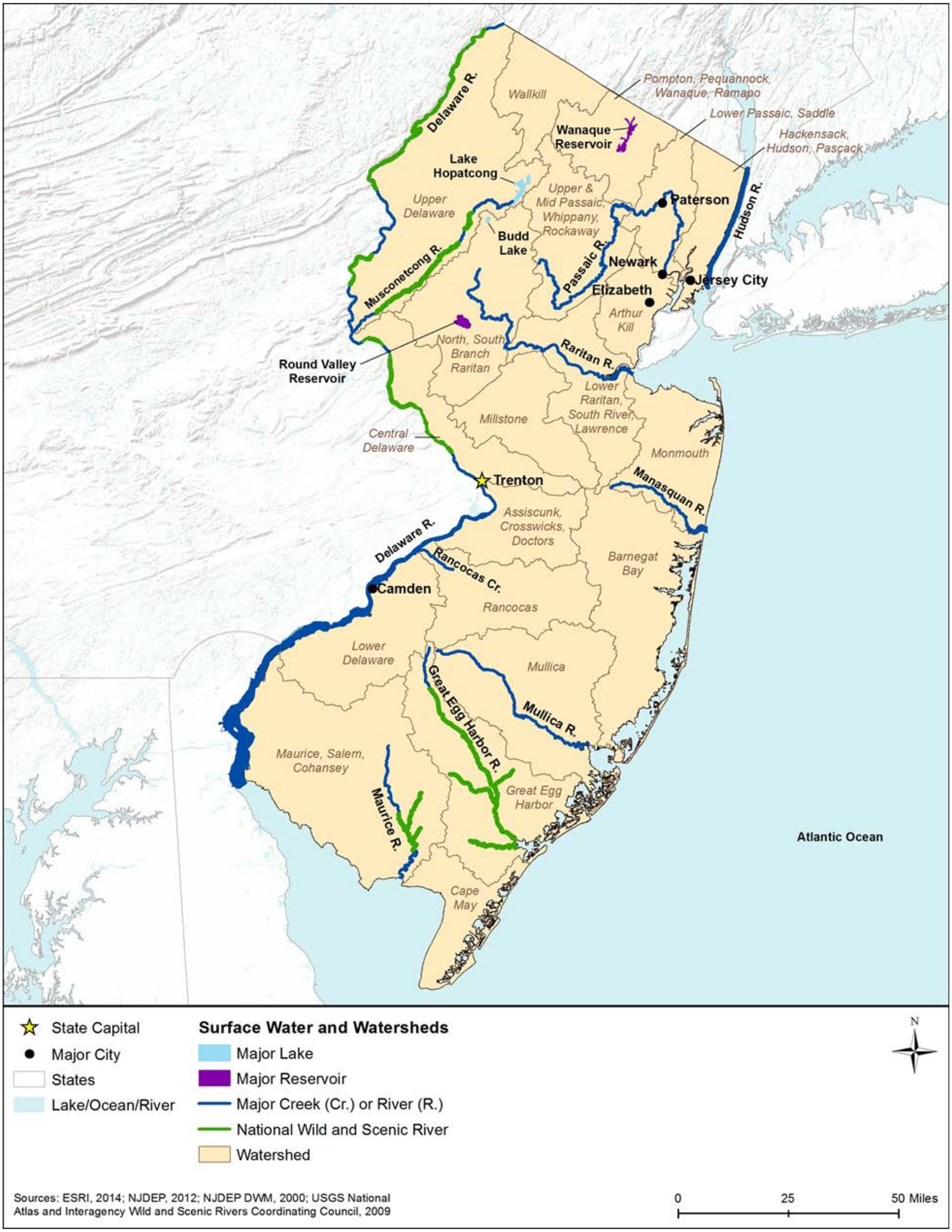


Figure 10.1.4-1. Major NJ Watersheds, defined by NJDEP, and Surface Waterbodies

The four watershed areas that span the eastern border of the lower half of New Jersey include: Monmouth, Barnegat Bay, Mullica, and Great Egg Harbor. The Cape May Watershed is located in the southern tip of New Jersey. It is bound by the Delaware Bay to the south and west and the Atlantic Ocean to the east. The area includes minimal surface water flow and is covered by wetlands, such as the large swamps in the north and tidal streams that terminate into freshwater swamps and saltwater marshes along the shore. (NJDEP, 2015h)

Freshwater

As shown in Figure 10.1.4-1, there are nine major rivers in New Jersey: Delaware, Hudson, Raritan, Passaic, Rancocas Creek, Mullica, Manasquan, Great Egg Harbor, Musconetcong and Maurice. The Delaware River is New Jersey's largest river and forms the entire western border with Pennsylvania, and most of the southern border with Delaware. The Hudson River forms the natural border between northeastern New Jersey and New York. The longest river system in the state is the Passaic River, "with its main stem approximately 80 miles long." (NJOEM, 2014)

New Jersey also contains 1,747 named lakes and ponds (approximately 37,835 acres) and 43 reservoirs (almost 15,000 acres). Of these lakes, ponds, and reservoirs, 380 are publicly owned and cover 24,000 acres within the state (NJDEP, 2012b). Major lakes and reservoirs in the state include: Budd Lake, Lake Hopatcong, Round Valley Reservoir, and Wanaque Reservoir.

- Budd Lake, the largest natural lake in New Jersey, is approximately 374 acres in size and considered the headwater source for the South Branch of the Raritan River. Budd Lake is recharged by groundwater seepage through a series of wetlands, including a large bog located at the northern end of the lake (New Jersey Natural Lands Trust, 2015a) (NJDFW, 2015a). Located in the northern portion of the state, local residents use Budd Lake for fishing and boating activities.
- Lake Hopatcong, located in the mountains of northern New Jersey, is approximately 2,500 acres in size and is New Jersey's largest freshwater lake. The Musconetcong River, a tributary of the Delaware River, flows from Lake Hopatcong and feeds the downstream Lake Musconetcong (NJDEP, 2011). Lake Hopatcong is used for recreation and as an emergency source of drinking water for surrounding municipalities (USEPA, 2010a).
- Round Valley Reservoir, located in north-central New Jersey, is the largest reservoir in the state, at approximately 2,350 acres in size (NJDEP, 2015i) (Kiriluck-Hill, 2013). The reservoir was created by damming Prescott Brook and the South Branch Rockaway Creek and gradually flooding the valley within the Cushetunk Mountain. Round Valley Reservoir is a water supply for central New Jersey and offers an ideal location for a variety of recreational activities such as swimming and fishing. (NJDEP, 1997)
- Wanaque Reservoir is the second largest reservoir in New Jersey and was created by damming the Wanaque River and its tributaries. The reservoir is located in northeastern New Jersey and is approximately 2,310 acres in size. The Wanaque Reservoir is a major water supply for the northeastern Massachusetts counties. (NJDEP, 2005)

Estuarine and Coastal Waters

Estuaries (including bays and tidal rivers) are bodies of water that serve as transition zones between fresh river water and saline ocean water. Barrier islands, sand bars, and other landmasses protect estuaries, including those in New Jersey, from ocean waves and storms (USEPA, 2012a). New Jersey's estuarine environments support a variety of habitats, including salt marshes, mudflats, oyster reefs, sandy beaches, and eelgrass beds, and are a critical part of the lifecycle of many different plant and animal species (Roman, Charles et al., 2000) (USEPA, 2014a). New Jersey's total coastal area encompasses approximately 260 square miles of estuaries, and approximately 130 miles of coastline, which stretches from Raritan Bay, south along the Atlantic Coast, to Delaware Bay (NJDEP, 2012b). Estuarine and coastal waters provide recreational areas for boating, swimming, hiking, bird watching, and other activities.

New Jersey has three major estuaries along the Atlantic coast to the east and south of the state (Figure 10.1.4-2).

- The **New York-New Jersey Harbor Estuary** is located at the mouth of the Hudson River and meets with several other smaller rivers (East, Hackensack, and Raritan) before opening into the New York Bight and Long Island Sound. The estuary watershed encompasses the waters of New York Harbor and the tidally influenced portions of all rivers and streams that empty into the New York-New Jersey Harbor (New York New Jersey Harbor and Estuary Program, 2015). In 1998, the U.S. Environmental Protection Agency's (USEPA) National Estuary Program (NEP) recognized the New York-New Jersey Harbor as an Estuary of National Significance (USEPA, 2014a). The New York-New Jersey Harbor Estuary's Comprehensive Conservation and Management Plan (CCMP) identified five areas of concern and management actions: habitat loss and degradation, toxic contamination/dredged material management, pathogen[66] contamination, floatable debris, and nutrient organic enrichment (NYSDEC, 2015a). For more information on the New York-New Jersey Harbor Estuary and CCMP, visit http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.
- The **Barnegat Bay Estuary-Little Egg Harbor Estuary** consists of Barnegat Bay, Little Egg Harbor, and Manahawkin Bay. This estuary is bordered by the New Jersey mainland to the west, and the barrier peninsula and island of Barnegat Peninsula and Long Beach Island to the east. In 1995, Barnegat Bay was designated as an Estuary of National Significance under USEPA's NEP. The estuary's 2002 CCMP identified four areas of concern and management actions: water quality/water supply, habitats and living resources, human activities and competing uses, and public participation and education (USEPA, 2014a). For more information on the Barnegat Estuary and CCMP, visit http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.
- The **Delaware Bay Estuary** stretches approximately 135 miles from Trenton, NJ, and Morrisville, PA, south to Cape May, NJ and Cape Henlopen, DE. The Delaware Estuary includes all of the Delaware Bay and the tidal reaches of the Delaware River. While the northwestern portion of the bay near the mouth of the Delaware River is in close proximity to

[66] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015a).

the urban centers of Wilmington, DE and Philadelphia, PA, the remainder of the bay is mostly bordered by agricultural and undeveloped land. In 1988, the USEPA's NEP recognized the Delaware Bay as an Estuary of National Significance. The estuary's 1996 CCMP identified seven areas of concern and management actions: land management, water use management, habitat and living resources, toxics, education and involvement, monitoring, and regional information management (USEPA, 2014a). For more information on the Delaware Inland Bays estuaries and CCMP, visit the USEPA's National Estuary Program at http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.

10.1.4.4 Sensitive and Protected Waters

Wild and Scenic Rivers

Five river segments in New Jersey have been designated as National Wild and Scenic Rivers (see Appendix C for more information on the Wild and Scenic Rivers Act) (National Wild and Scenic Rivers System, 2015a). These include: the Middle Delaware, the Lower Delaware, the Great Egg Harbor, the Maurice, and the Musconetcong Rivers (Figure 10.1.4-1).

- The Middle Delaware River segment extends 40 miles from "the northern boundary of the Delaware Water Gap National Recreation Area to the point where the river crosses the southern boundary" (NWSRS, 2015). The river provides many recreational, sightseeing, and geological study opportunities (NWSRS, 2015).
- The Great Egg Harbor River segment includes approximately 130 miles of the river and its tributaries that meanders through the wetlands of the Pine Barrens, a large forested area of New Jersey's Pinelands National Reserve, to Great Egg Harbor Bay. The river provides habitat for several endangered species and nesting and breeding areas for birds, waterfowl, rails, and anadromous[67] fish. (NPS, 2006a)
- The Maurice River segment includes 35.4 miles along the Maurice River and several of its tributaries (including Menantico and Muskee Creeks and the Manumuskin River). The river flows through southern New Jersey, within a portion of the Pinelands National Reserve, towards the Delaware Bay, serving as a "critical link between the Reserve and the Delaware Estuary" (NPS, 2006b). The Maurice River lies along the Atlantic flyway providing habitats and foraging for migratory birds and other aquatic wildlife (NPS, 2006b).
- The Lower Delaware River segment includes approximately 39 miles of the Delaware River and 28 miles of tributaries (Tinicum, Tohickon, and Paunacussing Creeks) (DRBC, 2015). The river is considered one of the most significant corridors in the nation with many Native American and colonial archaeological sites (NPS, 2014a).

[67] Anadromous: An anadromous fish is "born in fresh water, spends most of its life in the sea and returns to fresh water to spawn" (NOAA, 2011).

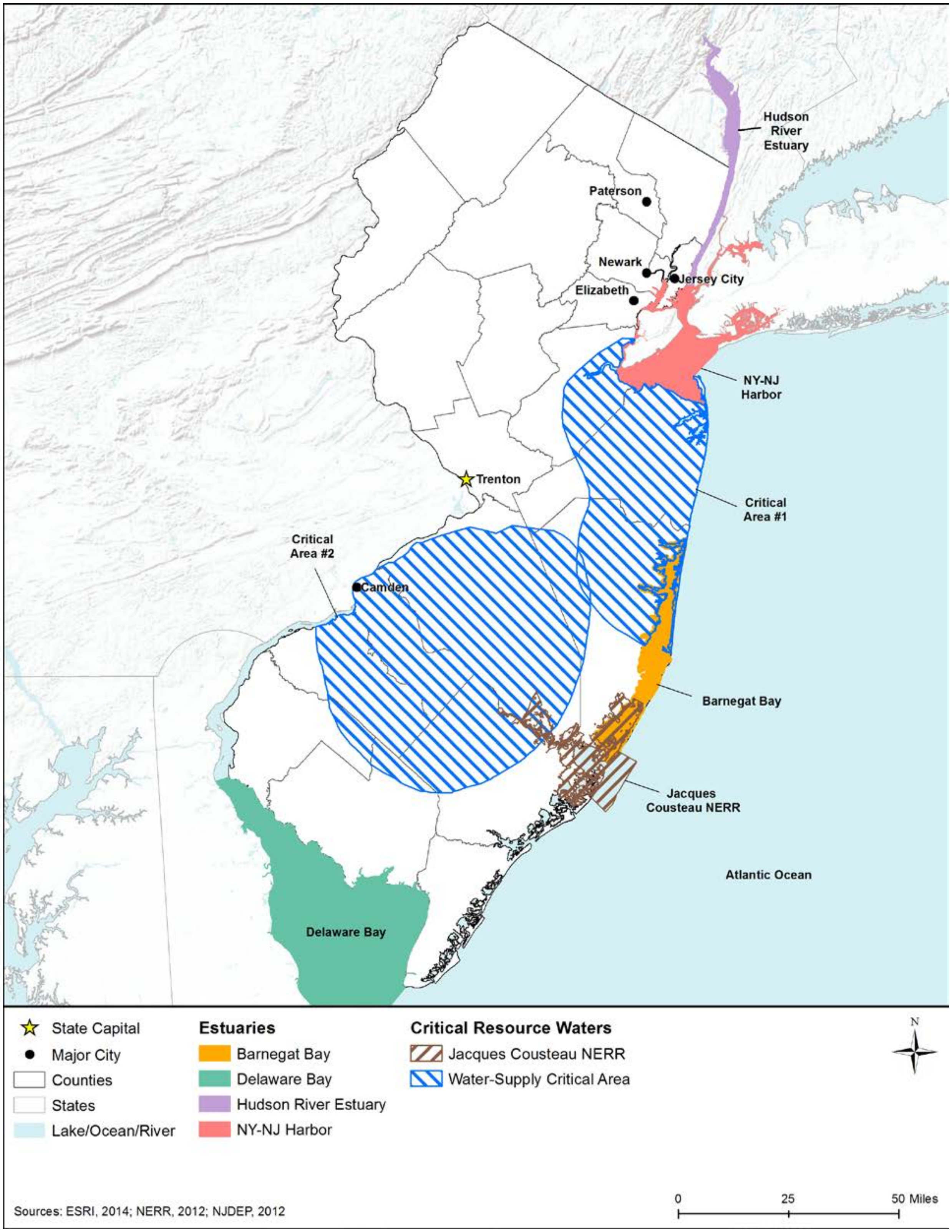


Figure 10.1.4-2: New Jersey's Estuaries and Critical Resource Waters

- The Musconetcong River segment is approximately 24 miles long. The river is located in the Highlands region of northwestern New Jersey and flows in a general southwest direction. The Musconetcong River is also known for its recreational resources and is a popular trout fishery in New Jersey. The remote location of the Musconetcong River has allowed for preservation of the corridor's historical and archaeological resources from American colonial and revolutionary times. (NPS, 2007b)

Critical Resource Waters[68]

Three areas in New Jersey have been designated as Critical Water Supply Areas: Critical Area Numbers One and Two (Figure 10.1.4-2), where "excessive water usage poses a threat to the long-term integrity of the water supply source." Critical Area Number One is located in east central New Jersey along the Atlantic coastline. Critical Area Number Two extends from the southwestern border of Critical Area Number One to the New Jersey-Pennsylvania border and south toward the Delaware Bay. Water use within this portion of the state has affected the following aquifers: Englishtown, Upper and Lower Potomac-Raritan-Magothy, and Wenonah-Mt. Laurel. Within these areas, water allocations have been reduced and future water use is limited. (DRBC, 2014)

The other designated New Jersey critical resource water is the Jacques Cousteau National Estuarine Research Reserve (NERR), administered by the National Ocean and Atmospheric Administration (NOAA) and managed by Rutgers University. The reserve encompasses 114,873 acres in southeastern New Jersey, including the diverse habitats of the New Jersey Pinelands forest and the Mullica River-Great Bay. The majority of the reserve has remained undisturbed by human development, allowing habitats to maintain high environmental quality. (NOAA, 2015a)

10.1.4.5 Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[69] the causes of impairment, and probable sources. Table 10.1.4-2 summarizes the water quality of New Jersey's major waterbodies that have been assessed by category, percent impaired, designated use, [70] cause, and probable sources. Figure 10.1.4-3 shows the Section 303(d) waters in New Jersey as of 2012.

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[68] Critical Resource Waters include designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened and endangered species, coral reefs, State natural heritage sites, and outstanding national resource waters or other waters officially designated by a State as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment (USACE, 2012a).

[69] Impaired waters: Waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters (USEPA, 2015a).

[70] Designated Use: An appropriate intended use by humans and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply (USEPA, 2015a).

Table 10.1.4-2: Section 303(d) Impaired Waters of New Jersey, 2012

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	96%	90%	Agricultural water supply, aquatic life, fish consumption, industrial water supply, primary contact recreation, public water supply, secondary contact recreation, shellfish harvesting	PCBs in fish tissue, fecal coliform, arsenic, phosphorus, mercury in fish tissue	Urban runoff/storm sewers, agriculture, atmospheric deposition,[c] industrial point source discharge
Lakes, Reservoirs, and Ponds	65%	95%	Agricultural water supply, aquatic life, fish consumption, industrial water supply, primary contact recreation, public water supply, secondary contact recreation, shellfish harvesting	Mercury in fish tissue, arsenic, PCBs in fish tissue, fecal coliform, E. Coli	Urban runoff/storm sewers, atmospheric deposition, agriculture
Estuaries and Bays	98%	90%	Agricultural water supply, aquatic life, fish consumption, industrial water supply, primary contact recreation, public water supply, secondary contact recreation, shellfish harvesting	PCBs in fish tissue, pathogens,[d] pesticides, and mercury in fish tissue	Urban runoff/storm sewers, atmospheric deposition, agriculture
Ocean and Near Coastal	100%	100%	Aquatic life, fish consumption, primary contact recreation, and shellfish harvesting	Dissolved oxygen, PCBs in fish tissue	Urban runoff/storm sewers, municipal point source discharges, package plant or other permitted small flows discharges

[a] Some waters may be considered for more than one water type
[b] New Jersey has not assessed all waterbodies within the state.
[c] Atmospheric deposition: The process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water. (USEPA, 2015a)
[d] Pathogen: A bacterium, virus, or other microorganism that can cause disease (USEPA, 2015a).

Source: (USEPA, 2015a)

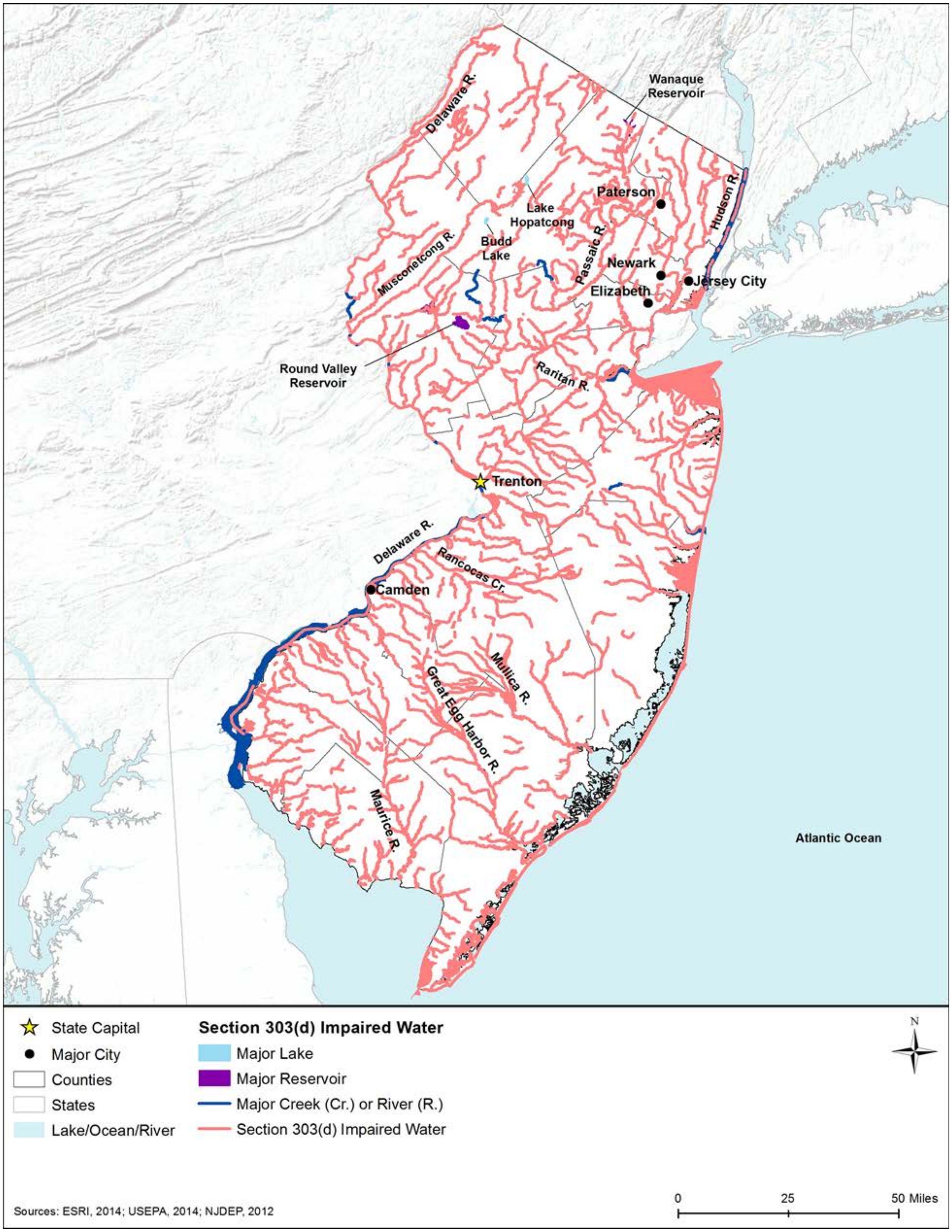

Figure 10.1.4-3: Section 303(d) Impaired Waters of New Jersey, 2012

As shown in Table 10.1.4-2, various sources affect New Jersey's waterbodies, causing impairments. For example, the USEPA has identified Lake Hopatcong and Weequahic Lake as areas of concern, due mainly to nonpoint source pollution[71] from agriculture and residential land use, soil erosion and high concentrations of nutrients causing excessive algae production (USEPA, 2014b). All of New Jersey's ocean and near coastal waters are impaired. Designated uses for these impaired waters include aquatic life and fish consumption. Discharges of polychlorinated biphenyls (PCBs) have resulted in fish consumption advisories for many species (NJDEP, 2014b).

10.1.4.6 Floodplains

Floodplains are lowlands along inland or coastal waters, including flood-prone areas of offshore islands. The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as "any land area susceptible to being inundated by water from any source" (44 Code of Federal Regulations [CFR] 59.1) (FEMA, 2000). Through FEMA's flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as "a flood that has a 1 percent chance of occurring in any given year," to allow communities to prepare and protect against flood events (FEMA, 2013a).

Floodplains provide suitable and sometimes unique habitat for a wide variety of plants and animals and are typically more biologically diverse than upland areas due to the combination of both terrestrial and aquatic ecosystems. Vegetation along stream banks provide shading, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Bodies of water in floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping. (FEMA, 2014a)

Floodplains in New Jersey include the following:

- **Riverine floodplains:** Occur along rivers and streams where overbank flooding may occur, inundating adjacent land areas. In steep river valleys in hilly areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014b)

[71] Nonpoint source pollution: A source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015a).

- **Coastal floodplains:** In coastal floodplains, flooding resulting from storm surge is the primary concern. Storm surge can occur from both winter storms and tropical storms. Additionally, heavy precipitation and swollen upland water courses can also cause flooding in coastal floodplains (Johnson, 2010). Coastal floodplains in New Jersey border the Atlantic Ocean coastline, and include the coastal counties of Atlantic, Cape May, Ocean, and Monmouth. In addition, a storm surge event that takes place during high tide can cause flood waters to exceed normal tide levels, resulting from strong winds preventing tidal waters to recede in conjunction with additional water being pushed toward the shore, as was the case during Hurricane Sandy.

There are several causes of flooding in New Jersey, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, hurricanes, and ice jams (NJOEM, 2014).

The northern half of New Jersey experiences the most damaging riverine floods, with the Delaware, Raritan, and Passaic Rivers draining more than 90 percent of northern New Jersey counties. Therefore, these rivers (and their tributaries) are the most common areas for flooding. Coastal communities in New Jersey are also vulnerable to flooding from major storms events, including nor'easters and hurricanes, along the state's approximately 130 miles of coastline. From 1955 to 2012, New Jersey has experienced 2 coastal storms, 8 floods, and 10 hurricanes (NJOEM, 2014).

Hurricane Sandy Damage in New Jersey

In 2012, Hurricane Sandy traveled through 24 states, from Florida to Maine and was, by far, the costliest natural disaster for New Jersey. Throughout the state, Hurricane Sandy caused an estimated $29.4 billion in damage, destroyed, or significantly damaged 30,000 homes and business, with an additional 42,000 structures affected, and directly or indirectly was responsible for 38 deaths. (NJOEM, 2014)

Source: (White House, 2015)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits to approximately 600 communities in New Jersey through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015b). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, New Jersey had 82 communities participating in the CRS (FEMA, 2014d).[72]

10.1.4.7 Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and include underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water, such as to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle. Table 10.1.4-3 provides details on aquifer characteristics in the state; Figure 10.1.4-4 shows New Jersey's principal and sole source aquifers.

New Jersey's principal aquifers[73] consist of carbonate-rock[74] and sandstone aquifers[75], sand and gravel aquifers of alluvial and glacial origin,[76] and unconsolidated coastal-plain aquifers. Approximately forty percent of New Jersey's freshwater supply (both domestic and public) is drawn from groundwater (Bartholomay, Carter, Qi, Squillace, & and Rowe, 2007), with groundwater providing 75 percent of the freshwater supply in the Coastal Plain (USGS, 2013d). Generally, the water quality of New Jersey' aquifers is suitable for drinking and most uses.

[72] A list of the 39 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

[73] In this PEIS, the term principal aquifer refers to the USGS definition ("A regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.") for nationwide consistency (USGS, 2003d).

[74] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott, 1995a).

[75] Sandstone aquifers form from the conversion of sand grains into rock caused by the weight of overlying soil/rock. The sand grains are rearranged and tightly packed, thereby reducing or eliminating the volume of pore space, which results in low-permeability rocks such as shale or siltstone. These aquifer types are highly productive in many places and provide large volumes of water (Olcott, 1995b).

[76] Sand and gravel aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin are highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (USGS, 2015k).

Table 10.1.4-3: Description of New Jersey's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Aquifers of Alluvial and Glacier Origin: These aquifers consist of layered deposits of sand, gravel, silt, and clay eroded by glaciers	In the northern part of New Jersey, Bergen, Essex, and Morris Counties, including the city of Newark	Suitable for most uses. Generally good to excellent water quality. Most productive aquifers in state and primary source of groundwater for public supply and large industrial or commercial uses. Stratified-drift aquifers are more susceptible to contamination than bedrock aquifers because they exist mainly in major river valleys where many cities and large industries occur.
Early Mesozoic basin aquifers: Consolidated bedrock made up of sedimentary and crystalline (non-carbonate) rock. Known locally as the Piedmont Mesozoic basin aquifers	Located in the northeastern part of New Jersey (Essex, Passaic, and Union Counties)	Water quality is generally good to excellent. Groundwater is suitable for drinking and most uses. These are the most productive aquifers in Essex, Passaic, and Union Counties, and are important sources of domestic water supplies in areas where the surficial and aquifer system is not present. Areas of large groundwater withdrawal near bays and estuaries have experienced saltwater intrusion.
Valley and Ridge aquifers: Consist of permeable rocks of primarily sandstone, shale, and carbonates	In the northwestern part of the state along the Delaware River valley	Water is generally suitable for municipal supplies and other purposes, with locally excessive iron, hardness, and low pH (acidic).
Valley and Ridge carbonate-rock aquifers: Contiguous fractured-bedrock aquifers.	Far northwestern part of the state	Water is generally suitable for municipal supplies and other purposes, with locally excessive iron, hardness, and low pH (acidic). The groundwater flow system is different where these rocks are folded and where they are not. Soluble carbonate rocks and easily eroded shales underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and some cherty dolomite underlie ridges.
Northern Atlantic Coastal Plain aquifer system: Composed of sand, gravel, and limestone to different extents, and although are separated by confining units of clay, silt, and silty or clayey sand	Eastern and southern part of the state, consisting of six regional aquifers in sedimentary deposits along the coast	Water quality is satisfactory except for locally excessive iron concentrations and contamination from saltwater intrusion and waste disposal. Because of the aquifer system's composition, some water flows between units, allowing potentially contaminated groundwater to move between aquifer units.
Piedmont and Blue Ridge crystalline-rock aquifers: Composed of crystalline metamorphic and igneous (volcanic) rocks of many types	Northern New Jersey	Natural water quality within the Piedmont and Blue Ridge aquifers is generally satisfactory, but locally, dissolved iron concentrations may be high (greater than 0.3 parts per million).
New York and New England carbonate-rock aquifers: Consolidated bedrock of limestone, dolomite, and marble and are generally soluble.	In the northwestern part of the state	Water is hard. Saltwater is present in places, especially at shallow depths. Overall, the water is suitable for most uses, though carbonate can make groundwater acidic. Where exposed, carbonate-rock aquifers are susceptible to contamination from the land surface because of their permeability. Groundwater is the principal source of water for small business or homes in the area.
Piedmont and Blue Ridge carbonate-rock aquifers: Limestone, dolomite, and marble	Located in north-central New Jersey	Water generally is suitable for drinking and other uses, but locally, excessive iron, manganese, and sulfate concentrations can occur.

Sources: (Barber & Maupin, 2005), (Bartholomay, Carter, Qi, Squillace, & and Rowe, 2007), (USGS, 1990), (USGS, 1997), (USGS, 2013d)

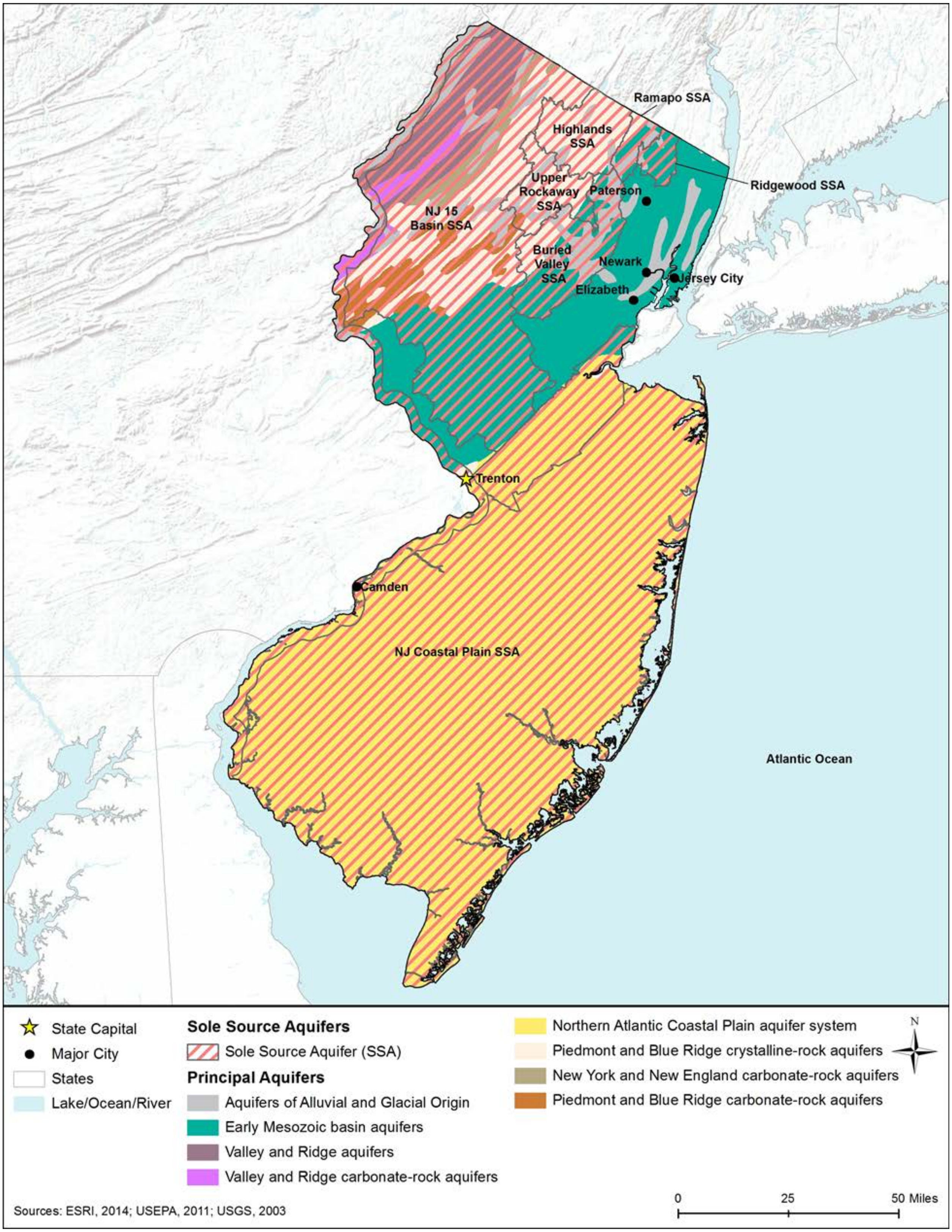

Figure 10.1.4-4: Principal and Sole Source Aquifers of New Jersey

Sole Source Aquifers

The U.S. Environmental Protection Agency (USEPA) defines a sole source aquifer (SSA) as one that "supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015b). New Jersey has seven designated SSAs within the state, including three that cross into New York and one that crosses into Delaware and Pennsylvania (as shown in Figure 10.1.4-4) (USEPA, 2014c). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015b).

10.1.5 Wetlands

10.1.5.1 Definition of the Resource

The Clean Water Act (CWA) defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (40 CFR 230.3(t), 1993).

USEPA estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half of such species use wetlands at some point in their lives" (USEPA, 1995). In addition to providing habitat for many plants and animals, wetlands also provide benefits to human communities. Wetlands store water during flood events, improve water quality by filtering polluted runoff, help control erosion by slowing water velocity and filtering sediments, serve as points of groundwater recharge, and help maintain base flow in streams and rivers. Additionally, wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.

10.1.5.2 Specific Regulatory Considerations

In 1994, the USEPA granted New Jersey approval to use the New Jersey Freshwater Wetland Protection Act in lieu of the Section 404 of the CWA[77] based on the quality of protection given to freshwater wetlands and stringent environmental requirements included in the Act. This decision makes the state responsible for "administering the Federal wetlands program (also known as the 404 program) in delegable[78] waters, as defined at New Jersey Administrative Code

[77] "As one of only two "Assumed Programs" in the US, the EPA has made the finding that New Jersey's regulation of activities in and around freshwater wetlands is consistent with the Federal 404b(1) Rule and acknowledges that the State has implemented a regulatory process of wetland delineation and permitting that is comparable to or more stringent than that found at the federal level" (NJDEP, 2013a).

[78] "Delegable waters means all waters of the United States, as defined in this section, within New Jersey, except waters which are presently used, or are susceptible to use in their natural condition or by reasonable improvement, as a means to transport interstate or foreign commerce, shoreward to their ordinary high water mark. This term includes all waters which are subject to the ebb and flow of the tide, shoreward to their mean high water mark, including wetlands that are partially or entirely located within 1000 feet of their ordinary high water mark or mean high tide. Waters that are not delegable waters include, but are not limited to: the entire length of the Delaware River within the State of New Jersey; waters of the U.S. under the jurisdiction of the Hackensack Meadowlands Development Commission; and Greenwood Lake" (State of New Jersey, 2015c).

(N.J.A.C.) 7:7A-1.4. In non-delegable waters, the U.S. Army Corp of Engineers (USACE) retains jurisdiction under federal law, and both federal and state requirements apply." A project in non-delegable waters requires two permits: one from the state and the other from the USACE. (State of New Jersey, 2015c)

The state shares permitting authority with the USACE for coastal wetlands and regulates them through the Wetlands Act of 1970. However, the state's regulatory jurisdiction is limited to areas identified and delineated as coastal wetlands on NJDEP's coastal wetlands maps. The USACE New York District administers wetland permitting for the tidal segments of northern New Jersey (Hudson/Raritan and other Atlantic Coast watersheds), while tidal wetlands in central and southern New Jersey and the Delaware River watershed are regulated by the USACE Philadelphia District.

Under the Freshwater Wetlands Protection Act, activities under jurisdiction of the Hackensack Meadowlands Development Commission (N.J.S.A. 13:17-1 et seq.) do not fall under the permitting requirements of New Jersey, except for the discharge of dredged or fill material; however, federal or state approvals may be necessary depending on the project, such as USACE approval for Section 404 permits. More information on Hackensack Meadowlands Development Commission freshwater wetland regulations can be found on its website at www.njmeadowlands.gov/.

The Act requires permits only for the "discharge of dredged or fill material in freshwater wetlands or state open waters under the jurisdiction of the Pinelands Commission" (State of New Jersey, 2015c). Any other activities regulated under the jurisdiction of the Pinelands Commission do not fall under the permitting requirements of the Freshwater Wetlands Protection Act. However, the Pinelands Commission may enforce more stringent regulations for activities in and around freshwater wetlands within its jurisdiction. Information on Pinelands Commission freshwater wetland regulations are available on its website at www.state.nj.us/pinelands. (State of New Jersey, 2015c)

In addition, New Jersey has different wetland delineation[79] parameters than many other states. Instead of using the USACE 1987 Wetland Delineation Manual methodology, the Freshwater Wetlands Protection Act established the identification and delineation process (three-parameter approach) for freshwater wetlands[80], in accordance with the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands published by U.S. Fish and Wildlife Service (USFWS). (NJDEP, 2015j)

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 10.1.5-1 summarizes major New Jersey state laws and permitting requirements relevant to the state's wetlands.

[79] A process to identify which water bodies within a project's boundaries meet the definition of "waters of the United States."
[80] http://www.nj.gov/dep/landuse/fww/fww_main.html.

Table 10.1.5-1: Relevant New Jersey Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Freshwater Wetlands Protection Act[81]	New Jersey Department of Environmental Protection (NJDEP), Division of Land Use Regulation	Activities in a freshwater wetland which do not meet the following conditions: • Occur in a surface water tributary system discharging into an inland lake or pond, or a river or stream, and • Result in the loss or substantial modification of more than one acre of freshwater wetland, if the activity will not take place in a freshwater wetland of exceptional resource value. Activities in a freshwater wetland in an area considered a headwater pursuant to the CWA if the regulated activity would not result in the loss or substantial modification of more than 1 acre of a swale or a human-made drainage ditch. The Act does not apply to any wetlands designated as priority wetlands by the USEPA.[82] (State of New Jersey, 2015d)
		For regulated activities having substantial[83] wetlands impacts that require an alternatives analysis to eliminate and/or reduce affects. (NJDEP, 2015k)
Wetlands Act of 1970[84]	NJDEP, Division of Land Use Regulation	The draining, dredging, excavation, or deposition of material, and the erection of any structure, driving of pilings or placing of obstructions in any coastal wetlands, which have been mapped or delineated under the Wetlands Act of 1970. (State of New Jersey, 2015e)

10.1.5.3 Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined by wwardin et al. (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 10.1.5-2). The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats (USFWS, 2015a).

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline

[81] The Freshwater Wetlands Protection Act includes the Water Quality Certification and New Jersey Pollutant Discharge Elimination System [NJPDES] Program permits from the NJDEP indicating that the proposed activity will not violate water quality standards.

[82] The EPA has identified priority wetlands in New Jersey in an effort to protect the most important wetlands in the region, reduce adverse impacts to wetlands from dredge, and fill discharges. The priority list developed by EPA is for those wetlands that are considered the most important and vulnerable in the state based on sites known to be essential and/or threatened (USEPA, 1994). New Jersey included EPA's list of priority wetlands into the state's Freshwater Wetlands Protection Act.

[83] "Substantial impacts means a regulated wetland disturbance does not fall into one of the standard general permit or transition area waiver categories (for "minimal" disturbance activities)" (NJDEP, 2015k).

[84] The Wetlands Act of 1970 includes the Water Quality Certification and NJPDES Program permits from the NJDEP indicating that the proposed activity will not violate water quality standards.

(more than 35 percent salty) water chemistry; minimal influence from rivers or estuaries. Where wave energy is low, mangroves, or mudflats may be present.

- The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that usually semi enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and the ocean water is at least occasionally diluted by freshwater runoff from the land.
- Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt or greater.
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy at least 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, and all wetlands that occur in tidal areas where the salinity is below 5 percent. The system is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013)

Table 10.1.5-2 uses 2014 NWI data to characterize and map New Jersey wetlands on a on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 10.1.5-2 correspond to the wetland types in the figure.

Table 10.1.5-2: New Jersey Wetland Types, Descriptions, Location, and Amount, 2014

<table>
<tr><th>Wetland Type</th><th>Map Code and Color</th><th>Description[a]</th><th>Occurrence</th><th>Amount (Acres)[b]</th></tr>
<tr><td>Palustrine forested wetland</td><td>PFO</td><td>PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.</td><td rowspan="2">Throughout the state often along major rivers and streams. PSS are also found on barrier islands.</td><td rowspan="2">604,294</td></tr>
<tr><td>Palustrine scrub-shrub wetland</td><td>PSS</td><td>Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.</td></tr>
<tr><td>Palustrine emergent wetlands</td><td>PEM</td><td>Palustrine emergent wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens[85], prairie potholes, and sloughs.</td><td>Throughout the state</td><td>66,957</td></tr>
</table>

[85] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water (Edinger, et al., 2014).

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (Acres)[b]
Palustrine unconsolidated bottom	PUB	PUB and PAB are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state and Outer Coastal Plains (southeastern part of the state)	26,680
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep[86], and other miscellaneous wetlands are included in this group.	Throughout the state	3,563
Riverine wetlands	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state	2,463
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are generally less than 8.2 feet deep.	Throughout the state	1,476
Estuarine intertidal and Marine intertidal wetland	E2/M2	These intertidal wetlands include the areas between the highest tide level and the lowest tide level. Semidiurnal tides (two high tides and two low tides per day) periodically expose and flood the substrate. Wetland examples include vegetated and non-vegetated brackish (mix of fresh and saltwater), and saltwater marshes, shrubs, beaches, sandbars, or flats.	Along the Atlantic coastline and a portions of the Hudson, Delaware Raritan, Passaic, and Hackensack Rivers.	203,111

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data have been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (FGDC, 2013)

[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. (USFWS, 2015a)

Sources: (Cowardin, Carter, Golet, & LaRoe, 1979), (USFWS, 2015a), (FGDC, 2013)

In New Jersey, there are two main types of wetlands: palustrine (freshwater) wetlands found on river and lake floodplains across the state, particularly within the Mid-Atlantic Coastal watershed, and estuarine (tidal) wetlands along the Atlantic coastline and portions of the Hudson, Delaware, Raritan, Passaic, and Hackensack Rivers. Land cover within the state is comprised of approximately 15 percent freshwater wetlands and 4 percent tidal wetlands (NJDEP, 2002). As shown in Figure 10.1.5-1, western and northern New Jersey are predominately palustrine wetlands, while estuarine/marine wetlands are found in the eastern and southern portions of the

[86] Saline seep is an area where saline groundwater discharges at the soil surface. Saline soils and salt tolerant plants characterize these wetland types (City of Lincoln, 2015).

state. Lacustrine and riverine wetlands comprise less than one percent of total state wetlands, and therefore, they are not discussed in detail in this Draft PEIS. Between the 1870s and 1970s, New Jersey lost approximately 39 percent of its wetlands and as much as 20 percent between the 1950s and 1970s (NJDEP, 2002). The state recognized the importance of tidal and freshwater wetlands by the passage of the New Jersey Wetlands Act of 1970 and the New Jersey Freshwater Wetlands Protection Act of 1987 (State of New Jersey, 2015d).

Palustrine Wetlands

In New Jersey, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs,[87] and ponds). Palustrine forested wetlands (PFO) form on organic soils (peats[88] and mucks[89]), loamy[90] and clayey soils, and sandy soils. Common types of Palustrine forested wetlands (PFO) in New Jersey are red maple swamps, hardwood swamps, Atlantic white cedar swamps, and pitch pine lowland forests. PFO is the most common type of palustrine wetlands within New Jersey. Dominant species in palustrine scrub-shrub wetlands (PSS) in New Jersey are alders (*Alnus sp.*), willows (*Salix sp.*), buttonbush (*Cephalanthus occidentalis*), and viburnums (*Viburnum sp.*). Palustrine emergent wetlands (PEM), or freshwater marsh, support diverse plant and animal populations. Common marsh plants in New Jersey include cattails (*Typha sp.*), bulrush (*Scirpoides holoschoenus*), rice cutgrass (*Leersia oryzoides*), common reed (*Phragmites sp.*), and woolgrass (*Scirpus cyperinus*). (Tiner, 1985)

Palustrine wetlands also include the shallow water zone of lakes, rivers, and ponds and aquatic beds formed by water lilies (*Nyphaea sp.*) and other floating-leaved or free-floating plants. These are the easiest wetlands to recognize and occur throughout the state (NJDEP, 2002).

In the mid-1970s, the most common freshwater wetland type was PFO (79 percent), followed by PSS (12 percent), PEM (5 percent), ponds (3 percent), and farmed wetland (1 percent) (Tiner, 1985). Based on the USFWS NWI 2014 analysis, PFO remains the dominant wetland type (75 percent), PSS (11 percent), PEM (9 percent), PUB/PAB (ponds) (4 percent), and other palustrine wetlands at 1 percent (USFWS, 2014a). There are currently about 720,000 acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a). Main threats to palustrine wetlands in New Jersey include agricultural conversion, reservoir and/or flood control construction and urbanization and associated impacts (e.g. filling, runoff) (Tiner, 1985).

In 1987, the New Jersey State Legislature passed the Freshwater Wetlands Protection Act to preserve “the purity and integrity of freshwater wetlands from random, unnecessary, or undesirable alteration or disturbance” (State of New Jersey, 2015d). This Act is considered to be “one of the most stringent wetland laws in the U.S.” However, between 1986 and 1995, approximately 1,800 acres of wetland loss occurred each year prior to the full implementation of the Act. Implementation of the Act has also still allowed for the “disturbance of approximately 150 acres of freshwater wetlands per year.” (NJDEP, 2002)

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[87] Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation (APA, 2013).
[88] Peat is partially decayed vegetation, usually mosses, found in bogs.
[89] Muck is a dark highly organic soil.
[90] Loamy soil combines all three of types of particles (sand, silt and clay) in relatively equal amounts.

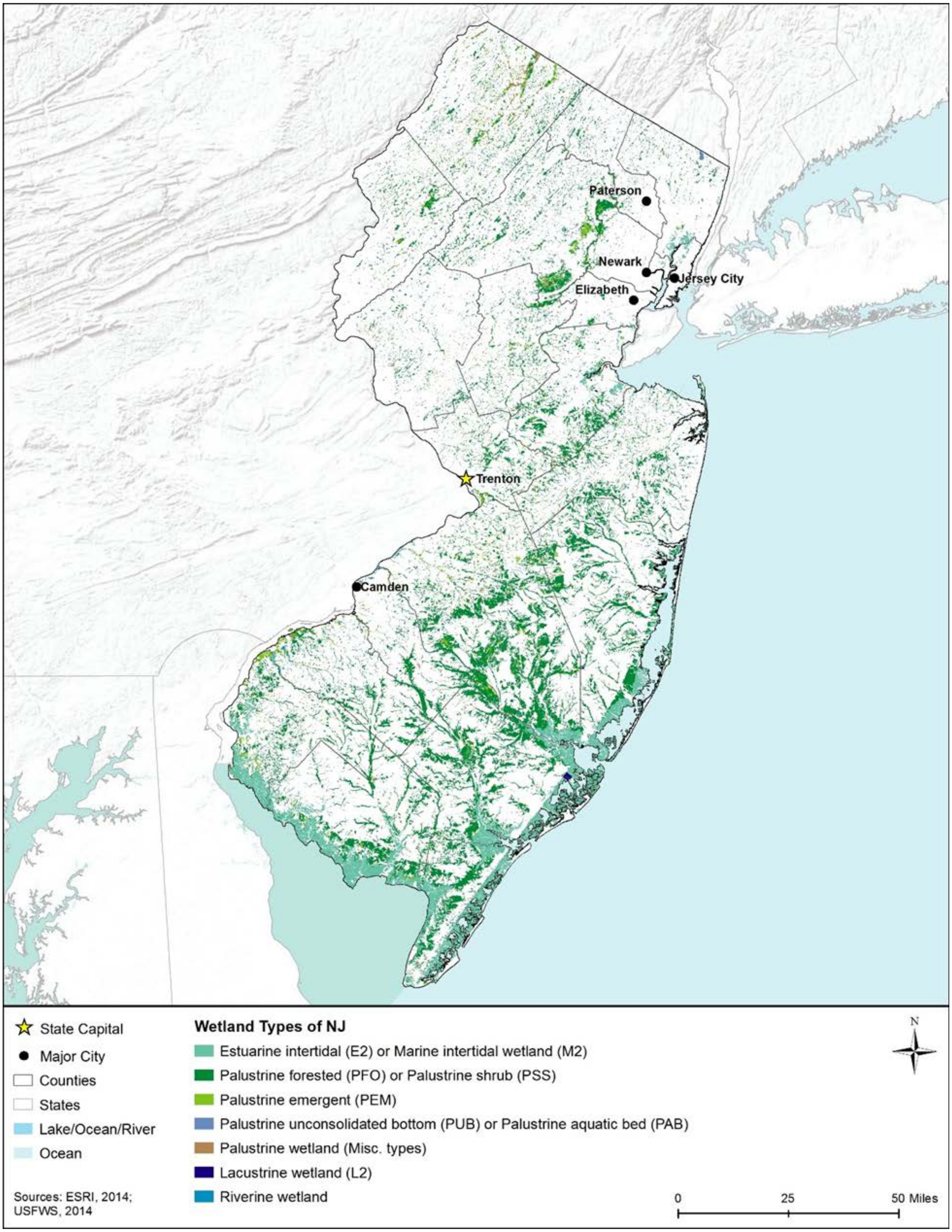

Figure 10.1.5-1 Wetlands by Type, in New Jersey, 2014

Estuarine and Marine Wetlands

In New Jersey, estuarine, or tidal fringe wetlands, can be vegetated (marshes) or unvegetated (mud and sand flats), and are found between the open saltwater of the bays or Atlantic Ocean and the uplands of the coastal plain and barrier islands, and along tidal rivers. Estuarine wetlands include mudflats exposed at low tide, salt marshes (tidally flooded grasslands) found along the coast from the Atlantic Highlands and Sandy Hook to Cape May and Delaware Bay, and aquatic beds which, are common in New Jersey estuaries located behind barrier islands (Tiner, 1985) (Figure 10.1.5-1).

Coastal development and urban expansion has historically caused great losses to estuarine wetlands in New Jersey. Substantial filling caused the loss of most estuarine marshes in the northern part of the state, especially in Newark, Elizabeth, and Jersey City. In addition, land subsidence and sea level rise contribute to estuarine wetland loss in the state. As of the early 1990s, approximately 200,000 acres of tidal marshes were present across the state (Steinburg, 2004). There are currently about 1,476,000 acres of estuarine and marine wetlands in the state (USFWS, 2014a).

10.1.5.4 Wetlands of Special Concern or Value

In addition to protections under the state's Freshwater Protection Wetlands Act, Wetlands Act of 1970, and national CWA, New Jersey considers certain wetland communities as areas of special value due to their regional scarcity, local importance, or habitat they support. These include vernal pools and wetlands associated with the Hackensack Meadowlands and New Jersey Pinelands (Figure 10.1.5-3) (Tesauro, 2002).

Vernal Pools

Vernal pools are seasonal wetlands in confined depressions or basins that lack a permanent outlet stream (Figure 10.1.5-2). They are typically filled with water during winter and spring and appear dry by late summer and early fall, which is unsuitable for sustaining fish. Vernal pools provide critical habitat for wildlife including highly diverse "obligate" species, or species specifically adapted to these watercourses. In New Jersey, there are seven obligate species, including two frogs and five salamanders that are dependent upon vernal pools for breeding (NJDFW, 2008).

Source: (Tesauro, 2002)

Figure 10.1.5-2: Vernal Pool, New Jersey

These wetlands are common in New Jersey, with approximately 3,000 to

5,000 pools scattered across the state. Due to their small size (typically less than 0.25 acre in New Jersey), vernal pools are exempt from regulatory protection under the state's Freshwater Wetlands Protection Act and federal regulations. However, the state has established measures for vernal pool protection by "cross-referencing land use permit applications with mapping of certified vernal pools." State protection is limited and only given to vernal pools that the NJDEP Land Use Regulation Program certifies. (Tesauro, 2002)

Hackensack Meadowlands

The Hackensack Meadowlands is part of the largest brackish wetland complex in the New York/New Jersey Harbor estuary, comprised of approximately 8,400 acres of wetlands. This wetland provides essential habitat for "significant concentrations of waterfowl, wading birds, shorebirds, raptors, anadromous fish, and estuarine fish," including 88 species of special emphasis or listed species. Based on the ecological significance of the site, the Hackensack Meadowlands are considered a regionally significant habitat complex in the New York/New Jersey Harbor Area by the USFWS. (USFWS, 1996a)

Located within the Newark metropolitan area, urban and port development, highway construction, industrial and residential development, and air and water pollution have affected this wetland system. In an effort to address these issues, in 2004 the New Jersey Meadowlands Commission (NJMC) adopted the NJMC Master Plan, which preserved 8,400 acres of wetlands and open space (NJMC, 2015). In efforts to protect the Hackensack Meadowlands wetland complex, the NJMC has also collaborated with other agencies and organizations, such as the USACE, USEPA, and National Oceanic and Atmospheric Administration. More information can be found at the NJMC website at www.njmeadowlands.gov/njmc/about/natural-resources.html.

New Jersey Pinelands

The New Jersey Pinelands complex is located in the southeastern portion of the state and consists of over 1 million acres of upland, aquatic, and wetland habitats, including the Pinelands National Reserve. The Pinelands is the "largest area of contiguous, undeveloped forest and wetland on the Atlantic Coastal Plain of the Mid-Atlantic region." (New Jersey Pinelands, 1997) The complex supports a variety of rare upland and wetland communities and species of national significance, including "endemic plant and animal species, several glacial relict species, and a few northern and numerous southern species that reach their geographical Coastal Plain limits in the Pinelands" (New Jersey Pinelands, 1997) and federally and state-listed species. In addition, the U.S. Forest Service (USFS) has identified several wetland areas in the complex as priority wetland sites under the Federal Emergency Wetlands Resources Act of 1986. Furthermore, the Pinelands overlay one of the largest aquifers in the country (Cohansey and Kirkwood formations), and within 15 to 20 percent of the Pinelands, the aquifer is near or at the surface for at least part of the year. With wetlands making up about one-third of the Pinelands total land area, these resources are vital for water quality and productively of New Jersey estuaries. (USFWS, 1996b)

The New Jersey Pinelands Commission protects the Pinelands through its implementation of the Pinelands Comprehensive Management Plan, which was developed to maintain the region's unique ecology while allowing appropriate development. Development within the Pinelands region is subject to approval by the Commission and typically not allowed within 300 feet of a wetland. However, exceptions can be made for non-intensive land uses, such as agriculture activities, including blueberry and cranberry cultivation. More information on the New Jersey Pinelands Commission is available on their website (www.state.nj.us/pinelands/index.shtml).

Other important wetland sites in New Jersey include:

- Wetland Nature Centers are open to the public and all are state-protected because of their ecological importance (USFWS, 2013a). More information on the centers is available at www.fws.gov/northeast/njfieldoffice/youcan.html.
- Wildlife Management Areas across the state are designated for outdoor recreation; these public lands include more than 354,000 acres, including wetlands (NJDEP, Division of Fish and Wildlife, 2015e). To learn more information about state Wildlife Management Areas, visit www.nj.gov/dep/fgw/wmaland.htm.
- National Natural Landmarks range in size from 15 acres to over 3,000 acres, and are owned by NJDEP, U.S. Fish and Wildlife Service, National Park Service Palisades Interstate Park Commission, universities, counties, municipalities, and other private conservation organizations and individuals. (NPS, 2015b) Visit www.nature.nps.gov/nnl/state.cfm?State=NJ to learn more about New Jersey's National Landmarks.
- Natural resource groups such as state land trusts, NJDEP, New Jersey State Agriculture Development Committee, D&R Greenway Land Trust, and USFWS manage wetland conservation easements or lands that contain important wetland habitat within New Jersey, according to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/). (NCED, 2015c)
- For more information on New Jersey's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 10.1.8, Visual Resources, and Section 10.1.7, Land Use.

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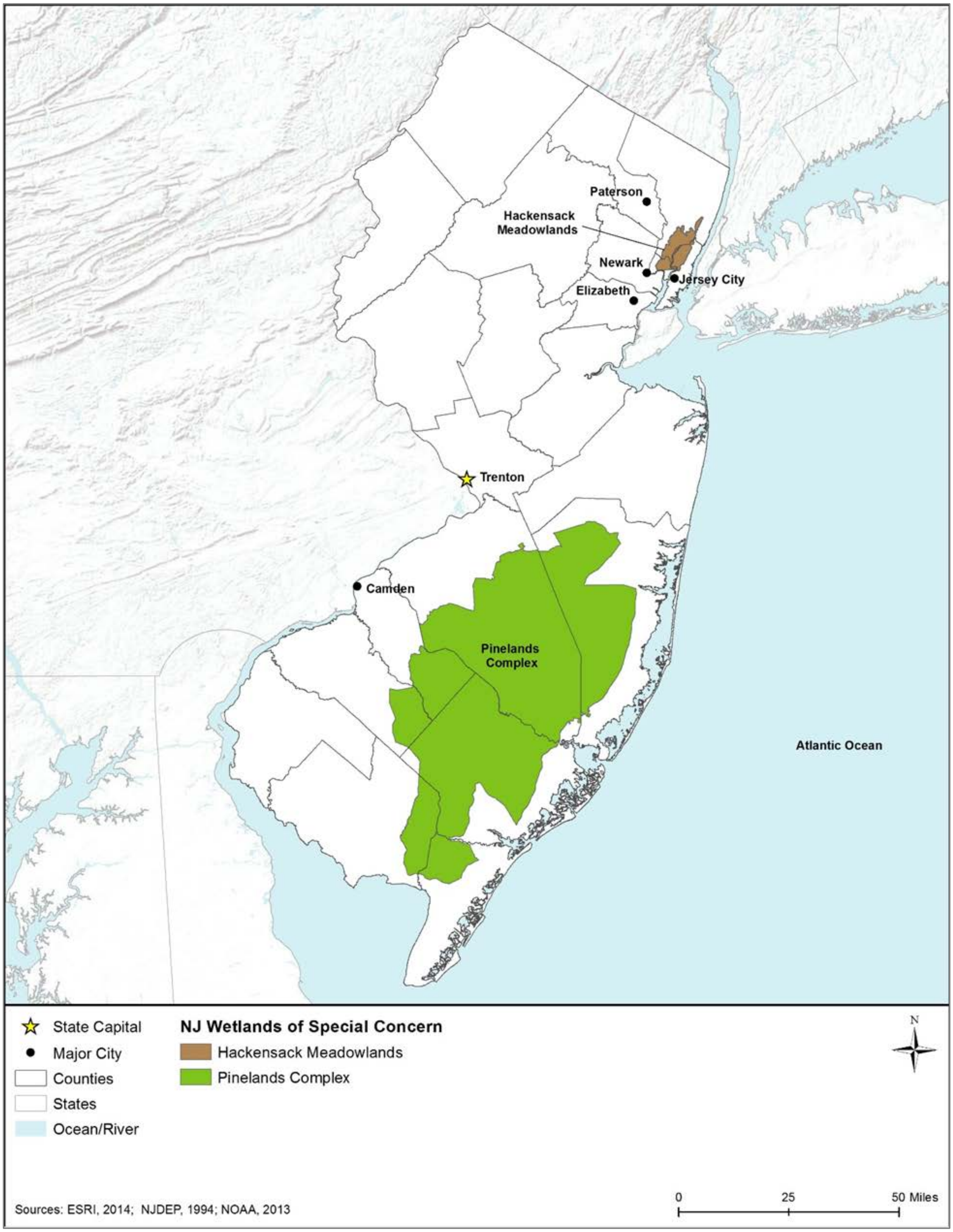

Figure 10.1.5-3: Wetlands of Concern, in New Jersey, 2014

10.1.6 Biological Resources

10.1.6.1 Definition of the Resource

This Chapter describes the biological resources of New Jersey. Biological resources include terrestrial[91] vegetation, wildlife, fisheries and aquatic[92] habitats, threatened[93] and endangered[94] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of the significant topographic variation within the state, the results of partial glaciation, and its location along the Atlantic coast, New Jersey supports a large diversity[95] of biological resources including coastal environments along its south and eastern shores, Pine Barrens in the south-central portion of the state, and mountainous forests in the Skylands region to the north. Each of these topics is discussed in more detail below.

10.1.6.2 Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of biological resources in New Jersey are discussed in Appendix C. Table 10.1.6-1 summarizes the major state laws relevant to New Jersey's biological resources and the Proposed Action.

Table 10.1.6-1. Relevant New Jersey Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Endangered Plant Species Program	NJDEP	Develops and adopts the official endangered plant list for the state
New Jersey Division of Fish and Wildlife (NJDFW) Rules	NJDEP	Manages the harvest of fish and wildlife in the state

10.1.6.3 Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology, soils, climate, and water of a given geographic area and correlates with distinct areas identified as ecoregions. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015). Ecoregion boundaries often coincide with geographic regions of a

[91] Terrestrial: "Pertaining to the land" (USEPA, 2015c).
[92] Aquatic: "Pertaining to water" (USEPA, 2015c).
[93] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C §1532(20)) (USEPA, 2015c).
[94] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C §1532(6)) (USEPA, 2015c).
[95] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA, 2015c).

state. New Jersey is comprised of six main geographic regions including, the Skylands, Gateway, Delaware River, Southern Shore, Greater Atlantic City, and Shore regions. The Skylands and Gateway regions cover the northern portion of the state consisting of the areas north and west of Trenton. In contrast, the other regions cover the southern portion of the state, both the inner and outer coastal plain, consisting of the areas south and east of Trenton. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also developed ecoregions that may differ slightly from those designated by the USEPA. The USEPA Level I ecoregion is the coarsest level, dividing North America into 15 ecological regions. Level II further divides the continent into 50 regions. The continental U.S. contains 104 Level III ecoregions and the conterminous U.S. has 84 ecoregions. This section presents a discussion of biological resources for New Jersey at USEPA Level III (Bryce, et al., 2010).

As shown in Figure 10.1.6-1, the USEPA divides New Jersey into five Level III ecoregions. These ecoregions support a variety of different plant communities, all predicated on their general location within the state. Communities range from forested mountainous communities in the north, to unglaciated coastal plain communities in the south. Areas adjacent to the Atlantic Ocean, the Delaware River, and Delaware Bay are influenced by the coastal sub-climates found at these locations. Table 10.1.6-2 provides a summary of the general abiotic characteristics, vegetative communities, and the typical vegetation found within each of the state's ecoregions.

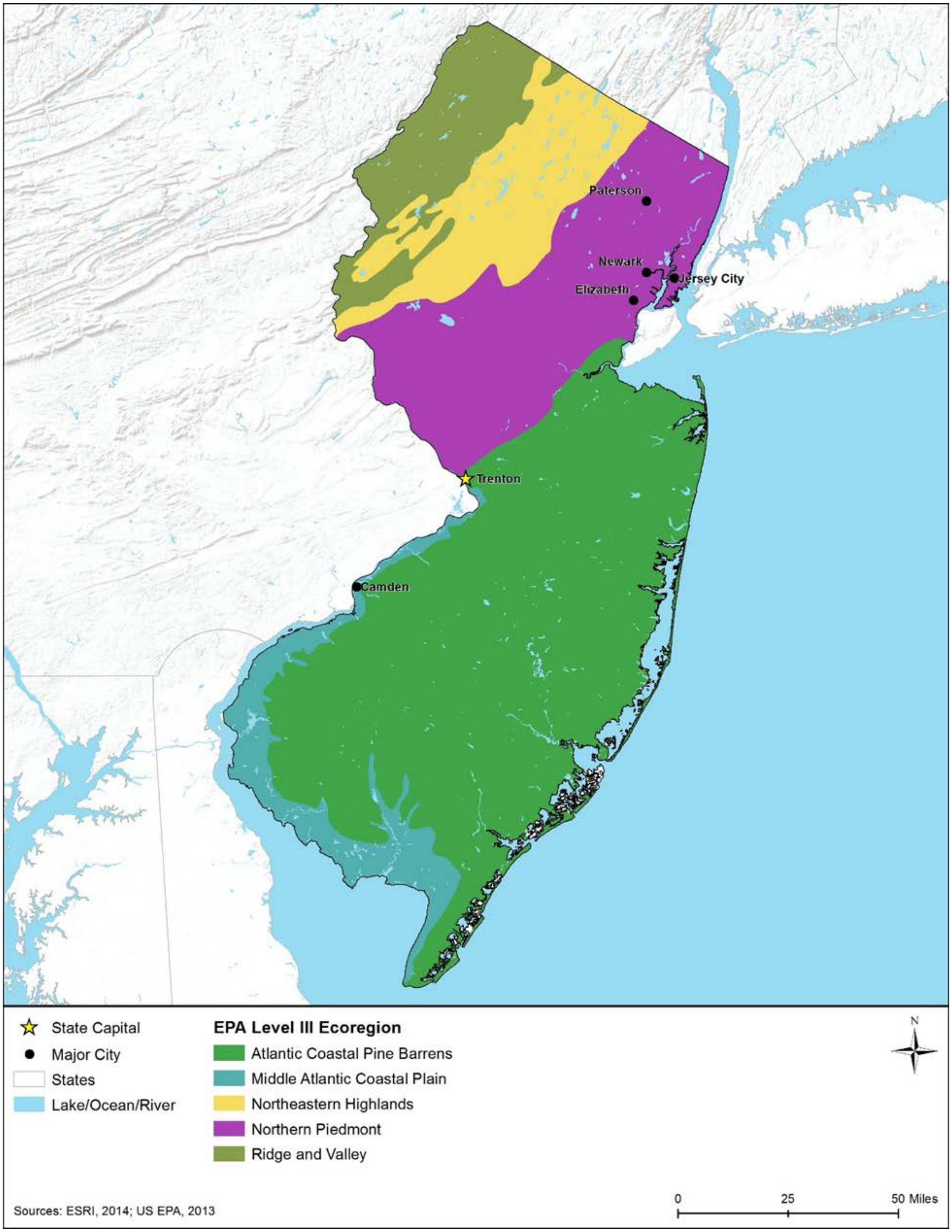

Figure 10.1.6-1: USEPA Level III Ecoregions in New Jersey

Table 10.1.6-2: USEPA Level III Ecoregions of New Jersey

Ecoregion Number	Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Skylands and Gateway				
58	Northeastern Highlands	Composed mostly of forested hills and mountains on nutrient poor soils, with numerous high-gradient streams and glacial lakes.	Mixed Oak-Hemlock forest, mixed hardwood forest, sugar maple-mixed hardwood forest	• **Hardwood Trees** – Black oak (*Quercus velutina*); Northern red oak (*Quercus rubra*); White oak (*Quercus alba*); Sugar maple (*Acer saccharum*); Gray birch (*Betula populifolia*); Black cherry (*Prunus serotina*), Trembling aspen (*Populus tremuloides*); and Big-toothed aspen (*Populus grandidentata*) • **Conifer Trees -** Eastern hemlock (*Tsuga canadensis*) and Eastern red cedar (*Juniperus virginiana*)
64	Northern Piedmont	Transitional region composed of low hills, irregular plains, and open valleys in contrast to the Northeastern Highlands. Also with freshwater wetlands and meadowlands interspersed.	Mixed hardwoods, freshwater wetlands, meadows	• **Hardwood Trees** – Black oak, Northern red oak, White oak, Sugar Maple, Gray birch, Black Cherry, Trembling aspen, and Big-toothed aspen • **Conifer Trees -** Eastern hemlock and Eastern red cedar
67	Ridge and Valley	A diverse region composed of ridges and valleys with a variety of widths, heights, and geologic composition, with numerous springs and caves.	Chestnut oak-pitch pine-scrub oak forest	• **Hardwood Trees -** Chestnut oak (*Quercus prinus*), Northern red oak, Scrub oak (*Quercus ilicifolia*), Black birch (*Betula lenta*), Fire cherry (*Prunus pensylvanica*), and Trembling aspen • **Conifer Trees -** Pitch pine (*Pinus rigida*)

Ecoregion Number	Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Delaware River and Southern Shore				
63	Middle Atlantic Coastal Plain	Composed mostly of mineral-poor fens or savannahs that form along streams in the pine barrens, freshwater swamps and tidal marshes along the Delaware River and Delaware Bay.	Freshwater tidal marshes, cedar swamp, hardwood swamp, pitch pine lowland, peatlands	• **Hardwood Trees -** Red maple (*Acer rubrum*), Black gum (*Nyssa sylvatica*), Sweet gum (*Liquidambar styraciflua*), Blackjack oak (*Quercus marilandica*), Black oak, Chestnut oak, White oak, Post oak, and Sassafras (*Sassafras albidum*) • **Conifer Trees -** Pitch pine and Atlantic white cedar (*Chamaecyparis thyoides*) • **Shrubs** - Buttonbush, Silky dogwood, Indigo bush (*Amorpha fruticosa*), and Swamp rose
Geographic Region: Delaware River, Southern Shore, Greater Atlantic City, South Shore				
84	Atlantic Coastal Pine Barrens	A transitional ecoregion, distinguished from the adjacent coastal ecoregion to the south by its coarser-grained soils, cooler climate, and oak-pine vegetation.	Dwarf pine forest; pitch pine-oak forest; coastal shrubland	• **Conifer Trees -** Pitch pine • **Shrubs** - Mountain laurel (*Kalmia latifolia*), Sea lavender (*Limonium carolinianum*), Marsh elder (*Iva frutescens*), Groundsel bush (*Baccharis halimifolia*), and Bayberry (*Myrica pensylvanica*)

Sources: (Anderson, 1994) (USEPA, 2012b)

Communities of Concern

New Jersey utilizes a community classification system as a tool to manage biodiversity conservation. A combination of factors such as the number of community occurrences, threats, geographic extent, the degree of decline from historic extent, and the degree of alteration of natural processes affecting the function, composition, or dynamics are used to rank communities and prioritize them according to their relative endangerment. The various state Natural Heritage Programs and The Association for Biodiversity Information use this information to assign levels of imperilment rank (Breden, 2001). As with most state heritage programs, the New Jersey Natural Heritage Program (NJNHP) ranking system assesses rarity using a state rank (e.g., S1, S2, S3, S4, S5, etc.) that indicates rarity within New Jersey. Communities ranked as an S1 by the NJNHP are of the greatest concern within the state.

The NJNHP is a component of The Natural Heritage Network, an international database network of Conservation Data Centers and other state Natural Heritage Programs that is continually updated with information on rare, threatened, and endangered species and natural communities. The NJNHP uses this inventory to identify the state's most noteworthy natural areas and species, and sets priorities for preserving natural diversity (NatureServe, 2015) (NJDEP, 2015l). Natural communities with a rank of S1 are considered to be of the highest priority as they are critically imperiled in the state.

There are 12 vegetative communities that are ranked as S1 communities[96] in New Jersey; these communities represent the rarest terrestrial habitat in the state and comprise a small portion of New Jersey's total land area. In New Jersey, the S1-ranked communities occur throughout the state. Seven of the 12 communities are rare coastal communities that occur in the Atlantic Coastal Plain region. The other five rare communities occur with the Appalachian Highlands region of northern New Jersey. New Jersey Appendix A, Table A-1 provides a description of the S1 communities along with their distribution and associated USEPA Level III ecoregions.

Nuisance and Invasive Plants

Nuisance and invasive plants is a broad category that includes a large number of undesirable plant species. Direct impacts to nuisance and invasive plants may be viewed as beneficial to the environment, but often such impacts result in the inadvertent and unintended spread and dispersal of these species. Construction sites in particular provide colonizing opportunities for nuisance and invasive species, and long-term maintenance activities can perpetuate a disturbance regime that facilitates a continued dispersal mechanism for the spread of these species.

Noxious weeds are defined in the Federal Noxious Weed Act of 1974 as "any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the U.S., and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture,

[96] S1 – Communities "at high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state." (Montana Fish Wildlife And Parks and Montana Natural Heritage Program, 2015).

including irrigation, or navigation or the fish and wildlife resources of the U.S. or the public health." (USDA, 2015b) Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (U.S. Legal, 2015). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S., 88 of which are terrestrial, 19 aquatic, and 5 parasitic (USDA, 2015c).

New Jersey does not maintain an official list of invasive nonindigenous plant species; however, 29 plant species and 4 aquatic species[97] are reported to be notably troublesome because their aggressive nature poses a threat to the state's natural communities. Purple loosestrife (*Lythrum salicaria*) is considered to be the greatest threat to the state's wetlands, whereas upland communities are under the greatest threat from autumn olive (*Eleagnus umbellata*), multiflora rose (*Rosa multiflora*), and Japanese barberry (*Berberis thunbergii*) (Snyder & Kaufman, 2004). Invasive aquatic plants include the water chestnut (*Eleocharis dulcis*), rock snot (*Didymosphenia geminata*), Hydrilla (*Hydrilla spp.*), and Eurasian water milfoil (*Myriophyllum spicatum*) (NJDEP, 2014c).

10.1.6.4 Terrestrial Wildlife

This section discusses the terrestrial wildlife species in New Jersey, divided among mammals, birds, reptiles and amphibians, and invertebrates. A discussion of non-native and/or invasive terrestrial wildlife species is also included. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or the habitats they occupy. New Jersey is home to 61 terrestrial and avian mammals (NJDEP, 2004a), 327 resident and migratory birds (Bird Nature, 2000) (NJDEP, 2004b) (USGS, 2011), 74 terrestrial reptiles and amphibians (New Jersey Audubon, 2014a), and innumerable invertebrates.

Mammals

Common and widespread terrestrial mammals in New Jersey include opossum (*Didelphis marsupialis*), eastern cottontail (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and white-tailed deer (*Odocoileus virginianus*). Many of New Jersey's mammals are more commonly found in the glaciated, relatively more forested northern half of the state, which are the northeastern highlands and ridge and valley ecoregions. These species are Indiana bat (*Myotis sodalis*), northern long-eared bat (*Myotis septentrionalis*), northern flying squirrel (*Glaucomys sabrinus*), porcupine (*Erethizon dorsatum*), black bear (*Ursus americanus*), and bobcat (*Lynz rufus*). Although the southern portion of the state contains unique habitats such as the Pine Barrens and

[97] http://www.njisst.org/fact-sheets.htm.

extensive coastal areas, aside from the marsh rice rat (*Oryzomys palustris*), the mammals found in the southern portion of the state are found in equal abundance elsewhere.

Two of New Jersey's mammals are federally listed, the Indiana bat and the northern long-eared bat. These species are discussed in further detail in Section 10.1.6.6 Threatened and Endangered Species and Species of Conservation Concern. Three mammals are state-listed, the Indiana bat, the Allegheny woodrat (*Neotoma magister*), and the bobcat. Some of New Jersey's mammals are introduced and affect developed areas such the brown rat (*Rattus norvegicus*) and house mouse (*Mus musculus*), whereas another introduced mammal, the nutria (*Myocastor coypus*)[98], inhabits marshlands and poses a potential threat to resident mammals.

Birds

The variety of ecological communities (i.e., coastal areas, mountains, large rivers and lakes, grasslands, etc.) in New Jersey supports a large variety of bird species. Of the 327 species known to occur within the state, 74 species (approximately 23 percent) are marine aquatic birds and 61 species (approximately 19 percent) are freshwater aquatic birds. The remainder generally occupy terrestrial habitats throughout the state.

There are many areas in New Jersey that provide important habitat for birds, and the variety of habitats present in this relatively small state provides for a high species richness and in some areas, a bottleneck for migrating birds[99]. The state's major habitats include coastal areas, forests, wetlands, and agricultural lands/grasslands (New Jersey Audubon, 2014b). A large variety of shorebirds, waterfowl, and passerines[100] use the coastal habitats along the state's Atlantic coastline and the Delaware Bay. These coastal areas include important bird habitats such as Cape May, the Edwin B. Forsythe National Wildlife Refuge (NWR), the Raritan Bay, Sandy Hook, and the New Jersey Meadowlands. The Delaware River corridor provides several habitat types, from the tidally influenced bay region at the southwestern part of the state, extending northward to the Delaware Water Gap at the Pennsylvania and New York border. This corridor is important habitat for migrating raptors, warblers, passerines, and nesting bald eagles (*Haliaeetus leucocephalus*) (DRBC, 2011) (NPS, 2015c) (NPS, 2015d). Golden eagles are rarely seen and a transient species in New Jersey. The large areas of wetlands and pine forests in the southern portion of New Jersey, and the forests in the northern portion provide important habitat for both year-round and migrating birds. The Watchung Mountains in the northern portion of New Jersey acts as a bottleneck for migrating birds.

New Jersey is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. It is the most densely human-populated of the four waterfowl migration flyways in North America (Atlantic, Mississippi, Central and Pacific), and many waterfowl species are thus threatened by urban sprawl and development (Ducks Unlimited, 2015). Nevertheless, large numbers of waterfowl and non-waterfowl birds utilize this flyway

[98] A large, herbivorous, semiaquatic rodent.
[99] Place of congestion for migrating birds.
[100] Of or relating to birds of the order Passeriformes, which have feet specialized for grasping branches and the first toe facing backward. Includes more than half of all bird species.

and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall.

A number of Important Bird Areas (IBAs) have also been identified in New Jersey (Figure 10.1.6-2). The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat[101] for native bird populations.

A total of 123 IBAs have been identified in New Jersey, including breeding, migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as forests, scrub/shrub, grasslands, freshwater and saltwater wetlands, and bodies of water (New Jersey Audubon, 2014b). These IBAs are widely distributed throughout the state although there are clusters around the Skylands, and the coastal areas of New Jersey. For example there are 20 IBAs in Sussex County – within the Skylands region in the northern most region of the state – covering over 600,000 acres.

Reptiles and Amphibians

A total of 71 native reptile and amphibian species occur in New Jersey, including 16 salamanders, 16 frogs and toads, 13 turtles, 3 lizards, and 23 snakes. These species occur in wet or humid areas in both the northern and southern region of the state. Some distinct populations are also found in some of the river basins, along the coastline and in the pine barrens of southern New Jersey. For example, common map turtle (*Graptemys geographica*) is found within the Delaware River Basin and Raritan River watershed, while the spiny softshell (*Apalone spinifera spinifera*) was introduced into the Maurice River system and Raritan river watershed and the mud turtle (*Kinosternon subrubrum subrubrum*) and the northern diamondback terrapin (*Malaclemys terrapin*) are found along the coast in brackish waters. In the Pine Barrens, species found in the area include the corn snake (*Elaphe guttatta*), pine snake (*Pituophis melanoleucus*), eastern mud salamander (*Pseudotriton montanus*), spotted salamander (*Ambystoma maculatum*), and the Pine Barrens tree frog (*Hyla andersonii*). The bog turtle (*Clemmys muhlengergii*) is found in agricultural landscapes in the western part of the state.

[101] Critical habitat includes “the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species” (16 U.S.C §1532(5)(A)) (USEPA, 2015c).

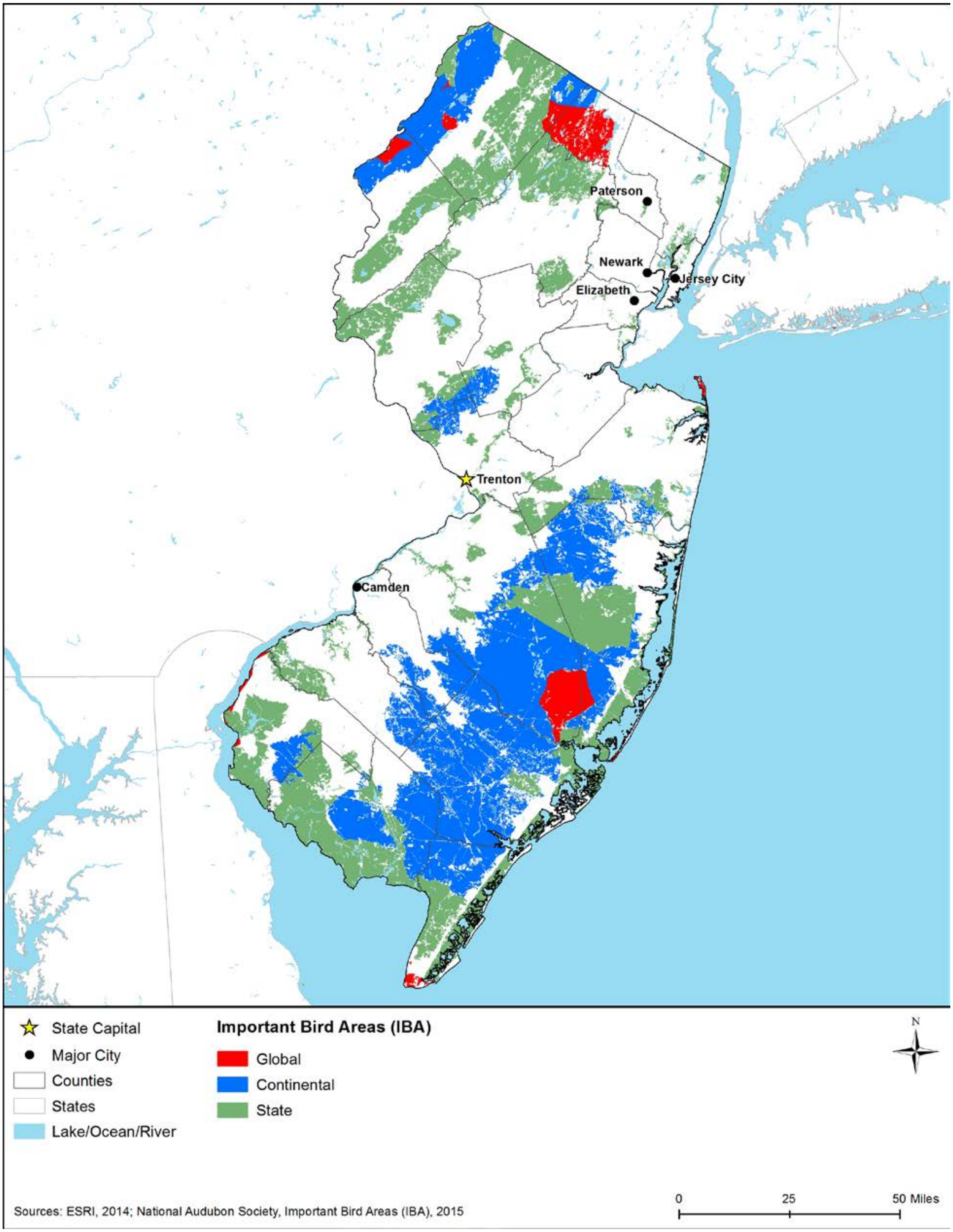

Figure 10.1.6-2: Important Birding Areas in New Jersey

The northern limit of New Jersey supports populations of the wood turtle (*Clemmys insculpta*), smooth green snake (*Opheodrys vernalis*), copperhead (*Agkistrodon contortix*), Jefferson salamander (*Ambystoma jeffersonianum*), blue spotted salamander (*A. laterale*), northern dusky salamander (*Desmognathus fuscus*), mountain dusky salamander (*D. ochrophaeus*), northern spring salamander (*Gyrinophilus porphyriticus*), long-tailed salamander (*Eurycea longicauda*), and the northern slimy salamander (*Plethadon glutinosus*), northern gray tree frog (*Hyla versicolor*). While in the southern region, species present include the eastern smooth earth snake (*Virginia valeriae*), eastern king snake (*Lampropeltis getula*), rough green snake (*Opheodrys aestivus*), northern scarlet snake (*Cemophora coccinea*), ground skink (*Scincella lateralis*), eastern tiger salamander (*Ambystoma tigrinum*), eastern spadefoot (*Scaphiopus holbrookii*), Fowler's toad (*Bufo woodhousii fowleri*), and Cope's gray tree frog (*Hyla chrysoscelis*).

These peripheral species are complemented by a large number of species that are widely distributed across the entire state, including the marbled salamander (*Ambystoma opacum*), eastern newt (*Notophthalmus viridescens*), red-backed salamander (*Plethodon cinereus*), four-toes salamander (*Hemidactylium scutatum*), northern red salamander (*Pseudotriton ruber*), northern two-lined salamander (*Eurycea bislineata*), bullfrog (*Lithobates catesbeianus*), spring peeper (*Pseudacris crucifer*), green frog (*Lithobates clamitans*), carpenter frog (*Rana virgatipes*), wood frog (*Lithobates sylvaticus*), pickerel frog (*Lithobates palustris*), leopard frog (Rana utricularia), Northern fence lizard (*Sceloporus undulates hycinthinus*), five-lined skink (Eumeces fasciatus), common snapping turtle (*Chelydra serpentina*), common musk turtle (*Sternotherus odoratus*), spotted turtle (*Clemmys guttata*), eastern box turtle (*Terrapene carolina carolina*), red-eared slider (*Trachemys scripta*), redbelly turtle (*Pseudemys rubriventris*), painted turtle (*Chrysemys picta*), common garter snake (*Thamnophis sirtalis*), northern water snake (*Nerodia sipedon*), eastern ribbon snake (*T. sauritus*), northern brown snake (*Storeria dekayi*), northern redbelly snake (*S. occipitomaculata*), eastern worm snake (Carphophis amoenus), ring snake (*Diadophis punctatus*), eastern hognose snake (*Heterodon platyrhinos*), northern black racer (*Coluber constrictor*), black rat snake (*Elaphe obsolete*), eastern milk snake (*Lampropeltis Triangulum*), Timber rattlesnake (*Crotalus horridus*), northern cricket frog (*Acris crepitans*), chorus frog (*Pseudacris triseriata*), and American toad (*Anaxyrus americanus)* (Scwartz & Golden, 2002).

Invertebrates

New Jersey is home to many different families of invertebrates, 60 species of which are state listed as threatened, endangered, or of special concern. This includes but is not limited to a variety species of beetles, insects, damselflies, dragonflies, butterflies, and moths, many of which can function as pollinators as well. In the U.S., one third of all agricultural output depends on pollinators[102]. These species carry pollen from plant to plant. In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity. In New Jersey, the Department of Agriculture's Division of Plant Industry protects both native and migratory from pests and disease to help

[102] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2015c).

ensure a viable population of pollinators for agriculture production (New Jersey Department of Agriculture, 2015b) (USDA, 2015a). New Jersey has more than 300 species of invertebrates, including 182 species of damselflies and dragonflies (Barlow, Golden, & Bangma, 2009). More than 30 of these species are at risk of extirpation in the future. The Kennedy's emerald (*Somatochlora kennedyi*) and subarctic darner (*Aeshna subarctica*) reach the southern extreme of their habitat in northern New Jersey. Some of the more uncommon species, such as the banner clubtail (*Gomphus apomyius*), and robust baskettail (*Epitheca spinosa*) are found only in pinelands habitat. New Jersey is also home to 143 species of butterfly.

Invasive Wildlife Species

New Jersey has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select invasive species, both plants and animals. This includes a state law that regulates the permanent status of agriculture and domestic animals, such as breeding nutria (4 NJ 4:2A-3). Invasive wildlife species are important to consider when proposing a project since project activities may result in conditions that favor the growth and spread of invasive wildlife populations. These situations may result from directly altering the landscape or habitat to a condition that is more favorable for an invasive species, or by altering the landscape or habitat to a condition that is less favorable for a native species.

There are 28 total invasive and destructive species in New Jersey which includes18 insect species, 3 mammal species, 2 reptile species, and 5 bird species (New Jersey Invasive Species Strike Team, 2015). The United States Department of Agriculture prohibits and regulates 11 of these species which includes four mammals, four birds, and three insect species (USDA, 2013). Nuisance animals can cause economic and environmental damage. In New Jersey, four species are categorized as being a nuisance animals. This includes feral cats, feral hogs (*Sus scofa*), Mute Swans (*Cygnus olor*), and resident Canada goose (*Branta canadensis*).

10.1.6.5 Fisheries and Aquatic Habitat

This section describes the aquatic wildlife species in New Jersey, including fish, invertebrates, marine mammals, and sea turtles. A discussion of non-native and/or invasive aquatic species is also presented. To facilitate discussion, fish are typically divided into freshwater and saltwater species, although many of New Jersey's fish are diadromous (i.e., anadromous[103] and catadromous[104]), reflecting the state's location along the Atlantic coast and the variety of aquatic habitats it provides. New Jersey is known for having many fishing opportunities due to its geography, extensive coastline, and abundant habitat. These areas include the ocean, estuaries, bays, inlets, and other coastal features that provides habitat for a large number of not only fish, but other aquatic wildlife.

Freshwater Fish

[103] Anadromous: "Referring to the lifecycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born" (USEPA, 2015c).
[104] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels" (USEPA, 2015c).

New Jersey is home to 85 species of freshwater fish ranging in size from small darters to large species such as sturgeon. These species are grouped into 22 families as follows: northern lampreys, sturgeon, basal ray-finned fish, eels, shards, ray-finned fish, smelts, mudminnows, pikes, carps, suckers, catfish, pirate perch, pupfish, toothed carps, sticklebacks, temperate basses, sunfish, perches, sculpins, loaches, and soles. Many of these fish families include diadromous species, such as the anadromous American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*), and Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), and the catadromous American eel (*Anguilla rostrata*).

The northern lamprey family includes two species, the American brook lamprey (*Lampetra appendix*) and sea lamprey (*Petromyzon marimus*). The American eel is the only freshwater eel species in New Jersey. Two species of sturgeon reside in New Jersey, the Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*). The bowfin (*Amia calva*) is the only species of basal ray-finned fish in New Jersey. The herring and shad family (*Clupeidae*) include five species, such as alewife (*Alosa pseudoharengus*) and gizzard shad (*Drosoma cepedianum*). New Jersey has four species of trout including, lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*). The smelt family includes the rainbow smelt (*Osmerus mordax*). The only species in the mudminnow family known in New Jersey is the eastern mudminnow (*Umbra pygmaea*).

New Jersey has a few distinct areas that are known for fishing. In the northern portion of the state, common species include striped bass hybrid (*Morone chrysops x Morone saxatilis*), brown bullhead (*Ameiurus nebulosus*), lake trout (*Salvelinus namaycush*), northern pike (*Esox Lucius*), and walleye (*Sander vitreus*). In the southern portion of the state, common species includes the brown bullhead (*Ameiurus nebulosus*). Other species found in New Jersey include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), chain pickerel (*Esox niger*), muskellunge (*Esox masquinongy*), carp, channel catfish (*Ictalurus punctatus*), yellow perch (*Perca flavescens*), crappie, and sunfish. Some well-known fishing areas include the Delaware Water Gap, Wawayanda State Park, Ramapo Mountain State Park, and along the Passaic River. A large number of well-known fishing areas are found along the tidally influenced streams of Delaware Bay (NJDEP, 2015m) (NJDEP, 2015n).

Saltwater Fish

New Jersey's nearshore marine waters are home to a large number of fish species, inhabiting the wide variety of marine habitats such as Barnegat Bay, Delaware Bay, Great Bay, the mouth of the Hudson River, and New Jersey Inland Bays. New Jersey has 83 miles of bay shores and 127 miles of Atlantic coastline (NJDEP, 2015m). New Jersey has 336 marine finfish species that are present or migrate along the shore.

Many saltwater fish species have recreational and commercial fishing value. Tourism is New Jersey's most important resource due to the state's extensive coastline. Fisheries are an important factor in the economics of the state, as many visitors come from far away to fish the New Jersey coastline. One important trophy fish is the anadromous striped bass, a high-profile and important fish species for both recreational anglers and the commercial fishing industry.

New Jersey has set up programs to increase this fish's popularity, including a striped bass bonus program for commercial fisheries and a research program that tags fish. Other important recreational and commercial fish include the tautog (*Tautoga onitis*), summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), weakfish (*Cynoscion regalis*), black sea bass (*Centropristis striata*), shark (*Carcharhinus amblyrhynchos*), and blue fish *(Pomatomus saltatrix*) (NJDEP, 2015o). Another key feature of New Jersey is the deep artificial reefs that have been constructed along the coast since 1984. Constructed from concrete and steel demolition debris, dredge rock, and dense materials such as barges and old ships, these artificial reefs provide a hard substrate for fish, shellfish and crustaceans. They also provide scuba diving and fishing opportunities (NJDEP, 2016b).

Essential Fish Habitat

As described in Section 10.2.6.4, the Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in U.S. federal waters. The Act calls for the identification and protection of fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. The National Marine Fisheries Service (NMFS) provides an online mapping application and a website to provide the public a means to obtain graphical representations of EFH. When assessing site-specific projects locations, this tool can be used to identify the potential for any conflicts between project activities and sensitive resources. Table 10.1.6-3 presents a summary of EFH offshore of New Jersey.

Table 10.1.6-3: Essential Fish Habitats Offshore of New Jersey

Common Name	Eggs	Larvae/YOY[105]	Juveniles	Adults
Atlantic albacore tuna	NA	NA	Eastern shore (in part)	NA
Atlantic bluefin tuna	NA	NA	New York Bight	NA
Atlantic cod	NA	NA	NA	Eastern shore
Atlantic herring	NA	NA	New York Bight (in part) and Delaware Bay	New York Bight and Delaware Bay
Dusky shark	NA	New York Bight	New York Bight	New York Bight
Clearnose skate	NA	NA	Eastern shore	Eastern shore and Delaware Bay
Little skate	NA	NA	New York Bight	New York Bight (in part) and Delaware Bay
Monkfish	New York Bight	New York Bight	Far offshore of New Jersey	Far offshore of New Jersey
Ocean pout	New York Bight (north)	New York Bight (north)	New York Bight (north)	New York Bight (north)
Red hake	New York Bight	New York Bight	New York Bight	New York Bight

[105] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1" (USEPA, 2015c).

Common Name	Eggs	Larvae/YOY[105]	Juveniles	Adults
Sand tiger shark	NA	New York Bight	New York Bight (south) and Delaware Bay	New York Bight (south) and Delaware Bay
Sandbar shark	NA	New York Bight (south)	New York Bight	New York Bight
Scalloped hammerhead shark	NA	NA	Eastern shore	Eastern shore (in part)
Shortfin mako shark	NA	New York Bight	New York Bight	New York Bight
Silver hake	New York Bight (in part)	New York Bight (in part)	New York Bight (in part)	Far offshore of New Jersey
Skipjack tuna	NA	NA	East-central shore	New York Bight
Thresher shark	NA	New York Bight	New York Bight	New York Bight
Tiger shark	NA	NA	New York Bight	New York Bight (in part)
White shark	NA	New York Bight	New York Bight	New York Bight
Witch flounder	New York Bight (in part)	New York Bight (in part)	NA	NA
Windowpane flounder	New York Bight and Delaware Bay	New York Bight and Delaware Bay	New York Bight and Delaware Bay	New York Bight and Delaware Bay
Winter flounder	New York Bight (in part) and Delaware Bay	New York Bight (in part) and Delaware Bay	New York Bight (in part) and Delaware Bay	New York Bight (in part) and Delaware Bay
Winter skate	NA	NA	New York Bight	Delaware Bay and NY Harbor
Yellowtail flounder	New York Bight (in part)	New York Bight (in part)	Far offshore of New Jersey	Far offshore of New Jersey

NA = not applicable

Shellfish and Other Invertebrates

New Jersey is home to both freshwater and marine shellfish. These species are important indicators of water quality due to their sensitive nature to pollutants and habitat degradation[106]. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known New Jersey freshwater invertebrates that spend their lives in aquatic systems include the eastern crayfish (*Cambarus bartoni*) and fairy shrimp (CWNJ, 2015a).

Freshwater invertebrates include species of crustaceans, mollusks, and insects. Native mussel species found in the state include alewife floater (*Anodonta implicate*), brook floater (*Alasmidonta varicose*), creeper (*Strophitus undulates*), dwarf wedgemussel (*Alasmidonta heterodon*), elliptio (*Elliptio complanata)*, eastern floater (*Pyganodon cataracta*), eastern lampmussel (*Lampsilis radiata*), eastern pondmussel (*Ligumia nasuta*), green floater (*Lasmigona subviridis*), tidewater mucket (*Leptodea ochracea*), triangle floater (*Alasmidonta undulata*), yellow lampmussel (*Lampsilis cariosa*). There are three species of mussels in New Jersey that

[106] Degradation: "The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards" (USEPA, 2015c).

are presumed to be nonnative these include the Asian clam (*Corbicula fluminea*), paper pondshell (*Utterbackia imbecillis*), and the lilliput (*Toxolasma parvum*). The Asian clam is the most widespread species in North America being introduced in the 1930s. The paper pondshell is believed to be introduced to New Jersey waters. However, the lilliput has only recently been discovered and is listed as a non-native species (CWNJ, 2015b).

New Jersey coastal waters are home to a wide variety of shellfish and shellfisheries. The Department of Environmental Protection's Bureau of Marine Water Monitoring is responsible for classifying growing waters and protecting human health throughout the state under the N.J.S.A. 58:24-1 et seq and N.J.A.C. 7:12-1.5(b). They are responsible for approximately 6,000 acres of growing waters. Ten species of commercial marine shellfish and other invertebrates occur in New Jersey, including eight mollusks and two crustaceans. Important commercial shellfish include bay scallops (*Aquipecten irradians*), Atlantic surf clams (*Spisula solidissima*), eastern oysters (*Crassostrea virginica*), hard clams (*Mercenaria mercenaria*), soft shelled clam (*Mya arenaria*), ocean quahog (*Arctica islandica*), blue mussel (*Mytillus edulis*), and sea scallop (*Aequipectin irradians*) (NJDEP, 2015p). Other species of shellfish include the American lobster, blue crab, and Atlantic horseshoe crab. In Barnegat Bay alone, there are 6 species of clams, one species of oysters, 12 species of crabs, 2 species of mussels, 1 species of scallops, 6 species of snails, 2 species of shrimp, and 2 species of whelks (Barnegat Bay Shellfish, 2013).

Marine Mammals

All marine mammals (i.e., whales, dolphins, porpoises, seals, and sea lions) are protected under the Marine Mammal Protection Act (MMPA), and a subset of these mammals are also protected under the Federal Endangered Species Act of 1973 (ESA), although there are no ESA-listed marine mammals in New Jersey. There are 28 marine mammals found in New Jersey waters including 17 whales, six dolphins, one porpoise, and four seal species. Although not typically seen, the 17 whale species may occasionally be observed offshore of New Jersey, three of which are listed as endangered.

Whale species may be found offshore of New Jersey as transient individuals as they migrate northward towards feeding grounds and southward towards warmer breeding grounds. Occasionally individuals may be beached or stranded along the coast, but these are considered to be relatively rare occurrences. Their presence offshore is often unnoticed because of their transient nature and preference for deep waters. Species that may make their way through New Jersey waters are the finback whale (*Balaenoptera physalus*), North Atlantic right whale (*Eubalaena glacialis*), and the humpback whale (*Megaptera novaengliae*).

Sea Turtles

Six species of sea turtles are found in U.S. waters, all of which are protected under the ESA. Three of these sea turtles occur in New Jersey's waters, but more typically off the coast of nearby Long Island, New York. For more information on sea turtles, refer to Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Aquatic Species

There are 11 mollusks, four crustaceans, and 11 fish species that are either prohibited or regulated in New Jersey. In New Jersey, possession and/or release of live potentially dangerous fish species is prohibited. Dangerous species includes non-native or introduced species that cause economic and environmental harm. These species may outcompete native or recreational fish, clog intake pipes (e.g., the highly invasive zebra mussel), destroy habitat for other fish, or may even leap out of the water and injure boaters.

In New Jersey, there are 11 invasive aquatic species—10 of which are fish, and one mussel species. This includes the Asian swamp eel (*Monopterus albus*), bighead carp (*Hypophthalmichthys nobolis*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), brook stickleback (*Culaea inconstans*), green sunfish (*Lepomis cyanellus*), flathead catfish (*Pylodictis olivaris*), snakehead (Channa spp.), warmouth (*Lepomis gulosus*), oriental weatherfish (*Misgurnus anguillicaudatus*), and zebra mussel (*Dreissena polymorpha*) (NJDEP, 2014c)**.**

10.1.6.6 Threatened and Endangered Species and Species of Conservation Concern

This section presents information on New Jersey species that are federally listed as endangered, [107] threatened, [108] or as a candidate[109] for listing. The ESA works to protect and recover imperiled species and the ecosystems upon which they depend. It is administered by the USFWS for terrestrial and freshwater organisms, and by the NMFS for marine wildlife and diadromous fish. Species are listed as either endangered or threatened under the ESA. Endangered means that a species is in danger of extinction[110] throughout all or a significant portion of its range, whereas threatened means that a species is likely to become endangered within the foreseeable future (USFWS, 2015b).

A list of candidate species is also maintained by the USFWS and NMFS. Candidate species are those species where the agencies have enough information to list them as threatened or endangered, but they are either undergoing a status review, or there are other priorities that are delaying their listing (NOAA, 2015b) (USFWS, 2015b). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends taking these species into consideration during environmental planning because they could be listed in the future (USFWS, 2014b).

[107] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C. §1532(6)).

[108] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. §1532(20)).

[109] Candidate species are plants and animals that the USFWS has "sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities" (USFWS, 2014c).

[110] Extinction: "The disappearance of a species from part or all of its range" (USEPA, 2015c).

The USFWS has identified 6 federally endangered and 11 federally threatened species believed or known to occur in New Jersey[111] (USFWS, 2015c). Of these species, none of them have designated critical habitat (USFWS, 2015d). One candidate species is identified by USFWS as occurring within the state (USFWS, 2015e). The federally listed species include two mammals, three birds, four reptiles, two invertebrates, and six plants (USFWS, 2015c), and are discussed in detail under the following sections. Several of the federally listed species in New Jersey are associated with the coastal or marine environment along the state's southern and eastern shores. The remaining mammals, reptiles, invertebrates, and plants occur within the terrestrial or freshwater environment throughout the state. Additional information regarding distribution is included in the species descriptions below.

Mammals

Two federally protected mammals are known to occur in New Jersey. Details on these species are presented in detail below and summarized in Table 10.1.6-4. Indiana bats (*Myotis sodalis*) are found in northern New Jersey, while northern long-eared bats (*Myotis septentrionalis*) are found throughout the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Jersey is provided below.

Table 10.1.6-4: Federally Listed Mammal Species of New Jersey

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Terrestrial Mammals				
Indiana Bat	*Myotis sodalis*	E	No	Occurs in abandoned mines, tunnels, limestone caves during the winter and in riparian112 floodplain forests for foraging. Medium-sized caves with large shallow passageways is preferred. In New Jersey, occurs in Hibernia Mine in Rockaway Township.
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Occurs in mines and caves during the winter in northern New Jersey and migrates throughout New Jersey during the feeding months.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015r)

Indiana Bat. The endangered Indiana bat is a small, insectivorous[113] mammal measuring approximately 1.5 to 2 inches long with dull grayish chestnut fur and strongly resembles the more common little brown bat (*Myotis lucifugus*) (USFWS, 2015f). The Indiana bat was in danger of extinction" in 1967 and was classified as endangered under the ESA (32 Federal

[111] Note that the NJDEP Division of Fish & Game lists several whale and fish species as occurring in New Jersey; however, the USFWS does not list either species in New Jersey. For purposes of this discussion, only listed species identified by USFWS will be discussed specifically as a threatened or endangered species in New Jersey.

[112] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands" (USEPA, 2015c).

[113] Insectivorous: "An animal that feeds on insects" (USEPA, 2015c).

Register [FR] 4001, March 11, 1967). In 2009, only 387,000 Indiana bats were known to exist in its region, less than half of the population of 1967 (USFWS, 2015h). Regionally, this species is found in the central portion of the eastern U.S., from Vermont west to Wisconsin, Missouri, and Arkansas, and south and east to northwest Florida. In New Jersey, Indiana bats occur in Sussex, Morris, Union, and Somerset counties (USFWS, 2015f).

In the summer, Indiana bats roost[114] singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs following hibernation[115]. Pregnant females then migrate to summer areas where they roost in small colonies. The species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents (USFWS, 2015f) (USFWS, 2015h). One of the largest mines, Hibernia Mine, is the state's largest hibernaculum[116] located in Rockaway Township, Morris County in the Northern Highlands ecoregion, and has been protected since 1994 (NJDEP, 2013b).

First discovered in New York, White Nose Syndrome is the leading cause for the decline of this species, having spread throughout the region. Although all of the life stages of Indiana bat are vulnerable, adverse impacts related to changes in cave conditions or the spread of disease during hibernation could greatly affect bat colonies. Conservation efforts have focused on this vulnerable period (CWNJ, 2015c). Other threats include the disturbance and intentional killing of hibernating and maternity colonies, temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation[117], and wind farm operations (NWHC, 2015) (USFWS, 2015f).

Northern Long-eared Bat. The northern long-eared bat is a medium-sized (3 to 3.7 inches in length), brown furred, insectivorous bat with long ears, relative to other members of the genus *Myotis*. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. (NWHC, 2015). It was first proposed as endangered in 2013 (78 FR 61046, October 2, 2013), and then listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the U.S., its range includes most of the eastern and north central states (USFWS, 2015i). In New Jersey, there are eight known hibernacula found in the northern part of the state; however, northern long-eared bats are found statewide (USFWS, 2015j).

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In the summer they roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. In southern New Jersey, they have been known to roost in pitch pine forests (*Pinus rigida*) and Atlantic white cedar swamps (*Chamaecyparis thyoides*) (USFWS, 2015j). Although mating occurs in the fall, fertilization occurs following hibernation.

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[114] Roost: "A place where a flying animal, usually a bird or bat, can sleep or rest, usually by perching or hanging" (USFWS, 2015g).

[115] Hibernation: "The act of passing the winter in a dormant state in which the metabolism is slowed to a tiny fraction of normal" (USFWS, 2015k).

[116] A place of abode in which a creature seeks refuge. A place of hibernation.

[117] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate" (USEPA, 2015c).

Pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015i).

White Nose Syndrome is the leading cause for the decline of this species. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation, and wind farm operations (USFWS, 2015i).

Birds

One federally listed endangered and two threatened bird species are known to occur in New Jersey, as summarized in Table 10.1.6-5. All three species, the red knot (*Calidris canutus rufa*) piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii dougallii*), are found along the southern coast of New Jersey. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Jersey is provided below.

Table 10.1.6-5: Federally Listed Bird Species of New Jersey

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Piping Plover	*Charadrius melodus*	T	No	Occurs on open front beaches, shorelines and barrier islands along coast of New Jersey from Sandy Hook to Cape May. Prefers sparse vegetation while nesting for protection from predators.
Red Knot	*Calidris canutus rufa*	T	No	Occurs as a migrant along the Delaware Bay of southern New Jersey.
Roseate Tern	*Sterna dougallii dougallii*	E	No	Occurs as a migrant in New Jersey, found only along the southern coast.

[a] T = Threatened, E = Endangered

Source: (USFWS, 2015r)

Piping Plover. The piping plover is a small, pale-colored shorebird with a short beak and black band across the forehead, listed as endangered in 1985 for the Great Lakes watershed of both the U.S. and Canada, and as threatened in the remainder of its range in the U.S., which includes the Northern Great Plains, Atlantic and Gulf Coasts, Puerto Rico, and the Virgin Islands (50 FR 50726, December 11, 1985) (USFWS, 2015dd). Piping plovers breed in three geographic regions of North America, comprising two separate subspecies (USFWS, 2015l). Those breeding within the northeastern U.S. and Canada are of the subspecies *C. m. melodus*, whose range extends from the Atlantic to the Great Lakes (USFWS, 2015dd). In New Jersey, piping plovers use coastal beaches for breeding in Monmouth, Ocean, Atlantic, and Cape May counties from March through August (USFWS, 2015m).

This species feeds in the intertidal[118] zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. They feed

[118] Intertidal: "The area of shoreline between the high tide and low tide marks" (USEPA, 2015c).

on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates (USFWS, 2015m) (USFWS, 2015n). Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation[119], flooding from coastal storms, and environmental contaminants (USFWS, 2015n) (USFWS, 2015o).

Red Knot. Federally listed as a threatened species in 2014 (79 FR 73705, December 11, 2014), the red knot is a large sandpiper that flies in large flocks along the Delaware Bay and the Atlantic coast each spring. Red knots spend their winters in the southern tip of South America, northern Brazil, the Caribbean, and the southeastern and Gulf Coasts of the U.S. and breed in the tundra of the central Canadian Arctic. Some have been documented to fly more than 9,300 miles from south to north every spring and return south in autumn (USFWS, 2015p) (USFWS, 2015q). In New Jersey, small numbers of red knots occur along the coast year round; however, these areas are also used as stopover habitats for migrating flocks. This species can be found in three coastal counties: Cumberland, Cape May, and Atlantic (USFWS, 2015p).

The red knot stops along the Atlantic coast during the spawning season for the horseshoe crab eggs (*Limulus polyphemus*), feeding on horseshoe crab eggs, and mussel and clam beds which include snails, marine worms, and whole mussels and clams, which serve as important food sources to the species. Threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at migratory stopovers; and disturbance by humans, dogs, vehicles, and climate change (USFWS, 2015p) (USFWS, 2015q).

Roseate Tern. The adult roseate tern is approximately 15 inches in length with light-gray wings and a black cap. During breeding season, the roseate tern's white chest gains a rosy tinge on the chest, and its bill and legs turn from black to orange-red (USFWS, 2011a). The tern was listed as endangered in 1987 in the northeast region and threatened in the southeast region (52 FR 42064, November 2, 1987) (USFWS, 2015s). In general, the species is present along the coasts of the Atlantic, Pacific, and Indian Oceans. In eastern North America, the roseate tern breeds from the Canadian maritime provinces south to New York (USFWS, 2011a). The last nesting pair in New Jersey was sited in 1980, though the entirety of New Jersey is considered within the species' potential range, and they are known or believed to occur in Atlantic, Cape May, Monmouth, and Ocean Counties (USFWS, 2015s) (USFWS, 1998).

The species is a marine bird that breeds along the coasts on salt marsh islands and beaches with sparse vegetation (USFWS, 2011a). This species was almost hunted to extinction for the millinery trade (e.g., for feathers used in women's hats). Ongoing threats include vegetation changes in breeding areas, competition with gulls for suitable nest sites, and predation (USFWS, 1998).

Reptiles

Two endangered and two threatened turtles are federally listed and known to occur in New Jersey, as summarized in Table 10.1.6-6. No federally listed amphibian species are protected or known to occur in New Jersey. All three sea turtles are found off the coast of New Jersey, while

[119] Predation: "The act or practice of capturing another creature (prey) as a means for securing food" (USEPA, 2015c).

the bog turtle (*Clemmys muhlenbergii*) is found sporadically throughout the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Jersey is provided below.

Terrestrial Reptiles

Bog Turtle. The bog turtle is a small turtle, averaging 3.1 to 4.5 inches in length it is characterized by a light brown to ebony shell and bright yellow, orange, or red blotches on each side of the head (USFWS, 2001) (USFWS, 2015t). The USFWS proposed a rule in 1997 to list the northern population of the bog turtle as threatened as well as the southern population due to similarity of appearance, under provisions of the ESA (*62 FR 59605, November 4, 1997*). Regionally, the northern population of the bog turtle is known to occur in localized distributions from western Massachusetts and Connecticut southward to Maryland, and the southern population is known to occur from Virginia southward to Georgia (USFWS, 2001). Within New Jersey, the bog turtle is found in 12 of the 21 counties, located sporadically throughout the state (USFWS, 2015t).

Table 10.1.6-6: Federally Listed Reptile Species of New Jersey

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Terrestrial Reptiles				
Bog Turtle	*Clemmys muhlenbergii*	T	No	Open and shrub wetlands such as shallow spring-fed fens, bogs, swamps, marshy meadows, and wet pastures that have both dry and wet pockets. Found throughout New Jersey.
Marine Reptiles				
Green Sea Turtle	*Chelonia mydas*	T	No	Occurs as a migrant along coast of New Jersey.
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	No	Occurs as a migrant along coast of New Jersey
Leatherback Sea Turtle	*Dermochelys coriacea*	E	No	Occurs as a migrant along coast of New Jersey

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015r)

The bog turtles prefer habitats that are open wetlands, sedge[120] meadows, and boggy areas with cool, shallow, slow-moving water, deep and soft muck soils, and with tussock[121]-forming vegetation (USFWS, 2001) (USFWS, 2011b). For hibernation, the bog turtle generally retreats back to densely vegetated areas in October and emerges from hibernation in late March and April (USFWS, 2001). Bog turtles are omnivorous feeding primarily on insects but also eating slugs, worms, frogs, plants, and carrion (PFBC, 2011).

[120] Sedge: "Plants of the family Cyperacae that resemble grasses, but have solid stems" (USFWS, 2015u).
[121] Tussock: "A compact tuft of grass or sedges, or an area of raised solid ground that is held together by roots of low vegetation. Tussocks are found in wetlands or tundra" (Joint Pipeline Office, 2002).

Current threats to this species are habitat loss and fragmentation from development, vegetation succession[122], and invasion of nonnative plants, such as purple loosestrife (*Lythrum salicaria*) which out-complete native wetland plants. The illegal collection of bog turtles has also been a major threat throughout the species' range (PFBC, 2015).

Marine Reptiles

Green Sea Turtle Photo credit: USFWS

Green Sea Turtle. The green sea turtle occurs throughout tropical and subtropical oceans and is among the largest of the hard-shelled sea turtles, growing to as much as 440 pounds and four feet in length. The breeding populations in Florida were listed as endangered in 1978 (43 FR 32800, July 28, 1978) whereas all other populations were listed as threatened (NOAA, 2015c). Regionally, green sea turtles are found from Maine south to Florida, and throughout the Gulf of Mexico and the Caribbean Sea (USFWS, 2015v) (USFWS, 2015w). The North Atlantic green sea turtle distinct population segment has recently been approved for continued listing as threatened via a Final Rule, continuing its current listing status near New Jersey (81 FR 20057 20090, April 6, 2016).

Green sea turtles are found in shallow waters (except during migration) of shoals, bays, lagoons reefs, and inlets, often where submerged aquatic vegetation exists (NOAA, 2015c). Breeding takes places in subtropical to tropical oceans every two, three, or four years between June and September, with peak nesting in June and July (NOAA, 2015c) (USFWS, 2015v). Hatching usually occurs at night, and many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015v).

The collection of green sea turtles for food was the primary cause for the decline of this species; however, current threats include disease, loss or degradation of nesting habitat; disorientation of hatchlings by lighting; nest predation; marine pollution; watercraft strikes; and incidental take from channel dredging and commercial fishing operations (NOAA, 2015c) (USFWS, 2015v).

Hawksbill Sea Turtle. The hawksbill sea turtle (*Eretmochelys imbricata*) is one of the smaller sea turtles. It was listed as endangered in 1970 (35 FR 8491, June 6, 1970). It has overlapping plates that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches and weigh up to 300 pounds. Its upper shell is dark brown with faint yellow streaks and a yellow under shell. The hawksbill is found throughout all of the oceans of the world (USFWS, 2015x) (USFWS, 2015kk). Although in the Atlantic they range from the East Coast of the U.S. to northern Brazil, they are occasionally found offshore of New England (NOAA, 2014). Although the species is known or believed to occur in Atlantic, Cape May, Monmouth, and Ocean

[122] Succession: "The process by which a plant or animal community successively gives way to another until a stable state is reached" (USEPA, 2015c).

Counties, there have been no recent documented sightings in New Jersey's waters (USFWS, 2015x) (CWNJ, 2015d).

The hawksbill sea turtle prefers warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation. It is an omnivore, feeding mostly sponges and is most often associated with the coral reef community. Nesting occurs on remote beaches in the Gulf of Mexico and the Caribbean Sea in 2- to 3-year cycles (USFWS, 2015x).

Current threats to the hawksbill sea turtle include: accidental capture in fishing lines, vessel strikes, contaminants, oil spills, disease, habitat loss of coral reef communities, and commercial exploitation. Outside of the U.S., a current threat is the collection for meat, eggs, and parts, which was the historic threat to this species causing their decline (USFWS, 2013b).

Leatherback Sea Turtle. The leatherback sea turtle is "the largest and most migratory and wide ranging of all sea turtles," found in all of the world's oceans. Adult leatherback sea turtles can weigh up to 2,000 pounds and grow up to 6.5 feet in length (USFWS, 2015y). It was listed as endangered in 1970 (35 FR 8491, June 2, 1970) and was grandfathered into the ESA of 1973 (NOAA, 2015d). The leatherback sea turtle ranges as far north as the Gulf of Maine and Newfoundland and may be found along the coasts of New Jersey during summer as an oceanic, visiting species (CWNJ, 2015e) (USFWS, 2015y). They are found near the continental shelf and may visit shallow estuaries; they are known or believed to occur in Atlantic, Cape May, Monmouth, and Ocean Counties (USFWS, 2015y). They can tolerate colder waters than most sea turtles and have been observed in waters as cold as 43 degrees Fahrenheit (CWNJ, 2015e).

The leatherback sea turtle's diet consists of jellyfish and squid and while they may forage in coastal waters but they prefer open sea environments (NOAA, 2015d) (USFWS, 2015y). Female leatherback sea turtles nest at 2- to 3-year intervals on beaches composed of coarse sand that are adjacent to deep water and subject to erosion (USFWS, 2015y). Major threats to the species include harvesting of their eggs, hunting, their incidental capture in fishing gear, beach lighting, beach cleaning, and consumption of plastics mistaken for food items (CWNJ, 2015e) (NOAA, 2015d).

Invertebrates

One endangered mussel and one threatened beetle is listed and known to occur in New Jersey, as summarized in Table 10.1.6-7. Dwarf wedgemussels (*Alasmidonta heterodon*) are found in northern New Jersey's watershed while the Northeastern beach tiger beetle (*Cinindela dorsalis dorsalis*) is found only at the Gateway National Recreation Area in Sandy Hook, NJ. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Jersey is provided below.

Table 10.1.6-7: Federally Listed Invertebrate Species of New Jersey

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Dwarf wedgemussel	*Alasmidonta heterodon*	E	No	Three occurrences in New Jersey at Paulins Kill, Pequest River, and Portions of the Delaware River. Prefers muddy sand and gravel bottoms with little silt deposition.
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T	No	Occurs only on sandy beaches at the Gateway National Recreation Area in Sandy Hook.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015r)

Dwarf Wedgemussel. The endangered dwarf wedgemussel is a small, brown or yellowish-brown freshwater mussel, with a small, brown or yellowish-brown outer shell and a bluish, silvery white inner shell, that is usually less than 1.5 inches in length (USFWS, 2010). The species was federally listed as endangered in 1990 (55 FR 9447, March 14, 1990) throughout its range except along the lower Neversink River in Orange County, New York and the Tar River in North Carolina where they number in the thousands (USFWS, 2015z). In New Jersey, this species occurs in two counties; Sussex and Warren County in the Paulins Kill, Pequest River and Portion of the Upper Delaware River (NJDEP, 2015q) (USFWS, 2014d).

Dwarf wedgemussels are sedimentary filter feeders that feed off suspended particles and algae and spend most of their time buried in stream bottoms. They inhabit creek and river areas with slow to moderate current and sand, gravel, or muddy bottoms. This species requires the tessellated darter (*Etheostoma olmstedi*), the Johnny darter (*Etheostoma nigrum),* or the mottled sculpin (*Cottus bairdi*) to host larvae in their gills while the mussels develop. Current threats to this species include silt deposition, water quality degradation, sedimentation from development, and agricultural runoff (USFWS, 2010) .

Northeastern Beach Tiger Beetle. The northeastern beach tiger beetle, growing as large as 0.6 inches in length, was first listed as threatened in 1990 (55 FR 32088, August 7, 1990). This species is identified by its bronze to greenish coloration on head and chest with wide, cream-colored markings on its wing covers and dark markings. Once abundant along coastal beaches from Massachusetts to New Jersey and along the Chesapeake Bay, the northeastern beach tiger beetle has lost a sizeable amount of habitat in New Jersey, and is currently found only at Gateway National Recreation Area in Sandy Hook (Monmouth County) where a colony was reestablished in 1997 (NJDEP, 2015r) (USFWS, 2015aa) (USFWS, 2015bb).

Found on long, wide and dynamic beaches, this species is most active near the water's edge on warm sunny days between June and September. The adult northeastern beach tiger beetle prefers medium to medium coarse sand with low organics and will forage on small invertebrates or scavenge off of dead marine organisms, including fish, crabs, and amphipods[123]. Maturity of these species requires three stages of larvae transformations over one to two years, which takes place in self-made burrows of 15 to 50 cm deep along the beaches (USFWS, 2015bb).

[123] Amphipod: "A small, shrimp-like crustacean." (USEPA, 2015c)

Primary threats to this species are from human-driven activities, including loss of habitat from coastal development, recreational uses such as off-road vehicles, as well as contamination from pollution, pesticides, and oil slicks. Natural threats to this species survival include winter storms, beach erosion, flood tides, hurricanes, parasites, and predators, which could be impacted by climate change (USFWS, 2015bb).

Plants

One endangered and five threatened plant species are federally listed and known to occur in New Jersey as summarized in Table 10.1.6-8. American chaffseed (*Schwalbea americana),* Knieskern's beaked-rush (*Rhynchospora knieskernii*), sensitive joint vetch (*Aeschynomene virginica*), and swamp pink (*Helonias bullata*) are found in the southern counties of New Jersey; seabeach amaranth (*Amaranthus pumilus*) is found along the coast of New Jersey; and small whorled pogonia (*Isotria medeoloides*) is found in the northernmost counties of New Jersey. One additional plant species, the Hirst Brothers' Panic Grass (*Dichanthelium panicum hirstii*) has been identified as a candidate species. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Jersey is provided below.

Table 10.1.6-8: Federally Listed Plant Species of New Jersey

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
American chaffseed	*Schwalbea americana*	E	No	Found on sandy, acidic, seasonally moist soils in early successional habitats controlled by fire and mowing. Occurs in Burlington County, New Jersey.
Knieskern's beaked-rush	*Rhynchospora knieskernii*	T	No	Occurs in southern New Jersey as an obligate wetland species.
Seabeach amaranth	*Amaranthus pumilus*	T	No	Occurs along coastal beaches of New Jersey growing above the high tide line.
Sensitive joint-vetch	*Aeschynomene virginica*	T	No	Occurs in Cumberland County in southern New Jersey. Found in fresh to brackish water on tidal river segments especially where marshes are formed by sediment deposition.
Small whorled-pogonia	*Isotria medeoloides*	T	No	Found in the northernmost portion of New Jersey on upland, mid-successional, wooded habitats.
Swamp pink	*Helonias bullata*	T	No	Found in shaded wetlands in southern New Jersey.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015r)

American Chaffseed. American chaffseed is an early successional herbaceous[124] perennial[125] (USDA, 2015d) (USFWS, 2014e). It consists of spike like clusters of showy purplish-yellow flowers, alternate leaves and stands erect at 12 to 24 inches high (USFWS, 1995) (USFWS, 2014e). In 1992, the American chaffseed was listed as endangered (57 FR 44703 44708, Sept. 29, 1992) (USDA, 2015d) (USFWS, 2014e).

The species is found in fire maintained savannahs, moist pine flatlands, and bog borders on sandy acidic seasonally moist-dry soils. It is highly dependent on fire, mowing, and fluctuating water tables and is very shade intolerant. While the chaffseed is capable of utilizing sunlight to produce energy, it is naturally parasitic, and can produce either all or part of its food by tapping into the roots of other plants for nutrients. In New Jersey, American chaffseed is only found in Burlington County in Lebanon State Forest (USFWS, 1995) (USFWS, 2014e). Threats include habitat loss, succession, disturbance and collection (USFWS, 2014e).

Knieskern's Beaked-rush. Knieskern's beaked-rush is federally listed as threatened as of 1991 (56 FR 32978, July 18, 1991). It is a semi-perennial sedge which reaches heights between 0.6 and 2.4 inches and is unique for a sedge in that it produces fruit, typically between the months of July and September (USFWS, 2014f). The species is considered endemic[126] to New Jersey and occurs within Atlantic, Burlington, Camden, Monmouth, and Ocean Counties, all of which are on the eastern side of New Jersey (USFWS, 2014f) (USFWS, 2015cc). The Hamilton Preserve in Atlantic County supports the largest population of Knieskern's beaked-rush (New Jersey Natural Lands Trust, 2015b).

Suitable habitat for the Knieskern's beaked-rush consist of "early successional wetland habitats, often on bog-iron[127] substrates adjacent to slow-moving streams" (USFWS, 2014f). Beaked-rush thrive in open and sparse wetlands, as the beaked-rush is intolerant to shade and competition. Disturbances that produce initial habitat succession, such as fires, water fluctuations, and some human-created disturbances, can beneficially contribute to beaked-rush habitat. However, habitat loss from natural wetland habitat succession and human sources such as intensive wetland alterations, chemical product use, uncontrolled off-road vehicle use, trash dumping, and construction and development, have led to the threatened status of the Knieskern's beaked-rush (USFWS, 1993) (USFWS, 2014f).

Seabeach Amaranth Photo Credit: USFWS

Seabeach Amaranth. Seabeach amaranth was federally listed as threatened in 1993 (58 FR 18035, April 7, 1993). This annual produces round leaves on red stems spreading close to the ground (USFWS, 2011c). Regionally, seabeach amaranth range from

[124] Herbaceous: "Plants without woody stems" (USEPA, 2015c).
[125] Perennial: "Plants that live for more than two growing seasons. Perennial plants either die back after each season (herbaceous plants) or grow continuously (shrubs)" (USEPA, 2015c).
[126] Endemic: "A species that is restricted in its distribution to a particular locality or region" (USEPA, 2015c).
[127] Bog-iron deposits: "Accumulations of iron oxides in swampy areas or shallow lakes" (USEPA, 2015c).

New York to South Carolina along the east coast. Locally, the species is known or believed to occur in the coastal areas of Monmouth, Ocean, Atlantic, and Cape May Counties (USFWS, 2015ee).

The seabeach amaranth grows in coastal areas along barrier beaches just above the high tide line, sharing habitat with other protected species such as the piping plover and roseate tern. The plants trap sand and subsequently can create mounds up to 3 cubic yards in size (USFWS, 2011c). Threats to seabeach amaranth include beach stabilization structures, off-road vehicles, habitat fragmentation, and webworms *(Hyphantria cunea)* that prey heavily on the plants (USFWS, 2011c) (USFWS, 2015ff).

Sensitive Joint-vetch. The sensitive joint-vetch is an annual plant from the legume family that can grow up to 6 feet tall. It has yellow pea-shaped flowers during the months of July to October. The species was listed in 1992 as threatened (57 FR 21569, May 20, 1992). Sensitive joint-vetch is found in Maryland, New Jersey, North Carolina, and Virginia. Within New Jersey, the species is only known to exist in Cumberland County (USFWS, 2014g) (USFWS, 2015g).

Sensitive joint-vetch is found in marshes on accumulated sediment among the edges of the intertidal zone of salty tidal rivers. These sites are nutrient deficient and may suffer from muskrat herbivory. Threats include dredging and filling marshes, dam construction, shoreline stabilization, human development, sedimentation, invasive species and salt-water intrusion from sea level rise (USFWS, 2014g) (USFWS, 2015g).

Small Whorled Pogonia. The small whorled pogonia is a member of the orchid family which grows between 10 to 14 inches in height with greenish yellow flowers. The species was federally listed as endangered in 1982 (47 FR 39827, September 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852, October 6, 1994) (USFWS, 2015hh). Regionally this species is known to occur sparsely distributed from Maine south to Georgia and eastern to Illinois (USFWS, 2008). Locally, the small whorled pogonia has been observed in Sussex and Passaic Counties in the northernmost region of New Jersey (USFWS, 2014h).

The small whorled pogonia occurs in hardwood stands that include beech, birch, maple, oak, hemlock, and hickory that have an open understory, preferring acidic soils along small streams that have a thick layer of litter. It blooms from May to June, producing a single tiny yellowish or greenish flower that lasts for seven days (USFWS, 2008). In some locations populations are most abundant in dry east or southeast facing hillsides. One distinct feature of this species is that it can remain dormant underground for multiple years before reappearing (USFWS, 1992). Current threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2008).

Swamp Pink. Federally listed in 1988 (53 FR 35076 35080, September 9, 1988), the swamp pink is an obligate wetland species[128] in the lily family with fragrant pink wildflowers. Leaves are evergreen lance shaped that form circular clusters that lay flat on the ground. Flowers grow on 1-3 feet tall stalks in clusters of 30-50 individual small pink flowers with blue anthers.

[128] Obligate wetland species: "Almost always occur in wetlands. With few exceptions, these plants are found in standing water or seasonally saturated soils (14 or more consecutive days) near the surface" (USACE, 2012b).

Swamp pink is found on the coastal plains of three states (Delaware, New Jersey, New York, Maryland and Virginia) and isolated spots of the southern Appalachian Mountains (Georgia, North Carolina and South Carolina) (USFWS, 2015ii). Southern New Jersey supports half the known populations of swamp pink in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Morris, Ocean, and Salem Counties (USFWS, 2014i).

The swamp pink is found in shaded forested wetland areas. Threats include human development that changes the physical and hydraulic conditions of the wetlands and invasive species (USFWS, 2015ii).

10.1.7 Land Use, Recreation, and Airspace

10.1.7.1 Definition of the Resources

The following summarizes major land uses, recreational venues, and airspace considerations in New Jersey, characterizing existing, baseline conditions for use in evaluating the potential environmental consequences resulting from implementing the Proposed Action or Alternatives.

Land Use and Recreation

Land use is defined as “the arrangements, activities and inputs people undertake in a certain land cover type to produce, change, or maintain it” (Di Gregorio & Jansen, 1998). A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (USGS, 2012b).

Recreational uses are activities in which residents and visitors participate. They include outdoor activities, such as hiking, fishing, boating, athletic events (e.g., golf), and other attractions (e.g., historic monuments and cultural sites) or indoor activities, such as museums and historic sites. Recreational resources can include trails, beaches, caves, lakes, forests, recreational facilities, museums, historic sites, and other areas/facilities. Recreational resources are typically managed by federal, state, county, or local governments.

Descriptions of land uses are presented in three primary categories: forest and woodlands, agricultural, and developed. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015a). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The Federal Aviation

Administration (FAA) is responsible for the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. “The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the U.S. and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico” (FAA, 2014a). The ATO is comprised of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015b). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

10.1.7.2 Specific Regulatory Considerations

The New Jersey Department of Environmental Protection (NJDEP) manages land use activities in the state. This important task is the responsibility of the NJDEP, primarily due to the connection between land use and the quality of the state’s surface waters, coastal areas, wildlife habitat, and drinking water. The NJDEP's Division of Land Use Regulation fulfills this responsibility by regulating land use activities through a permit process in accordance with the rules promulgated in support of the statutes included in Table 10.1.7-1. This process regulates activities to ensure environmental impacts associated with land use activities are minimized in accordance with applicable regulations.

Table 10.1.7-1: Relevant New Jersey Land Use, Recreation, and Airspace Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Freshwater Wetlands Protection Act	NJDEP	New Jersey protects wetlands under the Freshwater Wetlands Protection Act. In 1994, the NJDEP assumed responsibility for administering the federal wetlands program in delegable waters of the State. In non-delegable waters, the U.S. Army Corps of Engineers (USACE) retains jurisdiction under federal law, and both federal and state requirements apply. A project in non-delegable waters requires two permits, one from the NJDEP and one from the USACE (NJDEP, 2015s).

State Law/Regulation	Regulatory Agency	Applicability
Flood Hazard Area Control Act	NJDEP	The purpose of the act is to minimize damage to life and property from flooding caused by development within fluvial and tidal flood hazard areas, to preserve the quality of surface waters, and to protect the wildlife and vegetation that exist within and depend on such areas for sustenance and habitat (NJDEP, 2015s).
Wetlands Act of 1970	NJDEP	The act requires the NJDEP to regulate development in coastal wetlands. The regulated coastal wetlands are shown on maps prepared by the NJDEP. A coastal wetlands permit is needed to excavate, dredge, fill or place a structure on any coastal wetland shown on the maps (NJDEP, 2015s).
Waterfront Development Law	NJDEP	The law is designed to limit problems that new development could cause for existing navigation channels, marinas, moorings, other existing uses, and the environment. Development in a tidally flowed New Jersey waterway requires a Waterfront Development Permit. Examples of regulated projects include installation of docks, piers, pilings, bulkheads, marinas, bridges, pipelines, cables, and dredging (NJDEP, 2015s).
Water Pollution Control Act	NJDEP	The act addresses many facets of water quality protection by providing the authority for the National Pollutant Discharge Elimination System (NPDES) permit program for point sources of pollution. The act prohibits the discharge of oil or hazardous substances into U.S. navigable waters. It also prohibits the use of chemical agents like soaps, detergents, surfactants, or emulsifying agents to disperse fuel, oil, or other chemicals without the permission of the U.S. Coast Guard (NJDEP, 2015s).
Coastal Area Facility Review Act	NJDEP	The act applies to projects near coastal waters in the southern part of the state. CAFRA regulates a wide variety of residential, commercial, or industrial development, including construction, relocation, and enlargement of buildings or structures; and associated work, such as excavation, grading, site preparation, and the installation of shore protection structures. CAFRA prescribes designs for new marinas that promote water quality and protect public health (NJDEP, 2015s).
Tidelands Act	NJDEP	The act protects riparian lands that are currently or formerly flowed by the tide of a natural waterway. This includes lands that were previously flowed by the tide but have been filled and are no longer flowed by the tide ((NJDEP, 2015s).
Highlands Water Protection and Planning Act	NJDEP	The law preserves open space and protects the state's greatest diversity of natural resources, including the precious water resources that supply drinking water to more than half of New Jersey's population. The Highlands Act documents the geographical boundary of the Highlands Region and establishes the Highlands Preservation Area and the Highlands Planning Area. It required the Department to establish regulations in the Highlands Preservation Area and that the Highlands Water Protection and Planning Council develop a regional master plan for the entire Highlands Region (NJDEP, 2015s).

Because the nation's airspace is governed by Federal laws, there are no specific New Jersey state laws that would alter the existing conditions relating to airspace for this Draft PEIS.

10.1.7.3 Land Use and Ownership

For the purposes of this analysis, land use in New Jersey has been classified into three primary groups: forest and woodlands, agricultural, and developed. Land ownership within New Jersey has been classified into three main categories: private, federal, and state.

Land Use

Forest and woodlands comprise the largest portion of land use, with 42 percent of New Jersey's total land occupied by this category (Table 10.1.7-2 and Figure 10.1.7-1) (New Jersey Forestry Services, 2010). Developed land is the second largest area of land use, with 21 percent of the land occupied for this use, while agricultural land accounts for approximately 17 percent of the total land area. The remaining percentage of land includes public land and other land cover, shown in Figure 10.1.7-1, that are not associated with specific land uses. (USGS, 2012c)

Table 10.1.7-2: New Jersey Land Use

Land Use	Square Miles	Percent of Land
Forest and Woodland	3,089	42%
Agricultural Land	1,250	17%
Developed Land	1,544	21%
Open Water and Wetlands	1,483	20%

Source: (USGS, 2012c)

Forest and Woodland

Forest and woodland areas occur throughout the state, many of them interspersed with, and adjacent to, agricultural areas. The largest concentrations of forest are in the central and southeast area of the state and include the Wharton State Forest, Brendan T. Byrne State Forest, Bass River State Forest, Greenwood Forest Wildlife Management Area and other forested areas within these regions (Figure 10.1.7-1).

<u>State Forests</u>

State Forests account for 396 square miles of state land located within 11 state forest units (Figure 10.1.7-1), ranging in size from 3 to 187 square miles (New Jersey Division of Parks and Forestry, 2015a). State Forests are under the administration of the Division of Parks and Forestry.

<u>Private Forest and Woodland</u>

Approximately two-thirds of forested land in New Jersey is privately owned (New Jersey Forestry Services, 2010). Private forestlands provide many public benefits including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities. Scattered throughout the state, forests and woodlands on private lands often border agricultural fields, suburban neighborhoods, and state forests. For additional information regarding forests and woodlands, see Section 10.1.6, Vegetation and Section 10.1.8, Visual Resources.

Agricultural Land

Agricultural land covers 17 percent of the state with approximately 1,140 square miles dedicated to this use (Figure 10.1.7-1) (New Jersey Department of Agriculture, 2015c). Some of the state's largest agricultural uses include dairy, fruits, berries, vegetables, and poultry. Most farms within the state are operated by small, family businesses with the average farm size less than 80 acres. In 2012, there were 9,071 farms in New Jersey and nearly all were owned by families (USDA, 2012). Top crop items (based on number of acres) are forage-land, soybeans, corn, vegetables, and wheat. For more detailed information by county, access the U.S. Department of Agriculture (USDA) Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/New_Jersey/.

Developed Land

Developed land in New Jersey tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 10.1.7-1). Approximately 21 percent of land in New Jersey is identified as developed land (USGS, 2012d). These areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 10.1.7-3 lists the top four developed metropolitan areas within the state and their associated population estimates, while Figure 10.1.7-1, shows where these areas are located within the Developed category.

Table 10.1.7-3: Top Four Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Newark-Jersey City-Elizabeth	3,787,646
Camden	511,038
Trenton	371,537
Central Coast	629,279
Total Population of Metropolitan Areas	5,299,500

Source: (U.S. Census Bureau, 2015d)

Land Ownership

Land ownership within New Jersey is classified into three main categories: private, federal, and state (Figure 10.1.7-2).

Private Land

The majority of land in New Jersey is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed (Figure 10.1.7-2). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[129]

[129] Total acreage of private land could not be obtained for the state.

Federal Land

The U.S. federal government manages 256 square miles (3 percent) of New Jersey land with a variety of land types and uses, including national parks, monuments, historic sites, wildlife refuges, and military bases (Figure 10.1.7-2). Three federal agencies manage federal lands throughout the state (Table 10.1.7-4). Some of these areas overlap and are managed by more than one agency.

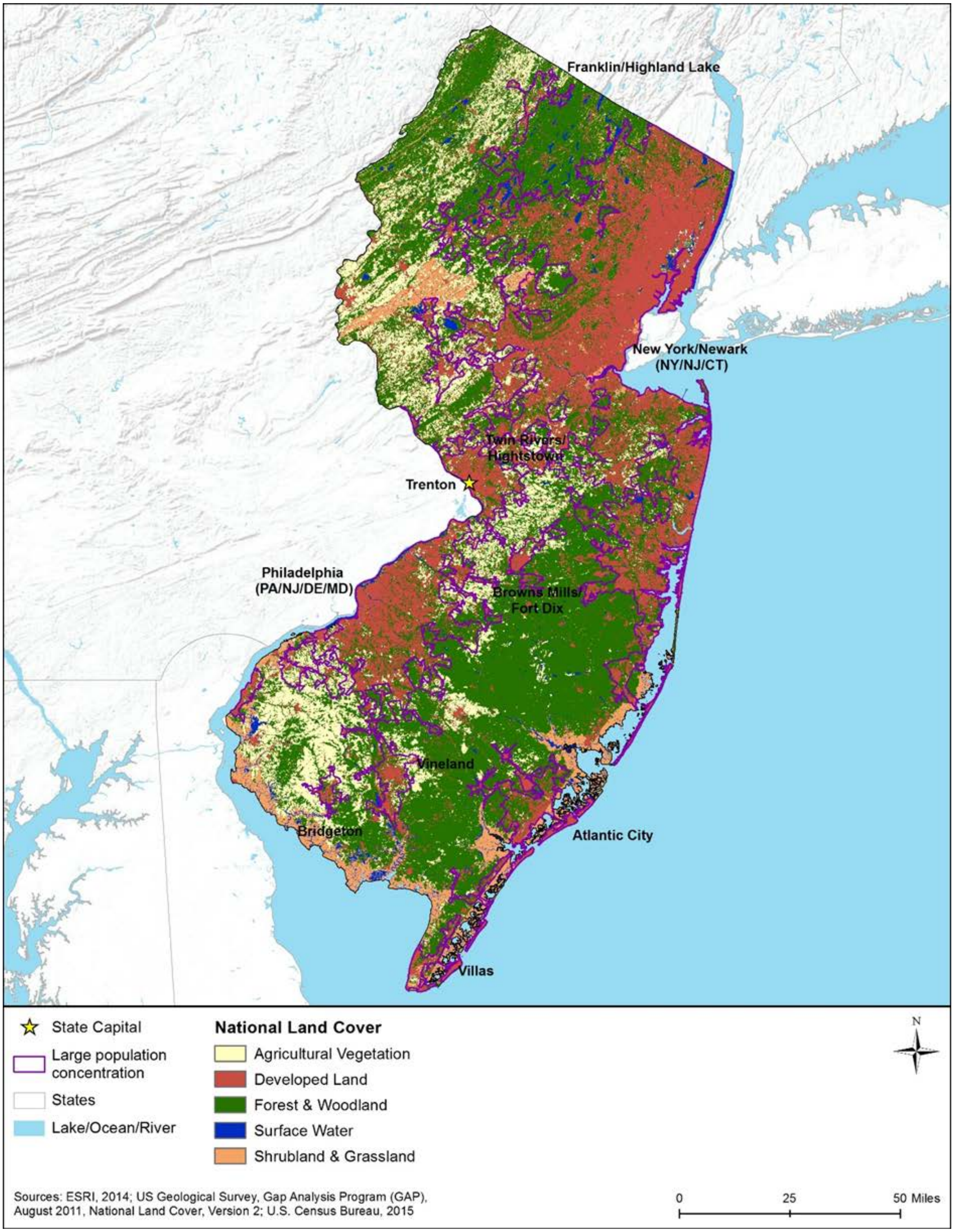

Figure 10.1.7-1: Land Use Distribution

Table 10.1.7-4: Federal Land in New Jersey

Agency	Square Miles	Representative Type
Department of Defense	98	Forts, naval stations, military reservations, air force bases
USFWS	103	National Wildlife Refuges
National Park Service	55	National Historical Parks, National Recreation Areas

Source: (USGS, 2012d)

- The Department of Defense owns and manages 98 square miles at Picatinny Arsenal, Fort Monmouth Military Reservation, Lakehurst Naval Air Station, Fort Dix, Belle Mead General Depot, Earle Naval Weapons Station, and McGuire Air Force Base;
- The USFWS owns and manages 103 square miles of land, consisting of five National Wildlife Refuges in New Jersey (Wallkill River, Great Swamp, Supawna, Edwin B. Forsythe, and Cape May); and
- The National Park Service manages 55 square miles of land, consisting of three National Historical Parks (Morristown, Thomas Edison, and Paterson Great Falls), Delaware Water Gap and Gateway National Recreation Areas, the Appalachian Trail, and Pinelands National Reserve (USGS, 2014i).

State Land

New Jersey state government manages approximately 840 square miles (16 percent) of New Jersey land comprised of forests and woodlands, historic sites, state offices, and recreation areas. The main agency charged with state land management is the NJDEP, under which there are four separate divisions: Division of Parks and Forestry, Office of Historic Sites, Division of Fish and Wildlife, and Division of Land Use Regulation (Table 10.1.7-5). In addition, the Division of Land Use Regulation manages land use activities on all state lands. Many of these areas overlap, such as state parks located within state forests (NJDEP, 2015t).

Table 10.1.7-5: State Land in New Jersey

Agency	Square Miles	Type
New Jersey Division of Parks and Forestry	396	State parks, forests, marinas, state recreation areas
New Jersey Division of Fish and Wildlife	553	State wildlife management areas

Sources: (NJDEP, 2015t) (NJDFW, 2015b) (New Jersey Division of Parks and Forestry, 2015a)

- The Division of Parks and Forestry owns and manages 11 state forests, ranging in size from 3 to 187 square miles, and totaling 396 square miles (Figure 10.1.7-2) (New Jersey Division of Parks and Forestry, 2015a);
- New Jersey has 39 state parks, state marinas, and state recreation areas (Figure 10.1.7-2). Most state parks are owned and managed by the state, while some are managed by counties, municipalities, or community organizations;
- The Office of Historic Sites owns and manages 35 state historic buildings, places, and landscapes such as the Walt Whitman House, Old Dutch Parsonage, and Barneget Lighthouse (NJDEP, 2015t).

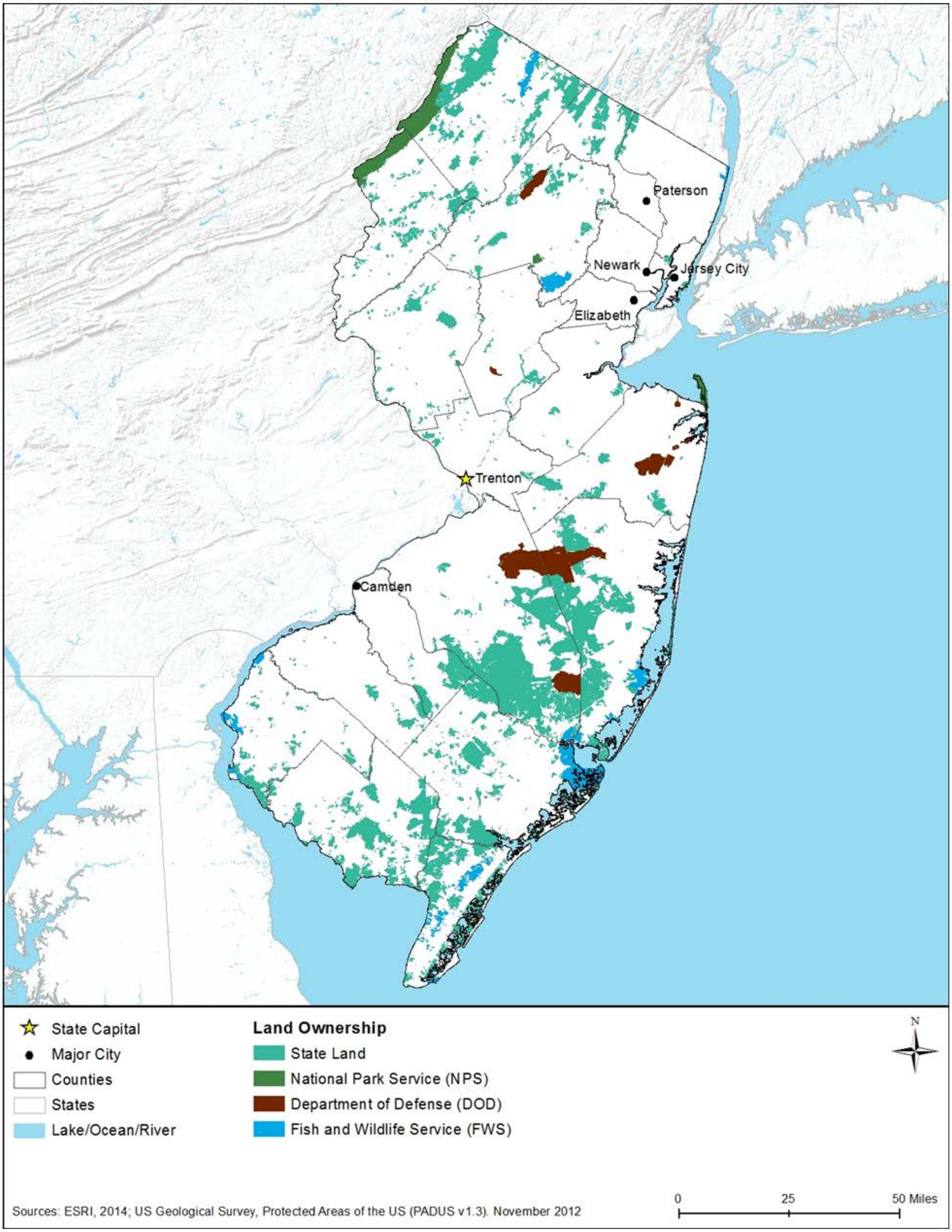

Figure 10.1.7-2: Land Ownership Distribution

Tribal Land

There are no tribal lands currently located in the state (USGS, 2012c).

10.1.7.4 Recreation

New Jersey is notable for having a high population density and a high median household income (see Section 10.1.9, Socioeconomics, and Section 10.1.10, Environmental Justice). On the community level, towns and cities provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, beaches, marinas and boating locations, zoos, and multiple-use trails commensurate with the population's distribution and interests. On the state level, New Jersey provides 28 state forests, parks, marinas, and recreation areas, together with four golf courses (New Jersey Division of Parks and Forestry, 2015a). Federally, the National Park Service and the Fish and Wildlife Service manage areas with recreational attributes, and New Jersey contains a National Estuarine Research Reserve, and two museums in the Smithsonian Institution Affiliation Program (Recreation.gov, 2014).

This section discusses recreation on a regional basis, calling out specific areas representative of recreational opportunities in each region, at various locations throughout New Jersey. For information on visual aspects, see Section 10.1.8, Visual Resources, and for information on the historical significance of locations, see Section 10.1.11, Cultural Resources.

10.1.7.5 Northern Region

The Northern Region (see Figure 10.1.7-3) is bordered to the west by the Delaware River; to the north by New York; to the east by the Hudson River, the Narrows, and the New York Harbor; and to the south by the Central Region and the Passaic River. It ranges from a moderately populated area in the west with the Kittatinny Mountains in the Appalachian Mountain Range, and agricultural areas to a major metropolitan area in the east.

The Appalachian Trail enters New Jersey at the Delaware Water Gap in Worthington State Forest, travels north along the mountains through the Delaware Water Gap National Recreation Area, Stokes State Forest, High Point State Park, Wawayanda State Park, and the Abram S. Hewitt State Forest before crossing into New York. In total, the Appalachian Trail covers 72.2 miles in New Jersey at a rating 5: lengthy graded climbs, alternating with easier sections (Appalachian Trail Conservancy, 2015).

The Delaware Water Gap National Recreation Area consists 109 square miles located on the northwest border, shared between New Jersey and Delaware. The area facilitates recreational activities along 40 miles of the Middle Delaware River, a National Scenic and Recreational River, and the forests along the Kittatinny Mountains. Examples of available recreation include: over 100 miles of hiking trails, including 27 miles of the Appalachian Trail, 32 miles of graveled multi-use trail, scenic drive on the Old Mine Road, swimming at Turtle Beach, river access for paddle and motorized boats at four sites, and seasonal fishing and hunting, as well as tours of historic villages and restored inns and homes (NPS, 2015e).

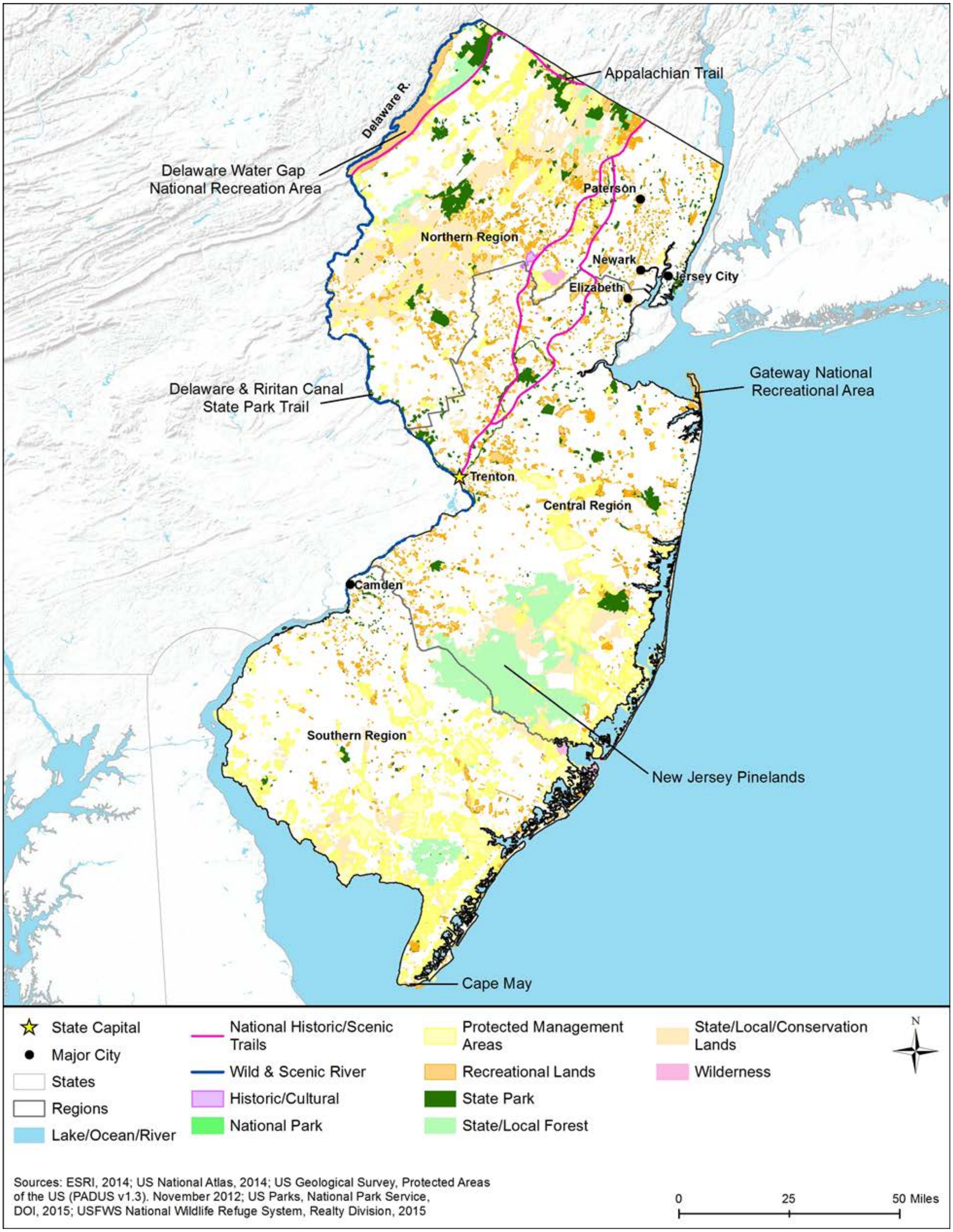

Figure 10.1.7-3: New Jersey Recreation Map

10.1.7.6 Central Region

The Central Region (see Figure 10.1.7-3) is bordered by the Delaware River to the west; the Northern Region and Passaic River to the north; the Atlantic Ocean to the west; and the Southern Region and Mullica River to the south. It contains the densely populated area south of Manhattan, industrial Trenton, and the majority of the barrier islands known as the Jersey Shore.

New Jersey shares the Gateway National Recreation Area with New York. The Sandy Hook Unit of the Gateway National Recreation Area in Monmouth County is the northernmost reach of the barrier islands that make up the eastern shore of New Jersey, with the Atlantic Ocean to the east and the Sandy Hook Bay to the west. The Sandy Hook Unit provides fishing and swimming both ocean-side and bayside, camping, boating, picnic facilities, and has an observation deck. The Sandy Hook Unit includes Fort Hancock, a National Historic Landmark and the oldest continuously operating lighthouse in the county. Tours are available of Fort Hancock's Sandy Hook Lighthouse, Keeper's Quarters and Barn (NPS, 2015f).

The New Jersey Pinelands was the first National Reserve in the United States. The Reserve's 1,719 square miles spans seven counties, and lies within both the Central and Southern Regions. Land within the boundaries of the Reserve is comprised of both public and private lands: among those are the Wharton State Forest, B. Byrne State Forest, Bass River State Forest, and Penn State Forest. Many locations within the Pinelands offer recreational activities such as canoeing, camping, hiking, wildlife viewing, bicycling, and historic tours (State of New Jersey Pinelands Commission, 2015b) (State of New Jersey Pinelands Commission, 2015a).

The Delaware and Raritan Canal State Park, a 70-mile corridor of recreational canals, towpaths, and multi-use trails, is one of the most popular areas in New Jersey. The canal begins at the Port Mercer Canal House in Lawrence and ends in New Brunswick. Approximately 58 miles of the main canal and feeder canal are open for non-motorized boating, and fishing is permitted along the entire length of the canal. The multi-use trails are used for hiking, jogging, bicycling, and horseback riding. Areas for picnicking, natural areas, and historic buildings are located along the corridor. The Delaware and Raritan Canal State Park includes the Six Mile Run Reservoir, an agricultural area complete with 18th century farmhouses, has recreational areas for hiking, horseback riding, and hunting (New Jersey Division of Parks and Forestry, 2015b) (Delaware and Raritan Canal Commission, 2015).

The New Jersey Shore stretches along the Atlantic coast from Sandy Hook in the Central Region to Cape May in the Southern Region, with beaches both ocean-side and bay-side, and on the barrier islands. Cities along the shore are notable for boardwalks, beaches, amusement parks, concert venues, and lighthouses. The shore is popular for summer vacations and summer homes, with associated activities catering to tourism (Visit New Jersey, 2015).

10.1.7.7 Southern Region

The Southern Region (see Figure 10.1.7-3) is bordered to the west by the Delaware River; to the north by the Mullica River; the Atlantic Ocean to the east; and the Delaware Bay to the south. It contains the suburbs of Philadelphia to the west, the southernmost barrier islands and beaches to the east, and beaches along the Delaware Bay to the south. The Jersey Shore stretches into the barrier islands of the southern region.

Atlantic City is notable for its Oceanside casino resorts, shopping, spas, and nightlife (Casino Reinvestment Development Authority, 2013). Another seaside resort, Cape May, at the southern point of New Jersey, is a notable seaside resort town that is also a National Historic Landmark. The Cape is famous for whale and dolphin watching areas, Victorian house tours, and restored historic hotels and bed and breakfasts (Cape May, 2015).

The Great Egg Harbor River, a National Scenic and Recreational River, begins in the Pinelands and continues into the Great Egg Harbor. Along the river, hiking, bicycling, boating, camping, and fishing are popular activities (NPS, 2015g). The Great Egg Harbor Bay enters the Atlantic Ocean at Ocean City, a city notable for its beachfront resorts.

Three national wildlife refuges are located in the Southern Region: Cape May, Edwin B. Forsythe, and Supawna. The Cape May, Edwin B. Forsythe, and Supawna National Wildlife Refuges offer hunting, and wildlife viewing; Cape May and Edwin B. Forsythe Refuges offer freshwater and saltwater fishing (USFWS, 2014j) (USFWS, 2013c) (USFWS, 2014k).

10.1.7.8 Airspace

The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public (FAA, 2008).

Airspace Categories

There are two categories of airspace or airspace areas.

1) **Regulatory airspace** consists of controlled airspace (Class A, B, C, D, and E airspace areas in descending order of restrictive operating rules), and restricted and prohibited areas.
2) **Non-regulatory airspace** consists of MOAs, warning areas, alert areas, and controlled firing areas.

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 10.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[130] service is based on the airspace classification." (FAA, 2008).

[130] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations (FAA, Federal Aviation Administration Aeronautical Information Manual, 2014).

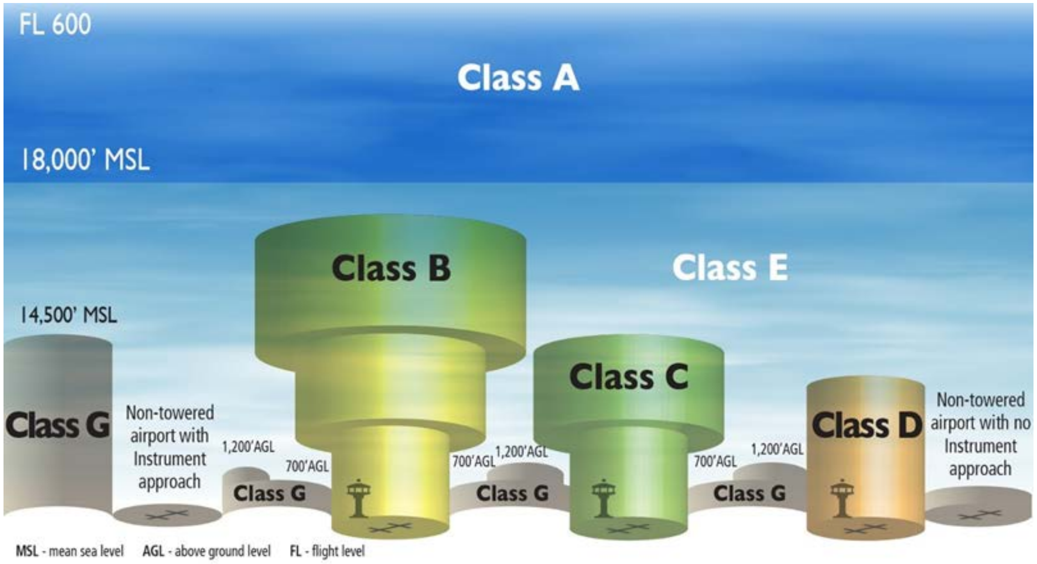

Figure 10.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008).

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[131]. Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[132]
- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

[131] MSL- The average level of for the surface of the ocean; "The height of the surface of the sea midway between the average high and low tides" (Merriam Webster Dictionary, 2015b).
[132] IFR - Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015c).

Uncontrolled Airspace

Class G: No specific definition. Refers generally to airspace not designated as Class A, B, C, D, or E. Class G airspace is from the surface to the base of Class E airspace.

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 10.1.7-6).

Table 10.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the UNITED STATES coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Sources: (FAA, 2015d) (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 10.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 10.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are 3 types: • Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the State of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Sources: (FAA, 2015d) (FAA, 2008)

Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/state/local governments, and other agencies. The FAA's Unmanned Aircraft Systems Integration Office integrates UAS into the NAS. The *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap of 2013* addresses the actions and considerations needed to integrate UAS into the NAS "without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies" (FAA, 2013 First Edition).

UAS at airports is a complex operational challenge with the need to separate UAS flight operations from mainstream air traffic. Separation can be achieved with specific UAS launch windows, special airports, or off-airport locations that allow the UAS to easily launch and recover. Special aviation procedures are applied to UAS flights. There must be the capability of Sense and Avoid (SAA) and Control and Communication (C2) during UAS operations. An Unmanned Aircraft (UA) must be able to see (or sense) other aircraft in the area and avoid the aircraft through corrected flight path changes. General equipment and operational requirements can include aircraft anti-collision lights, an altitude encoding transponder, cameras, sensors, and collision avoidance maneuvers. The C2 of the UA occurs with the pilot/operator, the UAS control station, and ATC. Research efforts, a component of the FAA's UAS roadmap, continue to mature the technology for both SAA and C2 capabilities (FAA, 2013 First Edition).

Balloons

Moored balloons and unmanned free balloons cannot be operated in a prohibited or restricted area unless approval is obtained from the controlling agency. Balloons also cannot be operated if they pose a hazard to people and their property (FAA, 2015e).

Obstructions to Airspace Considerations

The Airports Division of the FAA is responsible for the evaluation and analysis of proposed construction or alterations on airports. The FAA Air Traffic Office is responsible for determining obstructions to air navigation as a result of construction off airports that may affect the safe and efficient use of navigable airspace and the operation of planned or existing air navigation and communication facilities. Such facilities include air navigation aids, communication equipment, airports, federal airways, instrument approach or departure procedures, and approved off-airway routes. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) is required when there is the potential for airport construction/alteration of a facility that may impinge upon the NAS. Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

- "Any construction or alteration exceeding 200 ft above ground level
- Any construction or alteration:
    - within 20,000 ft of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft
    - within 10,000 ft of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft
    - within 5,000 ft of a public use heliport which exceeds a 25:1 surface
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location." (FAA, 2015f)

Construction or alternative facilities (such as towers) that are subject to Federal Communications Commission (FCC) licensing requirements are also required to have an OE/AAA performed by the FAA Airport Division (FAA, 2015f).

New Jersey Airspace

The New Jersey Department of Transportation (NJDOT) is responsible for the air transportation system ensuring overall efficiency to meet the state's needs. The New Jersey Division of Aeronautics within the NJDOT oversees operations and safety at public-use airports and restricted use facilities. Oversight includes airstrips, balloonports, and heliports (NJDOT, 2015b).

New Jersey airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key issues associated with their airports (National Association of State Aviation Officials (NASAO), 2015). Figure 10.1.7-5 depicts the different aviation facilities/airports residing in New Jersey, while Figures Figure 10.1.7-6 and Figure 10.1.7-7 show the breakout by public and private airports. There are approximately 321 airports (public and private) within New Jersey State as reflected in Table 10.1.7-8 and Figure 10.1.7-5 (DOT, 2015b).

Table 10.1.7-8: Type and Number of New Jersey Airports

Type	Public	Private
Airport	42	59
Heliport	0	208
Seaplane	1	6
Ultralight	0	0
Balloonport	0	5
Gliderport	0	0
Total	43	278

Source: (DOT, 2015c)

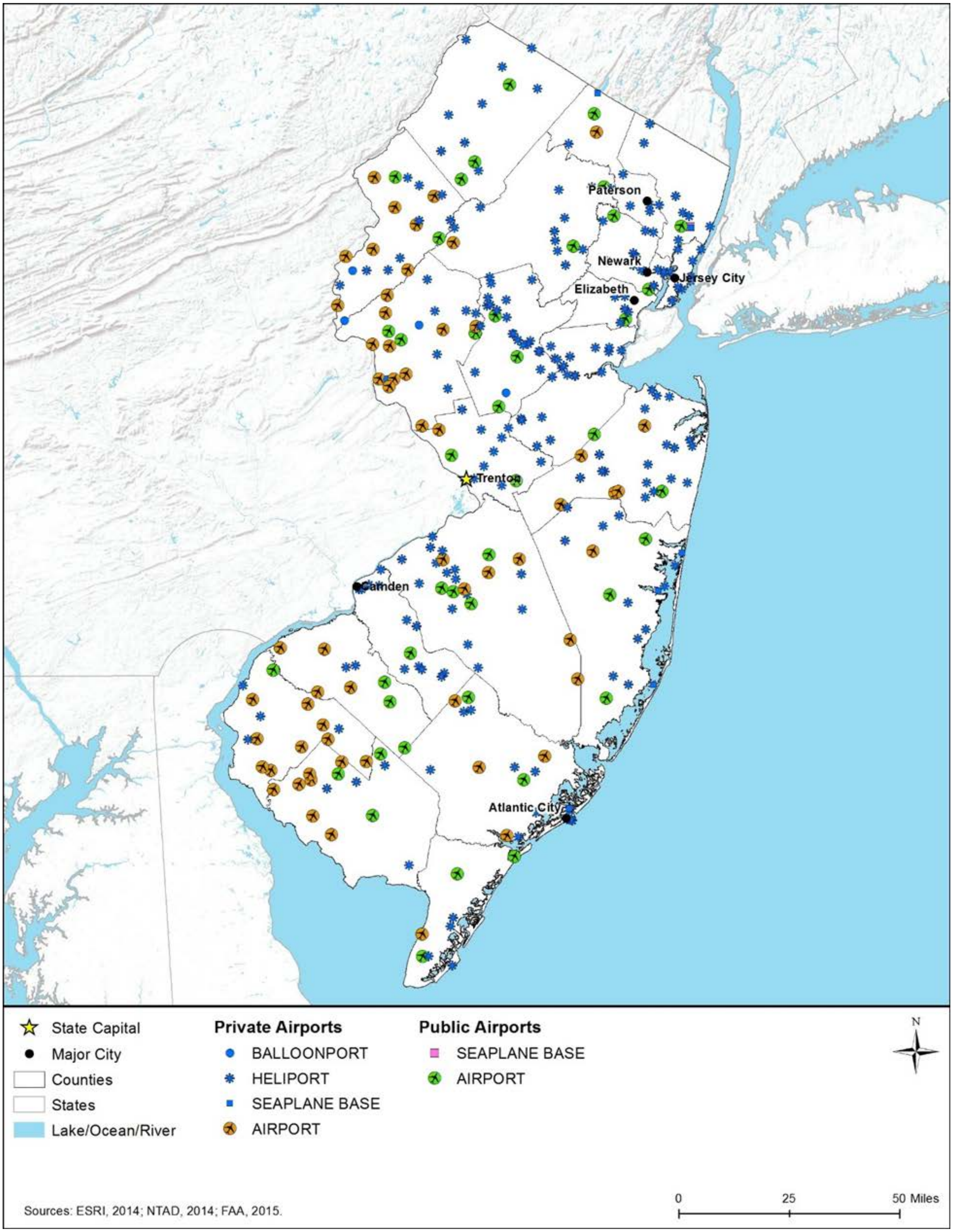

Figure 10.1.7-5: Composite of New Jersey Airports/Facilities

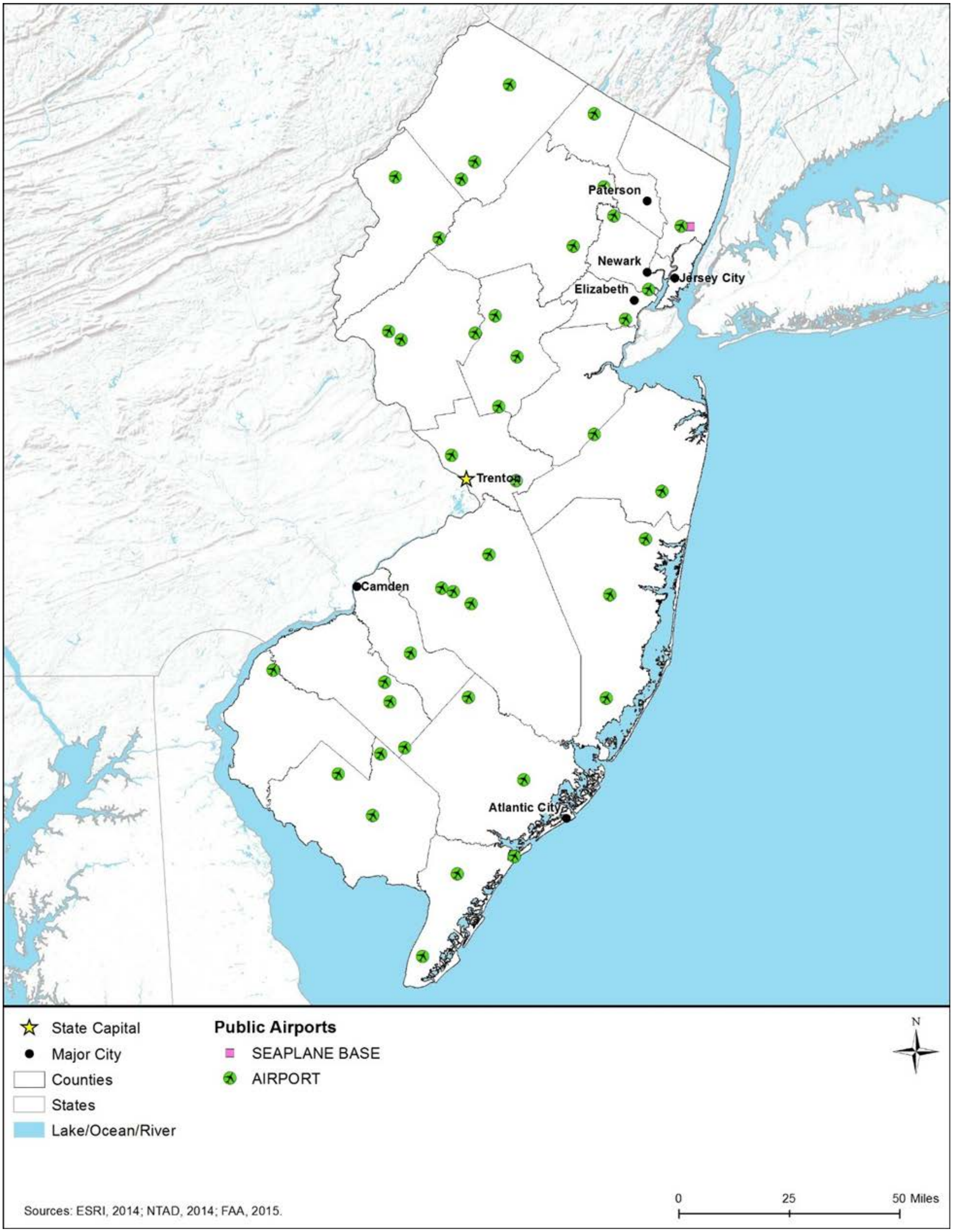

Figure 10.1.7-6: Public New Jersey Airports/Facilities

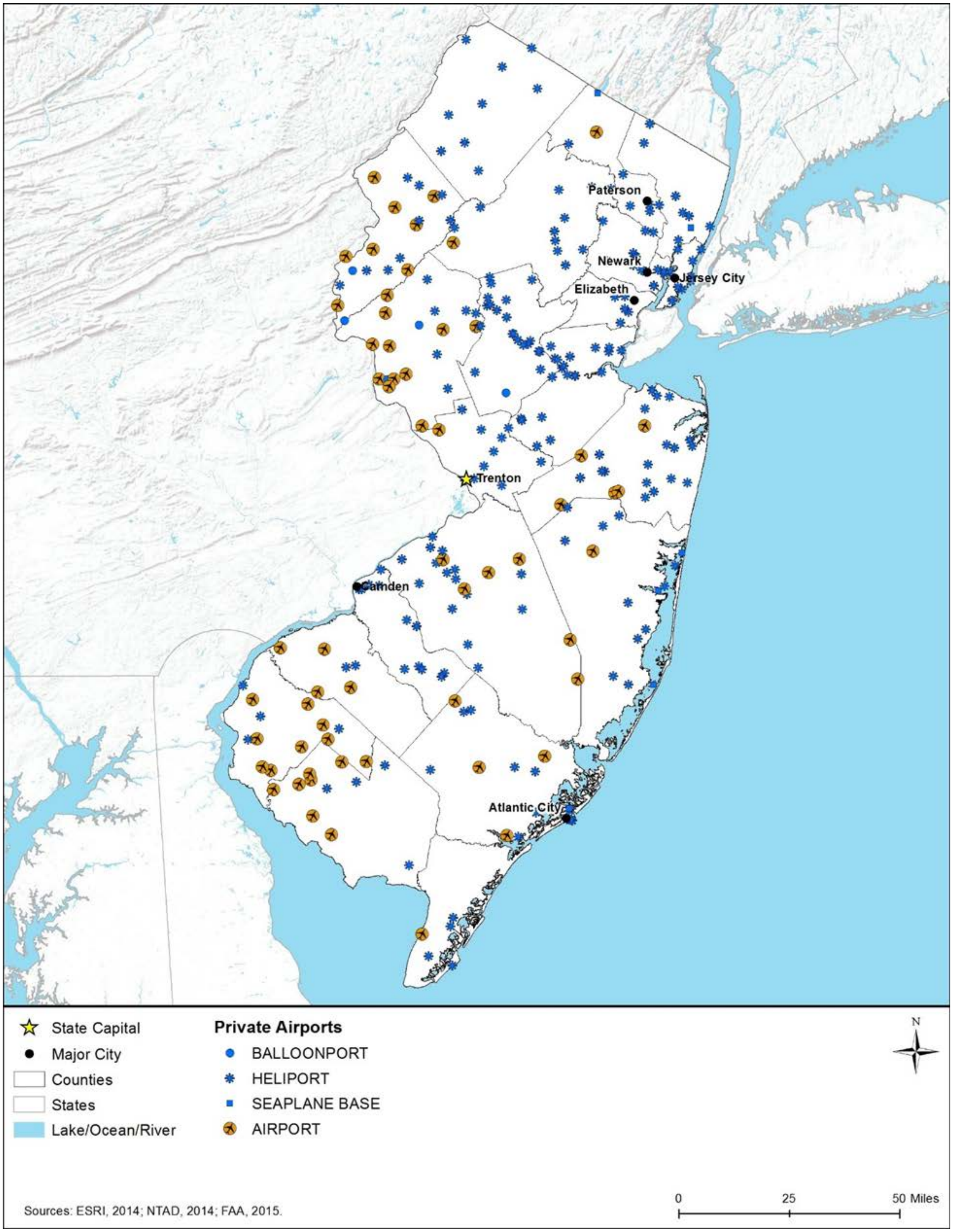

Figure 10.1.7-7: Private New Jersey Airports/Facilities

There are Class C, D, and E controlled airports in New Jersey as follows:

- One Class C – Atlantic City International
- Five Class D –
  - McGuire Air Force Base
  - Mercer County Airport, Trenton
  - Morristown Municipal Airport
  - Lakehurst Naval Support Activity/Maxfield Field, Joint Base McGuire-Dover-Lakehurst
  - Essex County Airport, Caldwell
- Two Class E –
  - Millville Municipal Airport
  - Mercer County Airport, Trenton (FAA, 2014b)

SUAs (i.e., restricted and alert areas) are located at Fort Dix, Warren Grove, and McGuire. Airspace considerations of these areas are as follows:

- Fort Dix (Restricted): R-5001A Surface to and including 45,000 feet MSL and R-5002B From 4,000 feet MSL to and including 8,000 feet MSL
- Warren Grove (Restricted):
  - R-5002A Surface to but not including 14,000 feet MSL
  - R-5002B 1,000 feet to but not including 14,000 feet MSL
  - R-5002C Surface to 3,000 feet MSL
  - R-5002D Surface to 4,000 feet MSL
  - R-5002E 3,500 feet MSL to but not including 14,000 feet MSL
  - R-5002F 14,000 feet MSL to but not including Flight Level (FL) 200
  - R-5002G FL 200 to FL 230
- McGuire (Alert): A-220 Surface to 4,500 feet MSL (FAA, 2015g)

Figure 10.1.7-8 presents the SUAs in New Jersey. MTRs in New Jersey, as presented in Figure 10.1.7-9, consist of one Visual Route (VR) 1709 and seven Slow Routes (SLs) 800, 801, 805, 844, 845, 846, and 847. When active, the airspace restrictions associated with TFRs in New York City (5/7385 and 5/7386) may impact the airspace of northern New Jersey.

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014b). There are nine national parks within the State of New Jersey (NPS, 2015h).

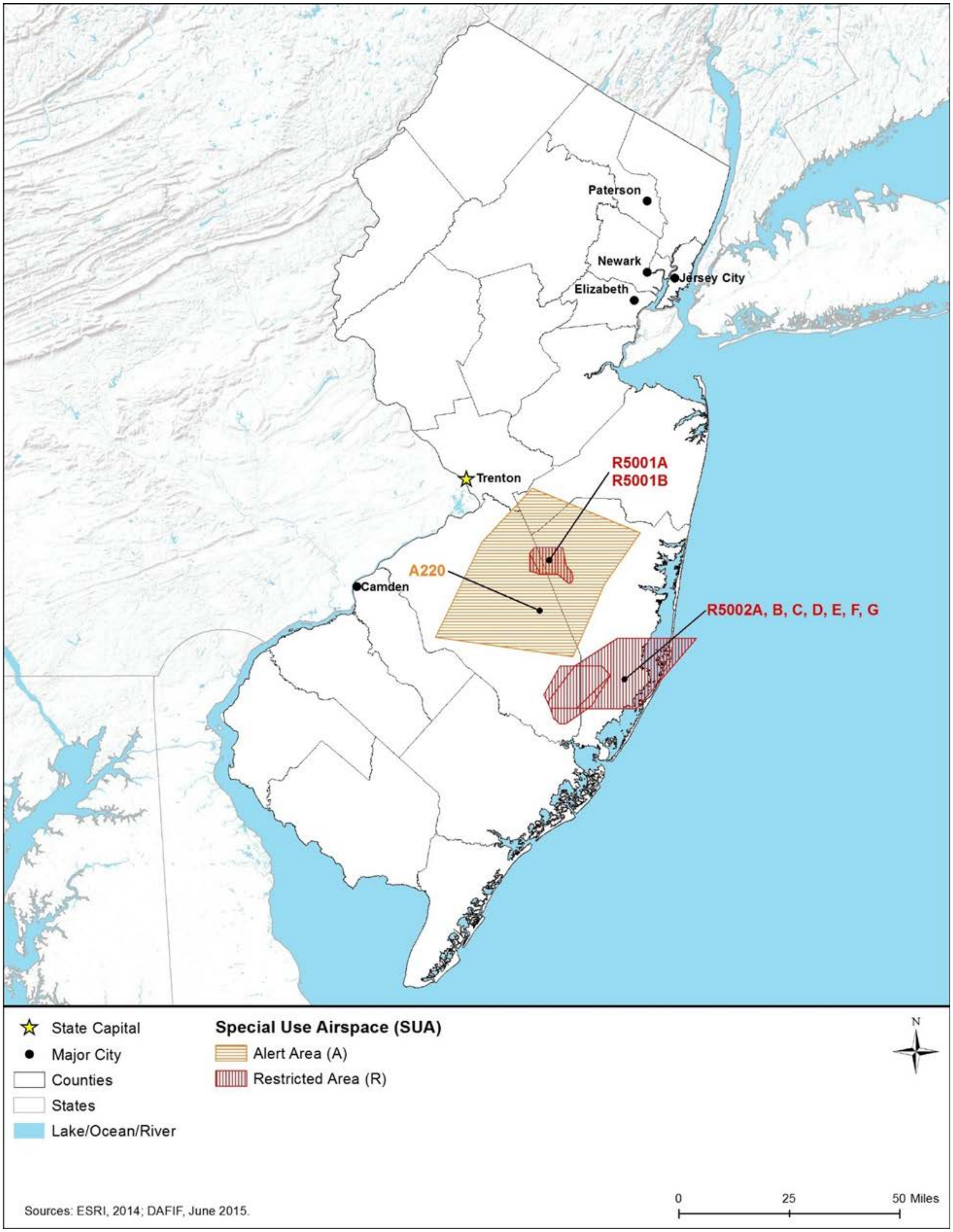

Figure 10.1.7-8: SUAs in New Jersey

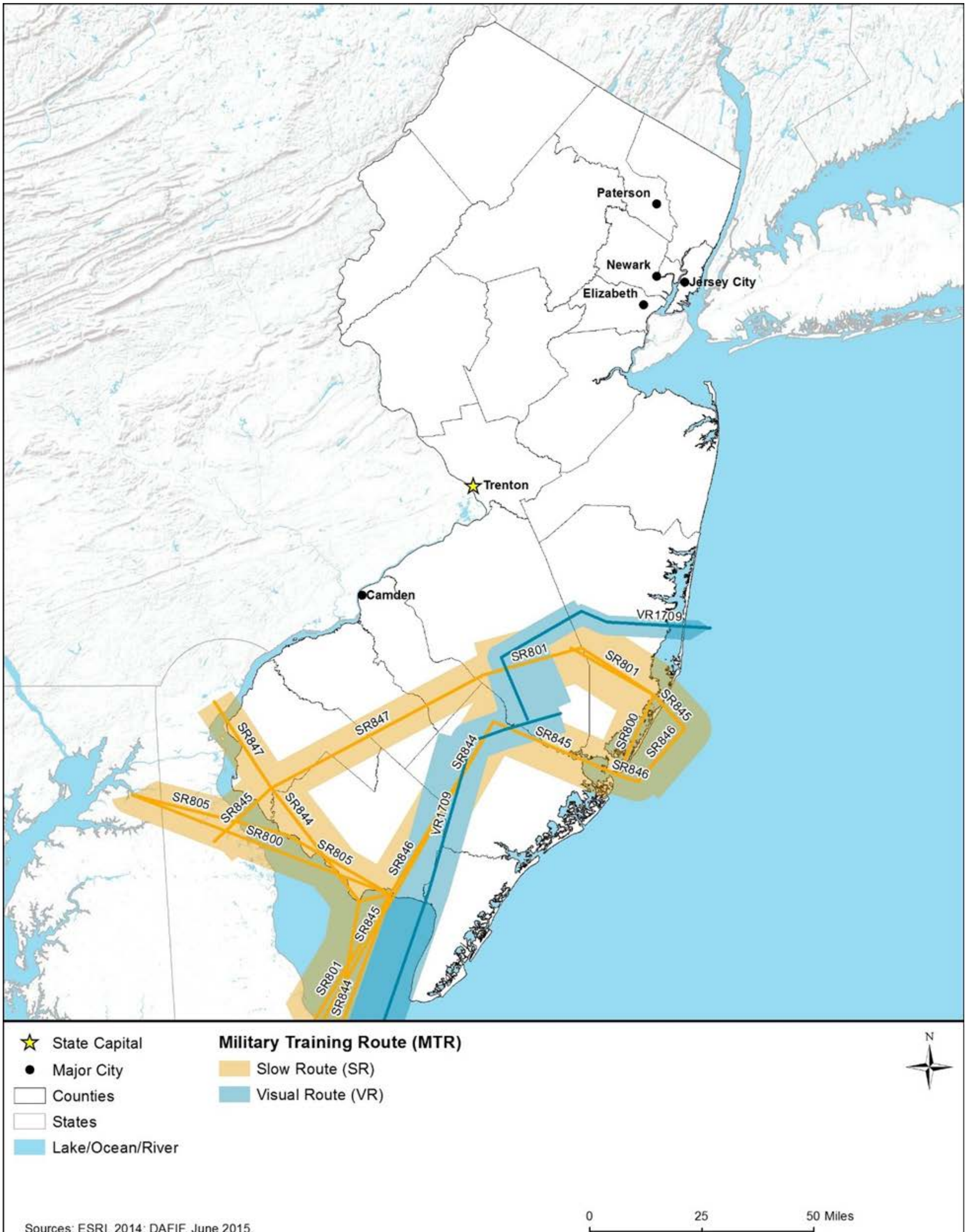

Figure 10.1.7-9: MTRs in New Jersey

10.1.8 Visual Resources

10.1.8.1 Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features such as mountain ranges, city skylines, ocean views, unique geological formations, rivers, and constructed landmarks such as bridges, memorials, cultural resources, or statues are considered visual resources. For some, cityscapes are valued visual resources; for others, views of natural areas are valued visual resources. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and NHPA compliance. A general definition of visual resources used by the Bureau of Land Management (BLM) is "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

10.1.8.2 Specific Regulatory Consideration

Table 10.1.8-1 present state policy regarding scenic and visual resources for New Jersey.

Table 10.1.8-1: Relevant New Jersey Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
N.J.A.C. 7:7 New Jersey Coastal Management Program and Coastal Zone Management Rules	NJDEP	Program contains multiple policy goals that reference the preservation, protection, and conservation of aesthetic resources along New Jersey's coast.
2013-2019 New Jersey Comprehensive Statewide Historic Preservation Plan	State Historic Preservation Office (SHPO)	Provides goals and objectives to manage and preserve historic places.

In addition to the state laws and regulations, local zoning laws may apply related to visual resources. Viewsheds and scenic vistas are increasingly important to the state's towns, cities, and villages as they look at the future planning of their municipalities. There are over 200 comprehensive master plans by counties, cities, and towns, many of which include consideration of visual resources, scenic easements, and telecommunications regulations (Rutgers University Libraries, 2013). Where counties, cities, towns, or villages have planning documents that address scenery, character, or visual resources, the placement of towers or temporary transmission structures would need to comply with requirements or provide mitigation measures to meet compliance.

10.1.8.3 Character and Visual Quality of the Existing Landscape

New Jersey, known as the "Garden State" because of its history in agriculture, is one of the most urbanized and populous states in the country. Most of this urbanization is located in the northeast portion of the state with more rural and suburban areas in other areas of the state. Some of the urban visual attributes include views of the Statue of Liberty and the New York skyline. Views of the Atlantic Ocean can be found along its many beaches and piers. The northwest area contains rugged mountain and forest vistas, such as the Pine Barrens. The southcentral area contains a number of state forests and parks with many natural aesthetic qualities (NJDEP, 2015u).

While the state and many municipalities have regulate some scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have some measure of management, significance, or protection through state or federal policy, as well as being identified as a visually significant area.

10.1.8.4 Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 10.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In New Jersey, there are 1,687 listed sites, which include 58 National Historic Landmarks, 1 National Heritage Area, and 3 National Historical Parks. Some State Historic Sites and Districts may also be included in the NRHP, whereas others may not.

The National Park Service is required to protect all aspects of historic landscapes considered significant, such as forests, gardens, trails, structures, ponds, and farming areas using *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes* (NPS, 1995). The standards and guidelines "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein (NPS, 1995).

National Heritage Areas

National Heritage Areas (NHA) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011). These areas help tell the history of the United States. Based on this criteria, NHAs in New Jersey may contain scenic or aesthetic areas considered visual resources or visually sensitive. The Crossroads of the American Revolution NHA encompasses 213 municipalities and 14 counties in New Jersey that were involved in the American Revolutionary War from 1776 through 1778. Most of this NHA is north and east of Trenton and encompasses 2,155 square miles (Figure 10.1.8-1). The NHA contains battlefields in Trenton, Princeton, and Monmouth. (Crossroads of the American Revolution, 2015).

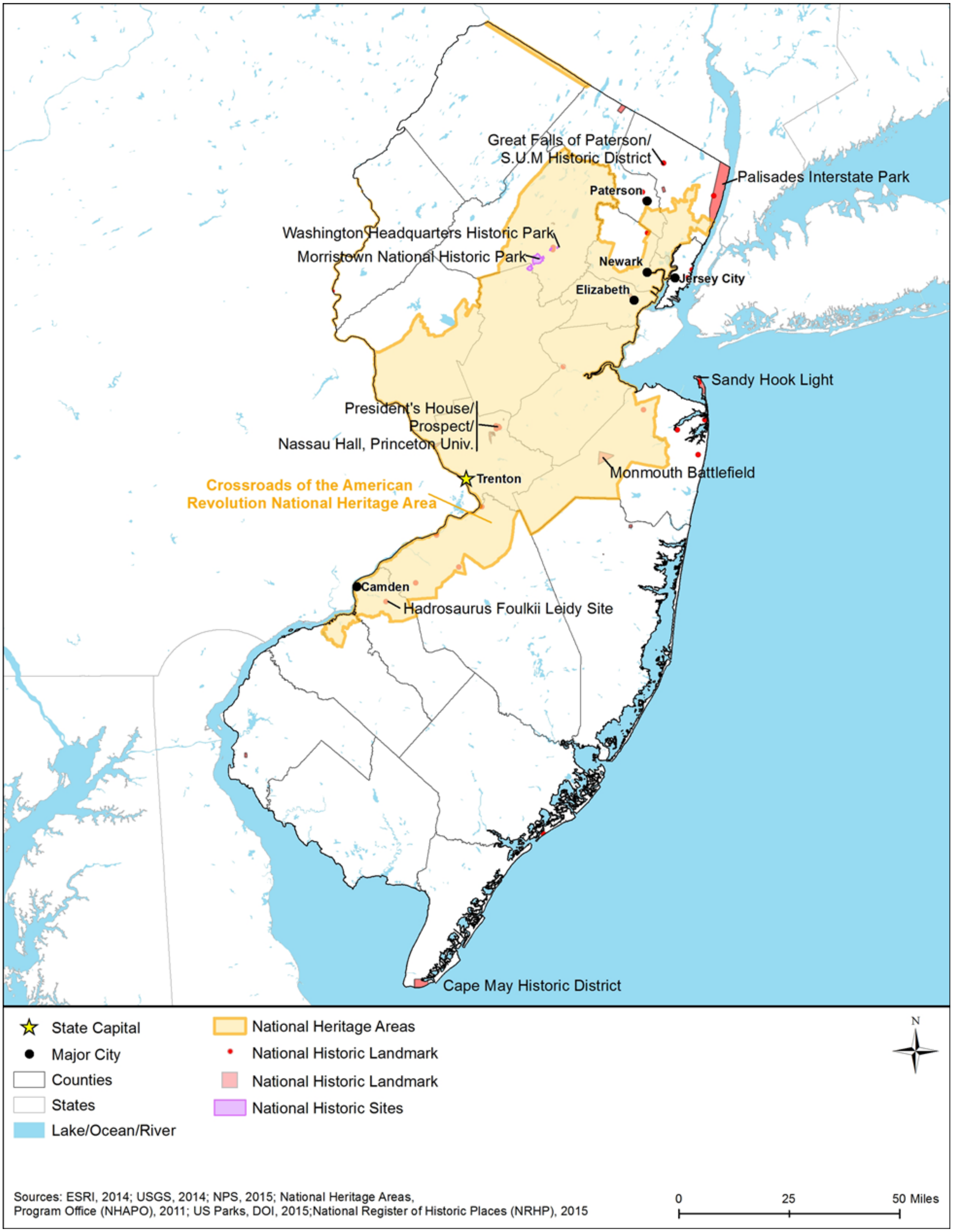

Figure 10.1.8-1: Cultural and Heritage Resources that May Be Visually Sensitive

National Historic Landmarks

National Historic Landmarks (NHL) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015i). Generally, NHLs are comprised of historic buildings such as residences, churches, civic buildings, and institutional buildings. Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities that may be considered visual resources or visually sensitive at these sites. In New Jersey, there are 58 NHLs, including sites such as the Grover Cleveland Home, the Holland Tunnel, and Monmouth Battlefield (NPS, 2015i). By comparison, there are over 2,500 NHLs in the U.S., with approximately 2 percent of these located in New Jersey.

State Historic Sites

Owned by the state and managed by the Office of Historic Sites, New Jersey's state historic sites include historic buildings, places, exhibits, and landscapes (NJDEP, 2015t). There are 35 sites across the state from urban areas to rural areas (Table 10.1.8-2). Examples of historic sites include the Walt Whitman House, Old Dutch Parsonage, and Barnegat Lighthouse (New Jersey Division of Parks and Forestry, 2015c).

Table 10.1.8-2: State Historic Sites

State Historic Sites	
Absecon Lighthouse	Johnson Ferry House
Allaire Village	Long Pond Ironworks Historic District
Barnegat Lighthouse	Monmouth Battlefield
Batsto Village	Old Dutch Parsonage
Boxwood Hall	Princeton Battlefield
Cape May Lighthouse	Ringwood Manor
Central Railroad of New Jersey Terminal	Rockingham
Clarke House	Skylands Manor & State Botanical Garden
Craig House	Somers Mansion
Delaware & Raritan Canal State Park (Blackwell Mills Canal House, Mule Tenders Barracks, Port Mercer Canal House, Prallsville Mills)	Steuben House at Historic New Bridge Landing
Double Trouble Village	Trenton Battle Monument
Edison Memorial Tower and Museum	Twin Lights
Fort Mott	Wallace House
Grover Cleveland Birthplace	Walt Whitman House
Hancock House	Washington Crossing
The Hermitage	Waterloo Village
High Point Monument	Whitesbog Village
Indian King Tavern	

Source: (New Jersey Division of Parks and Forestry, 2015c)

Properties Listed on the National Historic Register

New Jersey has 1,687 NRHP listed sites; some of these properties on the NRHP are also designated as National Historic Landmarks, while most are not. The NRHP listed sites consist of mostly historic buildings, but there are numerous historic districts, churches, lighthouses, mills, and farms. These sites are mostly privately owned and are covered by state and local historic and cultural resource policies, which protect scenic and visual resources (NPS, 2014c).

10.1.8.5 Parks and Recreation Areas

Park and recreation areas include State Parks, National Recreation Areas, National Seashores, National Forests and National and State Trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. Figure 10.1.8-4 identifies parks and recreational resources that may be visually sensitive in New Jersey. For additional information about recreation areas, including national and state parks, see Section 10.1.7, Land Use, Recreation, and Airspace.

National Park Service (NPS)

National Parks are managed by the National Park Service (NPS) and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In New Jersey, there are nine[133] officially designated National Parks in addition to other NPS affiliated areas, such as National Heritage Areas. There are 2 National Recreation Areas, 3 National Historical Parks, 1 National Monument, 1 National Reserve, and 2 National Historic Trails (NPS, 2015i). Table 10.1.8-3 identifies the National Parks and affiliated areas located in New Jersey (see Figure 10.1.8-4). For additional information regarding parks and recreation areas, see Section 10.1.7, Land Use, Recreation, and Airspace.

Table 10.1.8-3: National Park Service Areas and Associated Visual Attributes

National Park Service Area	Visual Attributes
Appalachian National Scenic Trail	Wooded, pastoral, wild lands; footpaths; forest
Delaware Water Gap National Recreation Area	Views of the river, valley, forested areas
Ellis Island (Statue of Liberty National Monument)	Views of historic sites, waterfront, skyline
Gateway National Recreation Area	Coastal views, forested areas, wildlife viewing, historic sites
Morristown National Historical Park	Historic sites, nature and wildlife viewing, scenic views
New Jersey Pinelands National Reserve	Largest open space on the Mid-Atlantic seaboard, nature, wildlife viewing
Paterson Great Falls National Historical Park	Views of Great Falls, forested areas, river scenic views, wildlife viewing, historic sites
Thomas Edison National Historical Park	Historic site
Washington-Rochambeau National Historic Trail	Historic route

Source: (NPS, 2015j)

[133] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015j). Actual lists of parks and NPS affiliated areas may vary here depending on when areas are designated by Congress.

State Parks

Figure 10.1.8-2: Liberty State Park

Photo credit: NJDEP

State parks contain natural, historic, cultural, and/or recreational resources of significance to New Jersey residents and visitors. There are 39 state parks, state marinas, and state recreation areas throughout New Jersey (Figure 10.1.8-4), most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive. Most state parks are owned and managed by the state, while some are managed by counties, municipalities, or community organizations. Table 10.1.8-4contains examples of state parks and their associated visual attributes (New Jersey Division of Parks and Forestry, 2015a).

Table 10.1.8-4: Examples of New Jersey State Parks and Associated Visual Attributes

State Park	Visual Attributes
Cape May Point State Park	Coastal views, historic lighthouse, forested areas, dunes, bird viewing.
Hacklebarney State Park	Views of the Black River, glacial valley, forested areas.
Liberty State Park	Views of the Manhattan skyline, the Statue of Liberty, and Ellis Island.
Parvin State Park	Views of Parvin Lake, forested areas, and wildlife.

Source: (New Jersey Division of Parks and Forestry, 2015a)

State and Federal Trails

State-designated trails in New Jersey encompass a wide variety of walking, bicycling, equestrian, jogging, and water-related activities. They cover all areas of the state and are managed by various state and local agencies and community groups. The two main agencies responsible for decisions affecting trails are the NJDEP and the New Jersey Department of Transportation (New Jersey Division of Parks and Forestry, 2015d). Although a trail inventory has not been completed by the state, the New Jersey Trails Plan Update of 2009 (New Jersey Division of Parks and Forestry, 2015d) lists the top 10 trails and trail areas most often used by the public. These include:

- Delaware & Raritan Canal State Park Multi-use Path,
- Wharton State Forest,
- NJ Off Road Vehicle Park – Chatsworth,
- Delaware Water Gap National Recreation Area,
- Brendan T. Byrne State Forest,
- Ringwood State Park,
- Appalachian Trail,
- Assunpink Wildlife Management Area,

- Wawayanda State Park, and
- Paulinskill Valley Trail.

National Scenic Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2012a). The Appalachian Trail and the Washington-Rochambeau Revolutionary Route National Historic Trail are the only national trails that pass through New Jersey.

10.1.8.6 Natural Areas

Natural areas vary by state depending on the amount of public or state lands within each state. Although many areas may not be managed specifically for visual resources, these areas exist because of their natural resources, and the resulting management may also protect the scenic resources therein.

State Forests

The New Jersey Division of Parks and Forestry owns and manages 11 state forests, totaling 396 square miles (Figure 10.1.8-4) (New Jersey Division of Parks and Forestry, 2015a). These state forests range in size from 3 to 187 square miles. Visual characteristics of state forests include mountain, river and valley scenic views, forested landscapes, wildlife viewing and other natural characteristics associated with visiting forested lands. For example, Norvin Green State Forest located in Bloomingdale and Passaic Counties is described as having "hills ranging from 400 to 1,300 feet in elevation, providing the avid hiker with scenic vistas, including the New York skyline, Burnt Meadow Brook and Lake Sonoma" (New Jersey Division of Parks and Forestry, 2015e). Another example, Jenny Jump State Forest located in Warren County, contains "the stunning rolling terrain of Jenny Jump Mountain Range, panoramic vistas of the Highlands and the Kittatinny Mountains and Valley to the west, and scenic views of the Great Meadows in the east" (New Jersey Division of Parks and Forestry, 2015f).

Figure 10.1.8-3: Maurice River

Source: (NPS, 2016)

Rivers Designated as National or State Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. There are five river segments, such as the Maurice River (Figure 10.1.8-3) designated as National Wild and Scenic Rivers in New Jersey (Figure 10.1.8-4) (National Wild and Scenic Rivers System, 2015b). These include:

- Delaware River (Lower),
- Delaware River (Middle),
- Great Egg Harbor River,
- Maurice River, and
- Musconetcong River.

National Wildlife Refuges (NWR)

NWRs are a network of lands and waters managed by the USFWS Figure 10.1.8-4). These lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015jj). Visual resources within the NWRs include views and sites of the coast, beaches, wildlife, and naturally vegetated areas. There are five NWRs in New Jersey:

- Cape May,
- E.B. Forsythe,
- Great Swamp,
- Supawna Meadows, and
- Wallkill.

State Wildlife Management Areas

State Wildlife Management Areas (WMAs) are lands owned by New Jersey that have been acquired primarily for the production and use of wildlife. WMAs are under the control and management of the New Jersey Division of Fish and Wildlife. There are 124 WMAs covering more than 553 square miles scattered throughout the state (NJDFW, 2015b). For additional information on wildlife refuges and management areas, see Section 10.1.7, Land Use, Recreation, and Airspace.

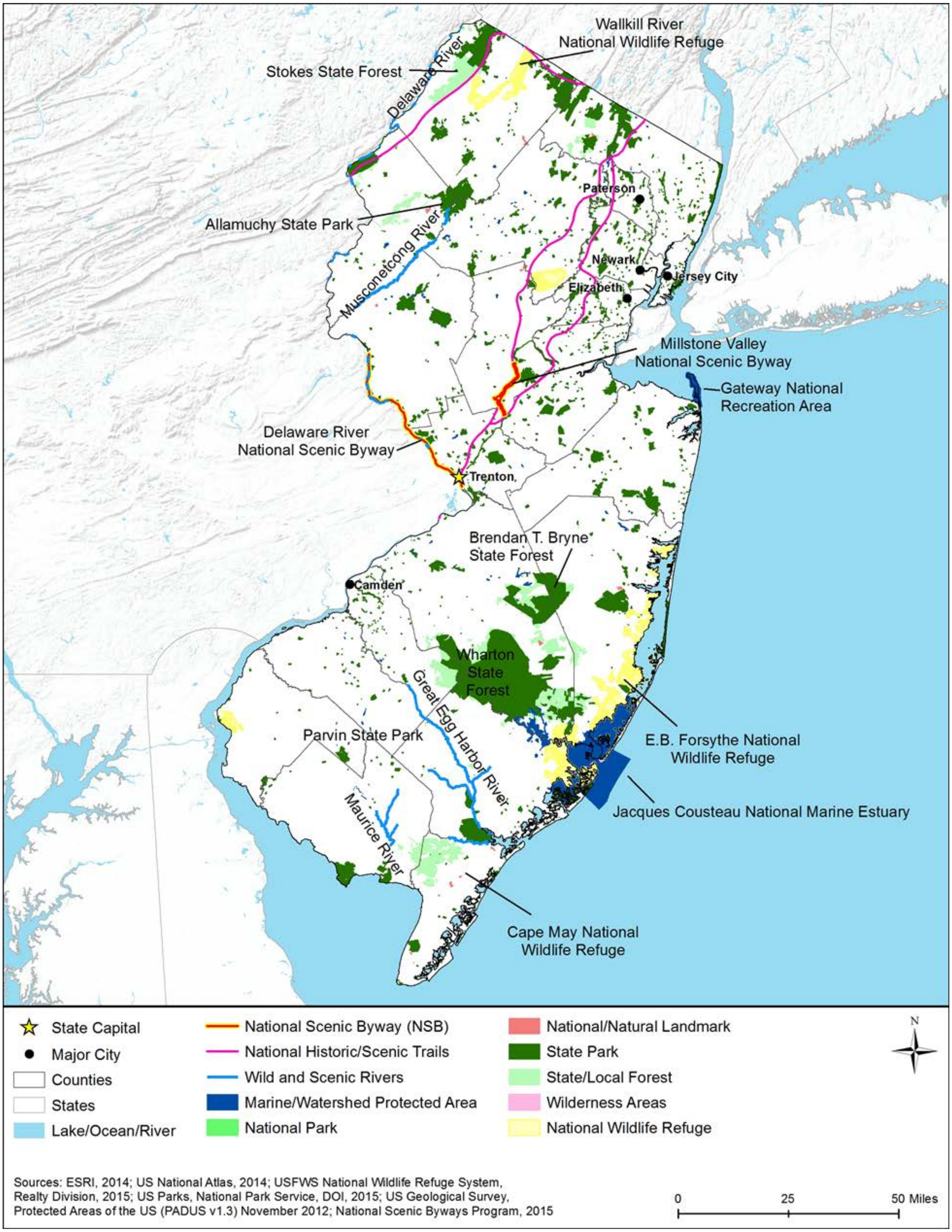

Figure 10.1.8-4: Natural Areas that May Be Visually Sensitive

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014d). These landmarks may be considered visual resources or visually sensitive. In New Jersey, there are 11 designated NNLs located entirely or partially within the state (Table 10.1.8-5). Some of the natural features located within these areas include "one of the finest remaining bottomland hardwood forests in the northern Atlantic Coastal Plain, the outlet for ancient glacial Lake Passaic, and the best example of a thick diabase sill formation known in the U.S." (NPS, 2012c). As an example of the scenic beauty found in these areas, the Troy Meadows NNL contains scenic meadow landscapes (NPS, 2012c).

Figure 10.1.8-5: Troy Meadows NNL

Source: (NPS, 2012b)

Table 10.1.8-5: New Jersey National Natural Landmarks

NNL Name	
Great Falls of Paterson-Garret Mountain	Great Swamp
Manahawkin Bottomland Hardwood Forest	Moggy Hollow Natural Area
Palisades of the Hudson	Pigeon Swamp
Riker Hill Fossil Site	Stone Harbor Bird Sanctuary
Sunfish Pond	Troy Meadows
William L. Hutcheson Memorial Forest	

Source: (NPS, 2014d)

10.1.8.7 Additional Areas

State and National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the U.S. Department of Transportation, Federal Highway Administration. New Jersey has two designated National Scenic Byways: the Delaware River Scenic Byway and the Millstone Valley Scenic Byway (Figure 10.1.8-4) (FHWA, 2015b). Similar to National Scenic Byways, New Jersey State Scenic Byways are transportation corridors that are of particular statewide interest. There are five State Scenic Byways (Figure 10.1.8-4), including:

- Bayshore Heritage Byway,
- Palisades Scenic Byway,
- Pine Barrens Byway,
- Warren Heritage Scenic Byway, and
- Upper Freehold Historic Farmland Byway (NJDOT, 2011).

Natural Lands Trust Preserves

Through the use of land easements and purchases, Natural Lands Trust Preserves are acquired for the specific purpose of preserving areas in their natural state "for enjoyment by the public and to protect natural diversity through the acquisition of open space" (New Jersey Natural Lands Trust, 2015c). The Trust currently manages over 40 square miles of land preserves. Located throughout the state, the preserves range in size from one acre to over 1,700 acres (New Jersey Natural Lands Trust, 2015c).

State Designated Natural Areas

The New Jersey Natural Areas System consists of 43 designated natural areas encompassing 62 square miles. By way of the Natural Areas Act of 1961, the lands are "set aside certain ecologically significant areas using a stricter set of rules than those governing other state-owned lands" (New Jersey Division of Parks and Forestry, 2007). All of these areas are located within other designated state lands, such as state parks, state forests, and state fish and wildlife areas.

10.1.9 Socioeconomics

10.1.9.1 Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis. Specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects, and in addition, FirstNet projects may affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8). This Draft PEIS addresses environmental justice in a separate section (Section 10.1.10). This Draft PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 10.1.7, Land Use, Recreation, and Airspace), infrastructure and public services (Section 10.1.1, Infrastructure), and aesthetic considerations (Section 10.1.8, Visual Resources).

The financial arrangements for deployment and operation of the FirstNet network have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the nationwide public safety broadband network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this Draft PEIS. In all cases, this section uses the most recent data available for New Jersey at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). This Draft PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level.

The remainder of this section addresses the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

10.1.9.2 Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to socioeconomics for this Draft PEIS.

10.1.9.3 Communities and Populations

This section discusses the population and major communities of New Jersey (NJ) and includes the following topics:

- Recent and projected statewide population growth
- Current distribution of the population across the state
- Identification of the largest population concentrations in the state

Statewide Population and Population Growth

Table 10.1.9-1 presents the 2014 population and population density of New Jersey in comparison to the East region[134] and the nation. The estimated population of New Jersey in 2014 was

[134] The East region is comprised of the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia, as well as the District of Columbia. Throughout the socioeconomics section, figures for the East region represent the sum of the values for all "states" (including the District of Columbia) in the region, or an average for the region based on summing the component parameters. For instance, the population density of the East region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

8,938,175. The population density was 1,215 persons per square mile (sq. mi.), which is higher than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, New Jersey was the 11th largest state by population among the 50 states and the District of Columbia, 47th largest by land area, and had the second greatest population density (U.S. Census Bureau, 2010) (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f).

Table 10.1.9-1: Land Area, Population, and Population Density of New Jersey

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
New Jersey	8,723	8,938,175	1,215
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2010) (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f)

Population growth is an important subject for this Draft PEIS, given FirstNet's mission. Table 10.1.9-2 presents the population growth trends of New Jersey from 2000 to 2014 in comparison to the East region and the nation. The state's annual growth rate decreased slightly in the 2010 to 2014 period compared to 2000 to 2010, from 0.44 percent to 0.41 percent. The state's growth rate in the latter period was slightly less than the region's rate (0.50 percent) and less than the nation's growth rate of 0.81 percent.

Table 10.1.9-2: Recent Population Growth of New Jersey

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
New Jersey	8,414,350	8,791,894	8,938,175	377,544	146,281	0.44%	0.41%
East Region	69,133,382	72,444,467	73,899,862	3,311,085	1,455,395	0.47%	0.50%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015e)

AARC = Average Annual Rate of Change (compound growth rate)

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide Draft PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore,

Table 10.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use but different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service. The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates that New Jersey's population will increase by approximately one million people, or 11.5 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.70 percent, which is higher than the historical growth rate from 2010 to 2014 of 0.41 percent. The projected growth rate of the state is higher than that of the region (0.57 percent) and less than the projected growth rate of the nation (0.80 percent).

Table 10.1.9-3: Projected Population Growth of New Jersey

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC) 2014 to 2030
New Jersey	8,938,175	9,674,480	10,252,175	9,963,328	1,025,153	11.5%	0.70%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.5%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

Sources: (U.S. Census Bureau, 2015e; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 10.1.9-1 presents the distribution and relative density of the population of New Jersey. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015h).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2016a; U.S. Census Bureau, 2016b). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. Figure 10.1.9-1 shows the heaviest concentrations are in the New Jersey portion of the New York/Newark area, followed by Trenton and the New Jersey portion of the Philadelphia area.

Table 10.1.9-4 provides the populations of the 10 largest population concentrations in New Jersey, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[135] In 2010, the largest population concentration by far was

[135] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the

the New Jersey portion of the New York/Newark area, which had over 6 million people. The only other population concentration of over 1 million was the New Jersey portion of the greater metropolitan area of Philadelphia All other areas had populations less than 300,000. The smallest of these 10 population concentrations was the Bridgeton area, with a 2010 population of 35,022. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Trenton area, with an annual growth rate of 1.00 percent. No other areas had an annual growth rate over 1.00 percent. Bridgeton, Browns Mills/Fort Dix, Twin Rivers/Hightstown, and Villas experienced population declines during this period.

Table 10.1.9-4 also shows that the top 10 population concentrations in New Jersey accounted for 93.0 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 90 percent of the entire state's growth.

Table 10.1.9-4: Population of the 10 Largest Population Concentrations in New Jersey

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Atlantic City	227,180	248,402	249,385	4	21,222	0.90%
Bridgeton	35,787	35,022	35,323	10	(765)	-0.22%
Browns Mills/Fort Dix	40,882	37,985	38,073	8	(2,897)	-0.73%
Franklin/Highland Lake	32,151	35,436	34,562	9	3,285	0.98%
New York/Newark (NY/NJ/CT) (NJ Portion)	5,928,765	6,159,466	6,195,674	1	230,701	0.38%
Philadelphia (PA/NJ/DE/MD) (NJ Portion)	1,088,772	1,150,865	1,150,126	2	62,093	0.56%
Trenton	268,472	296,668	295,921	3	28,196	1.00%
Twin Rivers/Hightstown	69,977	64,037	65,181	6	(5,940)	-0.88%
Villas*	52,550	51,291	50,148	7	(1,259)	-0.24%
Vineland	88,724	95,259	96,388	5	6,535	0.71%
Total for Top 10 Population Concentrations	7,833,260	8,174,431	8,210,781	NA	341,171	0.43%
New Jersey	8,414,350	8,791,894	8,832,406	NA	377,544	0.44%
Top 10 Total as Percentage of State	93.1%	93.0%	93.0%	NA	90.4%	NA

Sources: (U.S. Census Bureau, 2016a; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)

*Population data for 2000 are for the "Wildwood-North Wildwood-Cape May urbanized area." Villas, Wildwood, and Cape May form a contiguous urbanized area; the Census Bureau identified this area as "Wildwood-North Wildwood-Cape May" in 2000, and as "Villas" in 2010.
AARC = Average Annual Rate of Change (compound growth rate)

overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

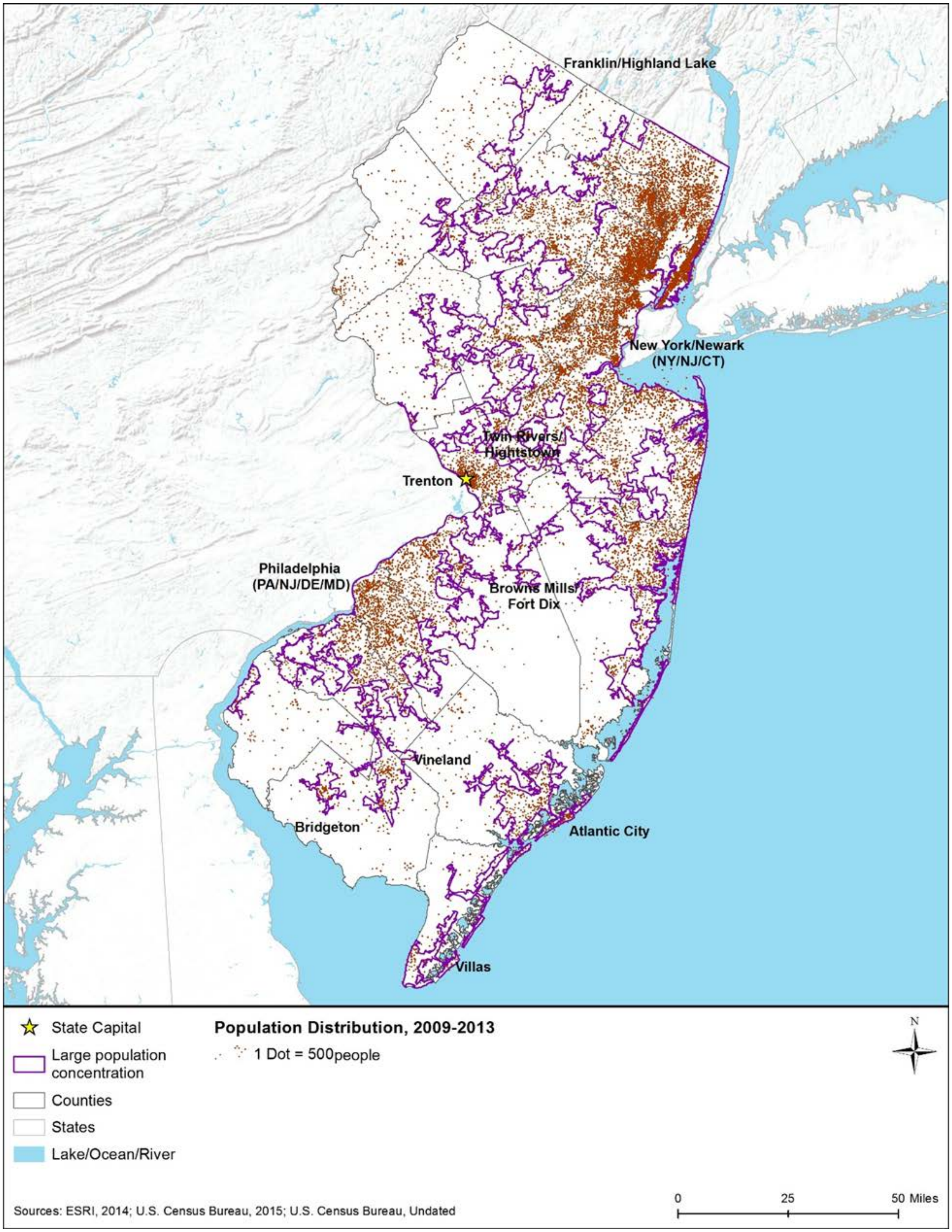

Figure 10.1.9-1: Population Distribution in New Jersey, 2009–2013

10.1.9.4 Economic Activity, Housing, Property Values, and Government Revenues

This section addresses other socioeconomic topics that are potentially relevant to FirstNet. These topics include:

- Economic activity,
- Housing,
- Property values, and
- Government revenues.

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This Draft PEIS addresses public services in Section 10.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 10.1.9-5 compares several economic indicators for New Jersey to the East region and the nation. The table presents two indicators of income[136] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 10.1.9-5, the per capita income in New Jersey in 2013 ($35,728) was $2,876 higher than that of the region ($32,852), and $7,544 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 10.1.9-5 shows that in 2013, the MHI in New Jersey ($70,224) was $9,720 higher than that of the region ($60,504), and $17,974 higher than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 10.1.9-5 compares the

[136] The Census Bureau defines income as follows: "'Total income' is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. Receipts from the following sources are not included as income: capital gains, money received from the sale of property (unless the recipient was engaged in the business of selling such property); the value of income "in kind" from food stamps, public housing subsidies, medical care, employer contributions for individuals, etc.; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances, insurance payments, and other types of lump-sum receipts" (U.S. Census Bureau, 2015n).

unemployment rate in New Jersey to the East region and the nation. In 2014, New Jersey's statewide unemployment rate of 6.6 percent was higher than the rate for the region (6.0 percent) and slightly higher than the rate for the nation (6.2 percent).[137]

Table 10.1.9-5: Selected Economic Indicators for New Jersey

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
New Jersey	$35,728	$70,224	6.6%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015b; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m)

Figure 10.1.9-2 and Figure 10.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015k) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 10.1.9-1 (U.S. Census Bureau, 2016a; U.S. Census Bureau, 2016b). Following these two maps, Table 10.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across New Jersey.

Figure 10.1.9-2 shows that, in general, most of New Jersey's counties had a MHI above the national median, with the highest MHI in the northern portions of the state. Only two counties, which included the Bridgeton, Vineland, and Atlantic City population concentration areas, had a MHI lower than the national median. Table 10.1.9-6 shows that half of the population concentrations had a MHI above or very close to the state average, and half had lower MHI values. MHI was lowest in the Villas, Bridgeton, and Vineland areas.

Figure 10.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that counties with unemployment rates below the national average (that is, better employment performance) were all located in the northern portion of the state. However, several northeastern counties had unemployment rates above the national average. These counties corresponded to counties with lower MHI than the surrounding counties (see Figure 10.1.9-2). All counties in the southern portion of the state had unemployment rates above the national average. The southernmost counties – those around the Bridgeton, Vineland, Atlantic City, and Villas areas – had the highest unemployment rates (above 8.6 percent). When comparing unemployment in the population concentrations to the state average (Table 10.1.9-6), only three population concentration areas (Twin Rivers/Hightstown, Franklin/Highland Lake, and the New Jersey portion of New York/Newark area) had unemployment rates that were lower than the state average. In general, the unemployment rate was comparable (within two percentage points)

[137] The timeframe for unemployment rates can change quarterly.

across the state except for the Vineland, Atlantic City, and Bridgeton areas, which had unemployment rates that were considerably higher than the state average.

Detailed employment data provide useful insights into the nature of a local, state, or national economy.

Table 10.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was somewhat higher in New Jersey than in the East region and the nation. The percentages of government workers and self-employed workers were somewhat lower in the state than in the region and nation.

By industry, New Jersey has a mixed economic base. Most of the industries in the state had comparable employment percentages (mostly within two percentage points) to the region and the nation.

Table 10.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in New Jersey, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Atlantic City	$53,299	12.8%
Bridgeton	$43,545	17.7%
Browns Mills/Fort Dix	$59,956	11.0%
Franklin/Highland Lake	$77,782	9.8%
New York/Newark (NY/NJ/CT) (NJ Portion)	$72,489	9.8%
Philadelphia (PA/NJ/DE/MD) (NJ Portion)	$69,661	10.8%
Trenton	$67,342	11.1%
Twin Rivers/Hightstown	$108,556	8.2%
Villas	$50,283	11.9%
Vineland	$49,588	14.3%
New Jersey (statewide)	$71,629	10.1%

Source: (U.S. Census Bureau, 2015o)

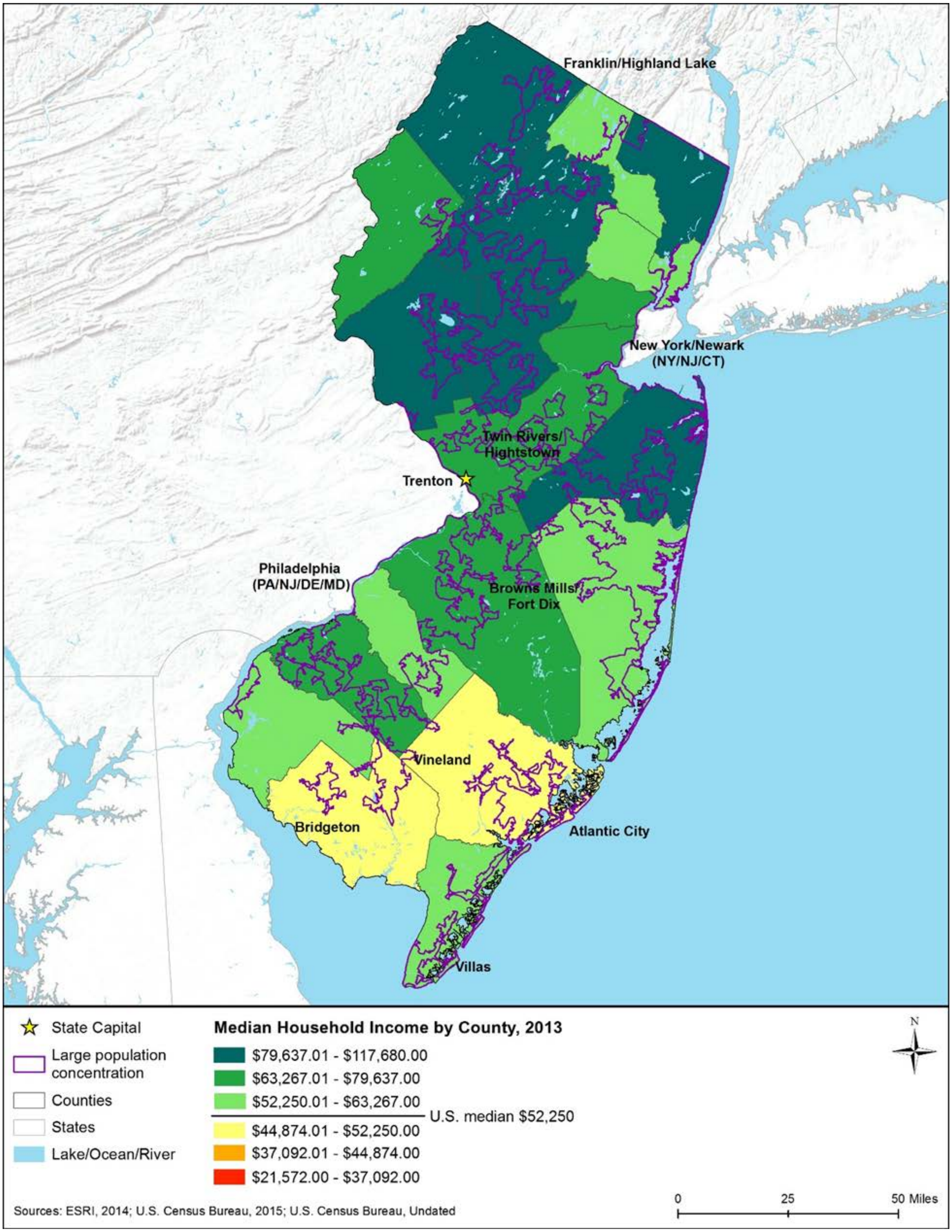

Figure 10.1.9-2: Median Household Income in New Jersey, by County, 2013

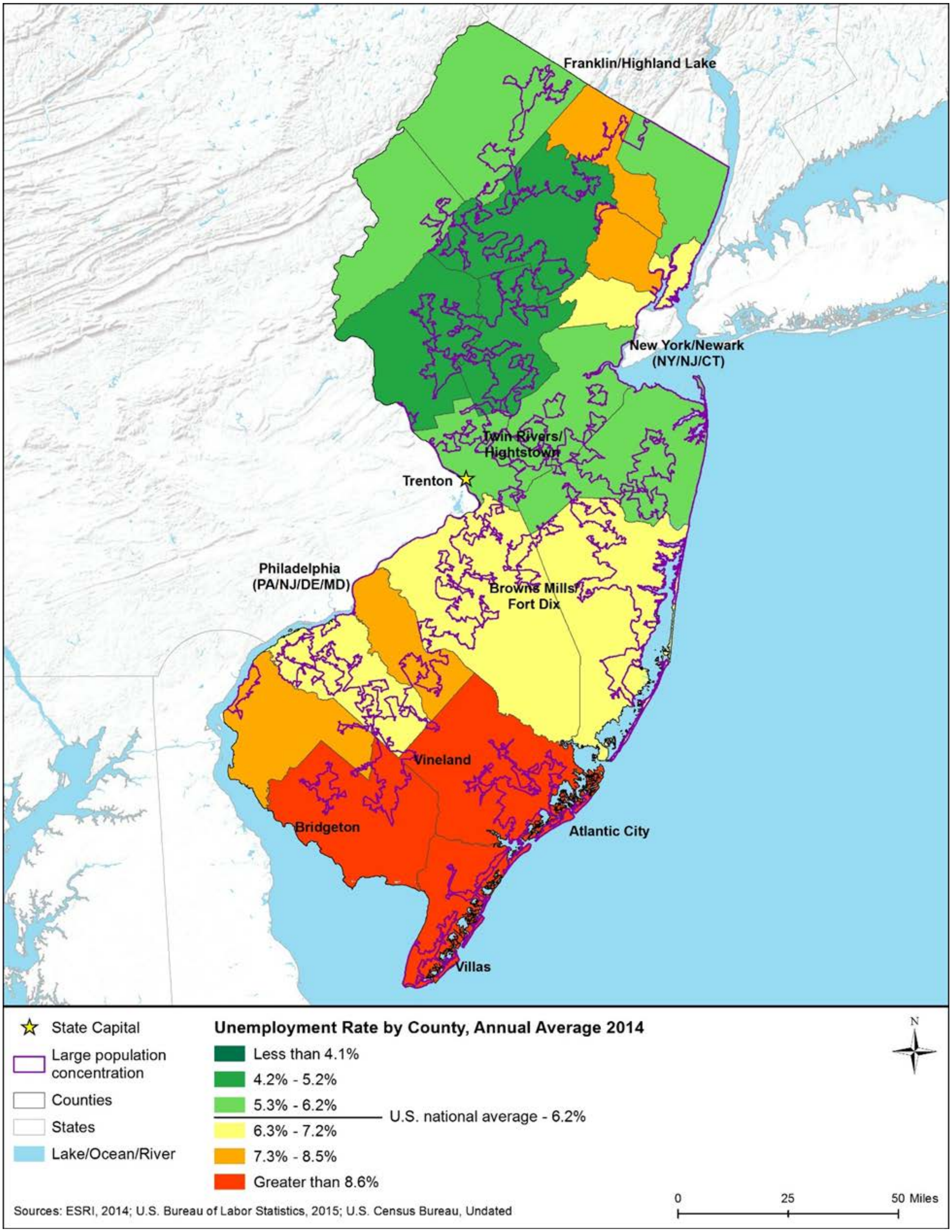

Figure 10.1.9-3: Unemployment Rates in New Jersey, by County, 2014

Table 10.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	New Jersey	East Region	United States
Civilian Employed Population 16 Years and Over	4,252,626	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	81.6%	79.3%	79.7%
Government workers	13.8%	15.1%	14.1%
Self-employed in own not incorporated business workers	4.5%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	0.3%	0.9%	2.0%
Construction	5.6%	5.8%	6.2%
Manufacturing	8.4%	8.5%	10.5%
Wholesale trade	3.4%	2.5%	2.7%
Retail trade	11.4%	11.1%	11.6%
Transportation and warehousing, and utilities	5.7%	4.6%	4.9%
Information	2.7%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	8.4%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	12.9%	12.3%	11.1%
Educational services, and health care and social assistance	23.8%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.5%	8.9%	9.7%
Other services, except public administration	4.6%	4.9%	5.0%
Public administration	4.2%	5.5%	4.7%

Source: (U.S. Census Bureau, 2015p)

Table 10.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 10.1.9-7 for 2013.

Table 10.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in New Jersey, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Atlantic City	5.3%	3.3%	1.4%	8.3%
Bridgeton	4.7%	4.5%	0.9%	10.0%
Browns Mills/Fort Dix	5.8%	5.6%	1.7%	7.2%
Franklin/Highland Lake	8.8%	5.5%	2.3%	10.0%
New York/Newark (NY/NJ/CT) (NJ Portion)	5.4%	5.9%	3.3%	13.2%
Philadelphia (PA/NJ/DE/MD) (NJ Portion)	5.1%	5.7%	2.1%	11.2%
Trenton	4.6%	4.4%	2.2%	12.6%
Twin Rivers/Hightstown	3.3%	3.8%	4.2%	17.5%
Villas	7.4%	3.4%	1.1%	7.3%
Vineland	5.5%	5.3%	1.0%	7.4%
New Jersey (statewide)	5.6%	5.6%	2.9%	12.6%

Source: (U.S. Census Bureau, 2015o)

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 10.1.9-9 compares New Jersey to the East region and nation on several common housing indicators.

As shown in Table 10.1.9-9, in 2013, New Jersey had a similar percentage of housing units that were occupied (88.8 percent) compared to the region (88.4 percent) or nation (87.5 percent). Of the occupied units, New Jersey had a slightly higher but similar percentage of owner-occupied units (64.0 percent) than the region (62.8 percent) or nation (63.5 percent). New Jersey had a similar percentage of detached single-unit housing (also known as single-family homes) in 2013 (53.2 percent) compared to the region (52.7 percent) and lower percentage compared to the nation (61.5 percent). The homeowner vacancy rate in New Jersey (1.7 percent) almost matched the rate for the region (1.6 percent) and was slightly lower than the rate for the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015p). The vacancy rate among rental units in New Jersey (6.2 percent) was similar to that of the nation (6.5 percent) and higher than the region (5.5 percent).

Table 10.1.9-9: Selected Housing Indicators for New Jersey, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
New Jersey	3,578,260	88.8%	64.0%	1.7%	6.2%	53.2%
East Region	31,108,124	88.4%	62.8%	1.6%	5.5%	52.7%
United States	132,808,137	87.5%	63.5%	1.9%	6.5%	61.5%

Source: (U.S. Census Bureau, 2015q)

Table 10.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Table 10.1.9-10 shows that during this period, the percentage of occupied housing units ranged between 46.5 to 95.6 percent across these population concentrations.

Table 10.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in New Jersey, 2009–2013

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Atlantic City	146,412	64.9%	66.4%	4.0%	12.1%	49.5%
Bridgeton	10,631	90.1%	55.0%	0.9%	8.1%	56.8%
Browns Mills/Fort Dix	12,585	91.2%	63.9%	1.7%	7.7%	61.5%
Franklin/Highland Lake	15,308	85.9%	80.7%	3.2%	9.6%	69.5%
New York/Newark (NY/NJ/CT) (NJ Portion)	2,446,993	90.9%	62.0%	1.7%	6.6%	49.6%
Philadelphia (PA/NJ/DE/MD) (NJ Portion)	457,345	92.9%	73.6%	1.4%	4.6%	61.2%
Trenton	117,802	90.3%	65.7%	1.5%	8.6%	47.8%
Twin Rivers/Hightstown	23,900	95.6%	72.9%	1.0%	5.0%	51.6%
Villas	48,750	46.5%	70.7%	5.4%	6.7%	52.7%
Vineland	37,092	91.7%	65.5%	1.8%	6.5%	62.1%
New Jersey (statewide)	3,563,130	89.4%	65.6%	1.8%	6.7%	53.7%

Sources: (U.S. Census Bureau, 2015r)

Property Values

Property values have important relationships to both the wealth and affordability of communities.

Table 10.1.9-11 provides indicators of residential property values for New Jersey and compares these values to values for the East region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015n).

The table shows that the median value of owner-occupied units in New Jersey in 2013 ($307,700) was higher than the corresponding values for the East region ($249,074) and the nation ($173,900).

Table 10.1.9-11: Residential Property Values in New Jersey, 2013

Geography	Median Value of Owner-Occupied Units
New Jersey	$307,700
East Region	$249,074
United States	$173,900

Source: (U.S. Census Bureau, 2015q)

Table 10.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Only two areas (Twin Rivers/Hightstown and the New Jersey portion of New York/Newark) had median values higher than the state median value. All other population concentrations had property values considerably below the state value. This indicates that the New York/Newark area (New Jersey portion) dominates the state median value due to its size and high MHI. The lowest values were in the same two areas – Bridgeton and Vineland – that had the lowest median household incomes (Table 10.1.9-6).

Table 10.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in New Jersey, 2009–2013

Area	Median Value of Owner-Occupied Units
Atlantic City	$255,900
Bridgeton	$145,600
Browns Mills/Fort Dix	$197,300
Franklin/Highland Lake	$247,000
New York/Newark (NY/NJ/CT) (NJ Portion)	$366,500
Philadelphia (PA/NJ/DE/MD) (NJ Portion)	$224,600
Trenton	$255,300

Area	Median Value of Owner-Occupied Units
Twin Rivers/Hightstown	$394,800
Villas	$272,000
Vineland	$172,300
New Jersey (statewide)	$327,100

Source: (U.S. Census Bureau, 2015r)

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes[138] are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 10.1.9-13 presents total and selected state and local government revenue sources as reported by Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure. General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 10.1.9-13 shows that New Jersey state and local governments in 2012 received less total revenue on a per capita basis than counterpart governments in the region, and more than counterparts in the nation. New Jersey state and local governments had lower levels of intergovernmental revenues[139] from the federal government than their counterparts elsewhere. The New Jersey state government obtained significantly less revenue per capita from property taxes compared to state governments in the region and nation, and New Jersey local governments received considerably more. General sales tax revenues per capita were higher for the New Jersey state government compared to state governments in the region and the nation, while New Jersey local governments received no revenue from general sales taxes. Selective sales tax revenue was roughly similar on a per capita basis for the state governments in New Jersey, the region, and the nation. Selective sales taxes and public utility tax revenues for New Jersey local governments were lower per capita compared to other local governments in the region and

[138] Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006).
[139] Intergovernmental revenues are those revenues received from the federal government or other government entities such as shared taxes, grants, or loans and advances.

nation. Individual and corporate income tax revenues per capita for the New Jersey state government were similar to such revenues for other state governments in the region, and higher than those for other state governments in the nation. There were no revenues from individual or corporate income taxes for New Jersey local governments.

Table 10.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		New Jersey		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$57,582	$46,976	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$6,496	$5,299	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$13,413	$1,058	$135,435	$20,289	$514,139	$70,360
	Per capita	$1,513	$119	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$11,992	$0	$120,274	$0	$469,147
	Per capita	$0	$1,353	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$657	$0	$9,810	$0	$19,518	$0
	Per capita	$74	$0	$134	$0	$62	$0
Property Taxes	($M)	$6	$25,880	$2,215	$144,319	$13,111	$432,989
	Per capita	$1	$2,919	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$8,100	$0	$49,123	$15,874	$245,446	$69,350
	Per capita	$914	$0	$671	$217	$782	$221
Selective Sales Taxes	($M)	$3,910	$161	$38,070	$5,996	$133,098	$28,553
	Per capita	$441	$18	$520	$82	$424	$91
Public Utilities Taxes	($M)	$958	$55	$4,314	$2,261	$14,564	$14,105
	Per capita	$108	$6	$59	$31	$46	$45
Individual Income Taxes	($M)	$11,128	$0	$102,813	$18,838	$280,693	$26,642
	Per capita	$1,255	$0	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$1,929	$0	$14,112	$6,733	$41,821	$7,210
	Per capita	$217	$0	$193	$92	$133	$23

Sources: (U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t)

Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

10.1.10 Environmental Justice

10.1.10.1 Definition of the Resource

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (See Section 1.8.11). The fundamental principle of environmental justice as stated in the EO is, "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (Executive Office of the President, 1994). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (DOC, 2013).

In 1997, the Council on Environmental Quality (CEQ) issued *Environmental Justice: Guidance under the National Environmental Policy Act (NEPA)* to assist federal agencies in meeting the requirements of the EO (CEQ, 1997). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015d) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015e).

The CEQ guidance provides several important definitions and clarifications that this Draft PEIS utilizes:

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau (Census Bureau).
- Environmental effects include social and economic effects. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997)

10.1.10.2 Specific Regulatory Considerations

New Jersey's Environmental Justice policy, *State of New Jersey Executive Order #96*, was established in 2004. The policy requires government agencies involved in actions that may impact environmental quality and public health to "provide meaningful opportunities for involvement to all people regardless of race, color, ethnicity, religion, income, or education level" (State of New Jersey, 2004; State of New Jersey, 2007). The Office of Environmental Justice within the New Jersey Department of Environmental Protection (NJDEP) is responsible for overseeing Environmental Justice concerns and ensuring fair treatment of vulnerable communities throughout the decision-making process (NJDEP, 2013c).

The policy also created two advisory bodies, the Environmental Justice Task Force and the Environmental Justice Advisory Council, to assist NJDEP in implementing the Environmental Justice program. The Environmental Justice Task Force ensures interagency collaboration to address environmental justice concerns (State of New Jersey, 2004). The Environmental Justice Advisory Council (EJAC) makes strategic recommendations regarding communication and outreach mechanisms as well as law and policies to ensure that "all communities, regardless of their racial, ethnic, or economic composition, are entitled to equal protection from the consequences of environmental hazards" (NJDEP, 2013d). The policy allows and encourages a community to file a petition with the Task Force to address potential environmental health concerns (State of New Jersey, 2004).

In addition, the New Jersey Environmental Justice program:

- "Champions urban redevelopment and revitalization;
- Aids in the development and/or implementation of department policy, regulations, and procedures to increase opportunities for meaningful public participation and to address potential environmental justice concerns;
- Aids in health tracking and environmental data analysis;
- Informs community members of opportunities for public participation;
- Acts as a community liaison to amplify community concerns within the department;
- Conducts outreach and educational efforts to municipalities and community-based organizations;
- Streamlines access to information to effectuate meaningful involvement in state level environmental decision-making;
- Fosters partnerships to increase involvement in environmental decision-making at all levels of government." (NJDEP, 2013c)

10.1.10.3 Environmental Setting: Minority and Low-Income Populations

Table 10.1.10-1 presents 2013 data on the composition of New Jersey's population by race and by Hispanic origin. The state's population has higher percentages of individuals who identify as Asian (9.0 percent) or Some Other Race (6.5 percent) than the populations of the East region and the nation. (Those percentages are, for Asian, 5.8 percent and 5.1 percent respectively; and for Some Other Race, 4.8 percent and 4.7 percent respectively.) The state's population of persons identifying as White (68.2 percent) is somewhat smaller than that of the East region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in New Jersey that identifies as Hispanic (18.9 percent) is considerably larger than in the East region (12.2 percent), and somewhat higher than in the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. New Jersey's All Minorities population percentage (42.7 percent) is considerably higher than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 10.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for New Jersey (11.4 percent) is lower than that for the East region (13.3 percent) and considerably lower than that for the nation (15.8 percent).

Table 10.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
New Jersey	8,899,339	68.2%	13.7%	0.2%	9.0%	0.0%	6.5%	2.4%	18.9%	42.7%
East Region	73,558,794	72.1%	14.4%	0.3%	5.8%	0.0%	4.8%	2.7%	12.2%	34.0%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

Source: (U.S. Census Bureau, 2015u)

"All Minorities" is defined as all persons other than Non-Hispanic White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 10.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
New Jersey	11.4%
East Region	13.3%
United States	15.8%

Source: (U.S. Census Bureau, 2015v)

10.1.10.4 Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix D, Environmental Justice Methodology, presents the methodology used in this Draft PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices used for environmental justice analysis. It uses data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 10.1.10-1 visually portrays the results of the environmental justice population screening analysis for New Jersey. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x; U.S. Census Bureau, 2015y; U.S. Census Bureau, 2015z) and Census Bureau urban classification data (U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2016b).

Figure 10.1.10-1 shows that New Jersey has many areas with High Potential for environmental justice populations. Notable concentrations of such areas occur in the New Jersey portion of the New York/Newark area and in the Twin Rivers/Hightstown and Trenton areas. There are multiple pockets of High Potential for environmental justice populations in the New Jersey portion of the Philadelphia area, and scattered pockets of High Potential in the southern and central portions of the state. Areas of Moderate Potential for environmental justice populations are distributed throughout the state. The northwest and south-central portions of the state have large areas with Low Potential for environmental justice populations.

It is important to understand how the data behind Figure 10.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show Moderate or High Potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 10.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the Moderate Potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier off the methodology of this Draft PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to NEPA criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). The Environmental Consequences section (Section 10.2.10) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

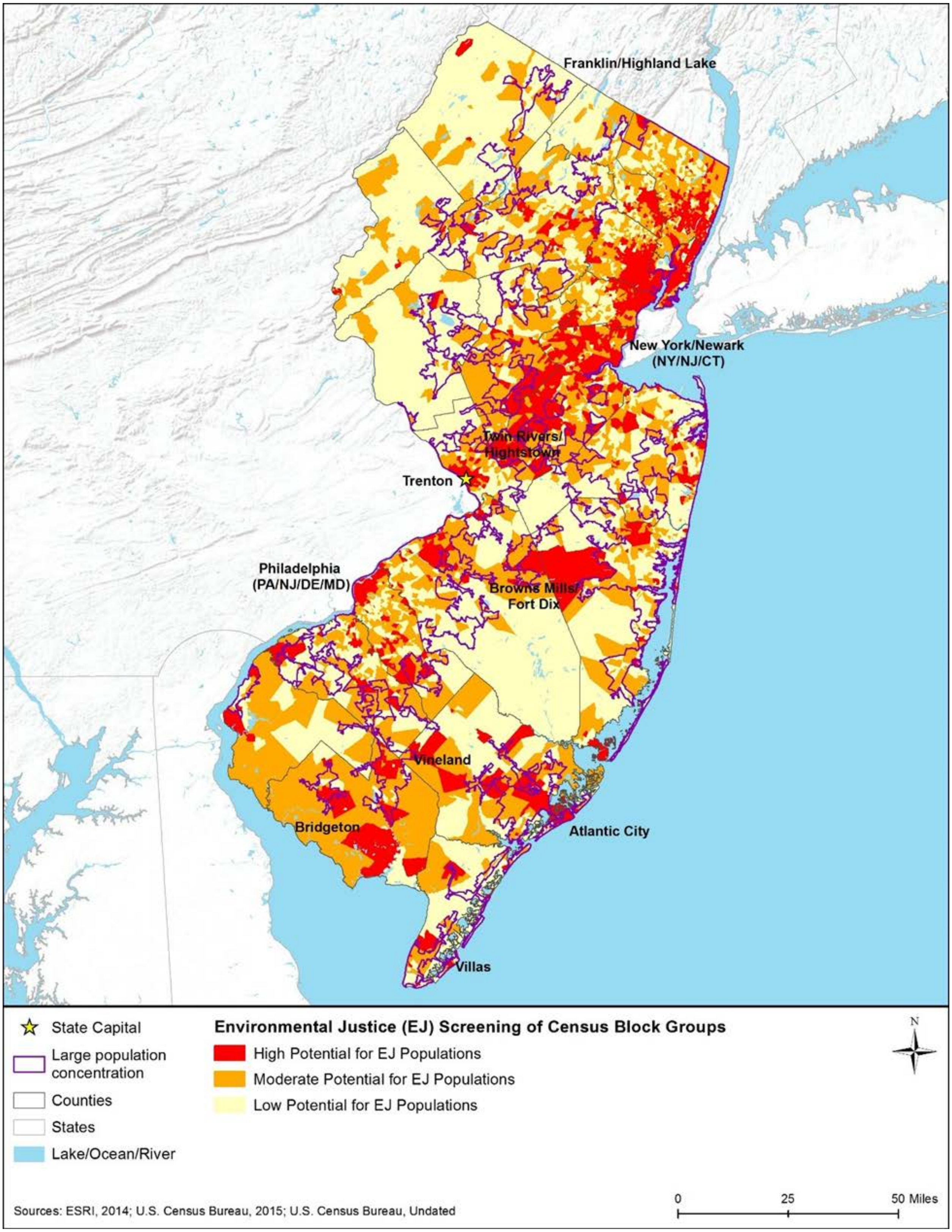

Figure 10.1.10-1: Potential for Environmental Justice Populations in New Jersey, 2009–2013

10.1.11 Cultural Resources

10.1.11.1 Definition of Resource

For the purposes of this Draft PEIS, Cultural Resources are defined as:

> Natural or manmade structures, objects, features, locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance and any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

This definition is consistent with how cultural resources are defined in the:

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2014c); and
- The Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

10.1.11.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 10.1.11), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

New Jersey has a state law that parallels the NHPA (refer to Table 10.1.11-1). However, federal laws and regulations supersede state laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 10.1.11-1: Relevant New Jersey Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
New Jersey Register of Historic Places Act Rules, N.J.A.C. 7:4	SHPO	This act establishes review procedures to ensure protection of state-listed historic resources during state and local government actions. “Projects which may impact New Jersey Register listed properties must have prior written authorization from the Commissioner of the Department of Environmental Protection.” (New Jersey Historic Preservation Office, 2008)

10.1.11.3 Cultural and Natural Setting

New Jersey has been inhabited by human beings for more than 12,000 years (Bolton, 1971; Stanzeski, 1998; Haynes, Donahue, Jull, & Zabel, 1984; Pauketat, 2012; Archaeological Society of New Jersey, 2015). The majority of New Jersey's early human habitation evidence is from the study of archeological sites of pre-European contact and historic populations. In many cases, archeological data are the only information available about the state's early peoples and places.

Archeological sites within the state can be found in a wide variety of settings, from forests and flood plains to waterways and mountaintops. There are also many "resource procurement sites" or areas where the activity appears to have consisted of a single action lasting for perhaps just a few hours, such as hunting sites that typically identify where animals were killed and butchered or well-established waterfront locations where groups of people gathered for a limited time on a regular basis to catch and prepare fish and shellfish (Archaeological Society of New Jersey, 2015).

Evidence at most archeological sites in New Jersey is found in relatively shallow deposits, within one to two feet of the surface. However, in some cases, natural factors have buried sites beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. These deposits can range between one and ten feet below the current surface, with older sites in the deeper sediments. Disturbed ground, including urban areas, may contain archaeological resources in deeper or shallower strata than undisturbed areas (Harris, 1979).

Archeological sites discovered in urban areas have strong potential to yield important information about a community's settlement and growth. For instance, a site in Atlantic City, excavated between 1960 and 1979 (Site 28AT10), represents some of the earliest inhabitants of the state. The artifacts from the Early Paleoindians to Late Paleoindian occupation, some of the earliest inhabitants of the state. Another Paleoindian site along Absecon Creek (between Absecon Bay and Atlantic City) is in tidal marshes with deep overfill of dirt, which represents a period when early man first harvested mussels, periwinkle, fiddler crab, and other types of marsh plants and animals (Stanzeski, Atlantic City Site 228AT105: A Paleo-Indian Site on the Present Day Coast of New Jersey, 2005).

Archaeologists typically divide large study areas into regions, based on the environment that early humans occupied. As described in Section 10.1.3, New Jersey is divided into several physiographic regions and provinces. The major New Jersey regions are the Appalachian Highlands and Atlantic Plain. The Appalachian Highlands is further divided into three physiographic provinces: Highlands, Piedmont, and Valley and Ridge. The Atlantic Plain Region has a single physiographic province, the Coastal Plain. By understanding the characteristics of the study area's physiographic regions and provinces, archaeologists are able to discern what types of sites may be present based on previous research of prehistoric (Stone Age) people that occupied the area.

There are three distinct periods associated with the prehistoric human populations of New Jersey and the greater northeast geography of North America: The Paleoindian period (12,000 to 10,000

B.C.); Archaic (10,000 to 3,000 B.C.); and Woodland (3,000 B.C. to A.D. 1600). Figure 10.1.11-1 shows a timeline of the periods that represent the evolving culture that existed within this region. Due to continuous research and site investigations in this region, there may be overlaps between phases, and there exists a blending of one period to the next. The dates associated with each period are estimated using either radio carbon dating techniques, or by associating the artifacts discovered with those of similar ones, which have been previously assigned to a particular period (Hoffman, 2006; Stanzeski, 1998; Pauketat, 2012; Institute of Maritime History, 2015).

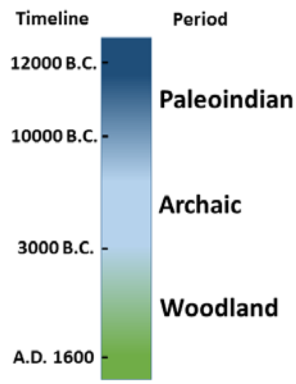

Figure 10.1.11-1: Timeline of Prehistoric Human Occupation

Source: (Pauketat, 2012; NJDEP, 2015v; Institute of Maritime History, 2015)

Paleoindian Period (12,000 - 10,000 B.C.)

Evidence of early man in New Jersey is based on the discovery of fluted points that have been scattered on the land, a few small prehistoric campsites, and other more prominent sites at various sites in New Jersey. One example is the Logan Site (28BU214), which was used by transient bands that probably occupied this area during seasonal changes such as in winter. Artifacts found include tools such as end scrapers, cutters, choppers, and hammerstones. The Steel Site (28CM42) in Cape May County is a Paleoindian and Early Archaic site that represents a micro-band of early settlers. These were likely campsites, occupied for perhaps a day or two only, where there was working of bone for tools, cutting, and scraping soft materials (e.g. hides) and the gathering and processing of acorns (Stanzeski, 1998; Stanzeski, 2005). Based on evidence acquired from these sites, Paleoindians were highly nomadic and lived in small groups. As hunters and gatherers, they used a small inventory of chipped-stone tools known as "fluted javelin head" spear points or Clovis form spear point (fluted projectile points). Early hypotheses in American archaeology suggested that the Clovis fluted point was not invented until prehistoric people reached North America and began hunting the large game of that period. However, studies that are more recent show that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002). It has been hypothesized that they formed small bands, which ranged freely and far, following large migratory game such as mastodon, caribou, stag-moose, giant beaver, and California condor, to name a few species (Laub, 2000).

Paleoindian camps appear to have been occupied seasonally, with some sites that may have formed the basis for more permanent settlements. No skeletal remains of these people have been identified to date in the state, so the appearance of these nomadic wanderers is unknown. This group of hunters and gatherers were related to a population of inhabitants that spread into North America via a land bridge at the Bering Strait during the latter part of the last ice age (Laub, 2000; Robinson, 2011). Based on archaeological evidence, technologies such as the Clovis fluted point was not invented until they reached North America. This technology was specifically designed for the hunting of large game of that period (Stanzeski, Four Paleoindian and Early Archaic Sites in Southern New Jersey, 1998; Stanzeski, Atlantic City Site 228AT105: A Paleo-Indian Site on the Present Day Coast of New Jersey, 2005).

The animal (faunal) and plant (floral) life of this region during the Paleoindian Period is yet to be completely understood. As opposed to similar occupation throughout the southwest region of the United States, the archaeological data collected within the New Jersey area and the Northeast United States, in general, is not as reliable. The arid climate in the Southwest lends itself to more well-preserved artifacts that can be dated through radio carbon dating techniques. Although inferences can be made concerning the distribution of these early hunters and gatherers in this region, the data are not as reliable as those in the Southwest (Wissler, 1947; Cross, 1956; Pauketat, 2012; Stanzeski, Atlantic City Site 228AT105: A Paleo-Indian Site on the Present Day Coast of New Jersey, 2005).

Archaic Period (10,000 - 3,000 B.C.)

During the Archaic Period in New Jersey and the greater northeastern portion of North America, people lived in small family based units, commonly referred to as bands. Temperatures were becoming warmer during this period because of the retreating glacial ice sheets, thus allowing for the plants and animals that inhabit this region today to begin to establish themselves. Much like the Paleoindian peoples that preceded them, Archaic Period people were hunter-gathers whose diet consisted of wild plants and animals. They gathered wild vegetable foods, hunted for game, and became very adept in fishing practices. Archaic Period peoples began building basic shelters and expanded on their ability to make stone weapons and stone tools. However, the culture lacked pottery, the smoking pipe, and technology associated with agriculture (Bolton, 1971; Wissler, 1947; Archaeological Society of New Jersey, 2015; Pagoulatos, 2003; Pauketat, 2012).

There are several sites in New Jersey that show evidence of the Archaic Period of North American pre-history. For example, Site 28OC45, in West Creek, NJ, was discovered over 90 years ago, and represents Early Archaic, Middle Archaic, and Late Woodland Periods of occupation. Archaic artifacts include projectile points and scrapers. Woodland pottery and pipe fragments have also been found here (Stanzeski, 1998).

The Archaic Period is divided into three sequential sub-periods: Early (10,000 B.C. to 8,000 B.C.); Middle (6,000 B.C. to 3,000 B.C.) and Late (3,000 B.C. to 1,000 B.C.). The sub-periods are delineated by changing environmental conditions and food resources, and the stages of development of sociocultural traditions resulting from contact with other groups through travel or trade (Bolton, 1971; Wissler, 1947; Pagoulatos, 2003; Pauketat, 2012).

At the beginning of the Archaic Period, the forests of New Jersey were dominated by trees that thrived in cold climates, such as spruce, pine, and hemlock. Deciduous trees, such as oak, chestnut, and maple were beginning to encroach from the south. These changes in weather and vegetation patterns provided the opportunity for human beings to expand their occupations throughout the continent to include the greater northeast and New Jersey (Pagoulatos, 2003).

Early Archaic groups were small bands of hunters and gathers that were scattered throughout the northeast exploiting whatever natural resources they could find. Their tools were much like those used during the late Paleoindian period. They used scrapers, chipped and polished adzes, varying forms of projectile points, and other stone tools. Throughout the northeast, there are few discovered Early Archaic sites, but based on the ones known, the people were probably living a nomadic life style, staying in places for short periods in small camps. Seasonal campsites were also used during the colder months as well. As previously mentioned, the Steel Site (28CM42) in Cape May County is a Paleoindian and Early Archaic site that represents use by a micro-band of early settlers. These campsites were probably short-term settlement locations for the purpose of hunting and gathering activities (Stanzeski, 1998; Pauketat, 2012; Pagoulatos, 2003).

The Middle Archaic culture began continued developing instruments as choppers, narrow-bladed projectile points, beveled adzes, and various other small tools and pendants. The inhabitants had not developed very sophisticated food storage techniques during this period, so this may have resulted in an abundance of food during the warmer months and shortages of food during the colder months. This may have caused a cultural shift to a more sedentary life style during times of abundance and a more nomadic lifestyle during the leaner winter months (Archaeological Society of New Jersey, 2015) (Bolton, 1971) (Pauketat, 2012) (Pagoulatos, 2003).

Archaeological evidence suggest that by the Middle Archaic Period, the climate in New Jersey had changed significantly enough to support a more deciduous forest environment, and ecological conditions were much like those that exist today, with minor floral and faunal variations. The region was now teaming with wild game, fowl, edible nuts, berries, tubers, roots, and various herbs, all of which could have supported larger populations of semi-nomadic peoples (Pauketat, 2012; Pagoulatos, 2003).

Much like the Early Archaic Period, there is little archaeological evidence about how inhabitants lived. Many of the coastal sites that may have contained thriving communities of semi-nomadic peoples have been subsequently submerged underwater by rising sea levels. Tools such as the atlatl javelin[140] have been recovered within this region suggesting a more technologically advanced culture was beginning to emerge. Other stone and bone tools associated with the

[140] The atlatl javelin was a spear-throwing device, which had a fashioned stone weight. The weight was placed on a narrow board, which works like a lever, and the device projected out behind the throwing hand a foot or more, permitting the javelin resting into its end to be hurled with greater force and precision.

Middle Archaic Period are grooved and shaft abraders (scrapers), ovate and triangular knives, ulus (women's knives), sinewstones (stone for rubbing strips of sinew to soften them in preparation for use as bow strings or string for lashing or tying objects), drills, scrapers, and choppers. Woodworking tools such as gouges, celts, and adzes suggest probable use for the construction of shelters, dugout boats, household utensils, and other personal ornaments or ceremonial objects (Bolton, 1971; Wissler, 1947; Pauketat, 2012).

By 3000 B.C., hardwood forests dominated this region of North America and the subsistence base included white tail deer, black bear, and an abundance of small game animals Aquatic and wild vegetable food sources were also thriving within this region. The warmer climate, and abundance and variety of food sources, gave rise to population increases, either through new migration of extant groups within the region, via an increase of indigenous populations, or both (Tuck 1971, Ritchie and MacNeish 1949).

By the Late Archaic Period, the climate and culture of the settlers of this region were changing significantly. People were starting to live a more sedentary lifestyle, scheduling their movements, manufacturing more elaborate tools, developing more sophisticated social structures, and trading. For example, native groups living within the Delaware Valley created formalized exchange or trade networks both within and with neighboring groups (Lattanzi, 2007).

The Terminal Archaic Period is a transitional stage from the Archaic to the Woodland, and the archaeological record shows that people were using broad spearheads that were useful in coastal environments for harpooning sturgeon and other large fish (Lavin, 1988; Archaeological Society of New Jersey, 2015). Several archaeological sites for this period have been discovered around marshes and coastal/riverine environments. Shellfishing appears to have been a major subsistence occupation that developed during this time and continued into the Woodland Period (Lightfoot & Cerrato, 1988; Lavin, 1988; Archaeological Society of New Jersey, 2015).

Woodland Period (3,000 B.C. – A.D. 1600)

The Woodland Period was approximately 3,000 B.C. to A.D. 1600 in New Jersey. Similar to the Archaic Period, the Woodland Period is divided into three sequential sub-periods: Early, Middle, and Late. The sub-periods are defined by cultural differences that can be distinguished by their temporal (place in time) location and adaptive details that come from close scientific examination. During the Early Woodland Period, there is a gradual shift from a semi-nomadic lifestyle, which rapidly moved to a system primarily based on horticulture by the Late Woodland Period. The Woodland Period in general is characterized as the period in which homes were established along rivers and trade exchange systems and burial systems were employed (Bolton, 1971; Archaeological Society of New Jersey, 2015).

Hunting and fishing remained the predominant form of subsistence during the Early Woodland Period. Some variations in the tools that were previously used during the Archaic Period begin to be noticed in such artifacts as chipped stone, bone groundstone, and some copper tools. The main technology that differentiates the Woodland Period from previous periods is the development of the first significant use of pottery, which began to appear in large quantities.

Also, the presence of ceremonial objects and artifacts such as gorgets (a piece of armor protecting the throat), birdstones (abstract stone carving), smoking pipes, and copper ornaments began to appear in the archaeological record (Lattanzi, 2007; Bello, 2001; Pauketat, 2012).

The main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which originated in the Southeastern United States during the late Archaic Period and spread northward to New Jersey and elsewhere (Sassaman, 1998). The Middle Woodland Period is distinguished by the development of classic Woodland styles of stamped or impressed pottery:-dentate, pseudo-scallop-shell, rocker-stamped (dentate and plain varieties) and cord-ornamented. These artifacts can be attributed to an apparent center in the Upper Great Lakes region, and are evidence of migration and trade. Artifacts such as the elbow pipe and the platform pipe are associated with the practice of mortuary ceremonialism. These pipe artifacts are associated with the Hopewellian mound building complex (Archaeological Society of New Jersey, 2015; Bello, 2001).

The Middle Woodland Phase is generally associated with a variety of plain and decorated ceramic types as well as numerous lithic and bone tool types. Shellfishing became more important economic pursuit along the coast, while rudimentary horticulture began to make a significant contribution to the diet of the local populations. The wide range of burial practices, the use of exotic materials as grave goods, and the presence of artifact types, which are typically associated with a sedentary patterns of existence, represent a transition to a drastically different form of livelihood for the peoples of this region (Bello, 2001).

Beginning around 1000 B.C., the archaeological record reveals a drastic change in cultural lifestyle for the people in New Jersey. Pottery of traditional classic Woodland lineage underwent progressive modifications, as did pipe styles derived from the straight and elbow forms. This period is denoted distinctively by an increased dependence on horticulture, especially as it relates to the introduction of corn, maize, beans, and squash. This change in diet resulted in a major shift in settlement patterns of the people of this region. Large villages began to emerge, and later during this period, they were protected by palisades, containing a sessile or semi-sedentary population that dwelled together in communally in what became to be known as “longhouses.” The Late Woodland period represents the extinction of the practice of mortuary ceremonialism, which was waning already throughout the Middle Woodland period. One burial site that represents the late woodland period contains a small tobacco pipe of which only the bowl was preserved. The pipe is five centimeters, contains a ring of dots impressed below the rim, and below that has three raised bands. The pipe is an obtuse-angle form called “trumpet” and made of buff clay (Bello, 2001).

10.1.11.4 Federally Recognized Tribes of New Jersey

According to the Bureau of Indian Affairs and the National Council of State Legislators office, there are no federally recognized tribes in New Jersey. Figure 10.1.11-2 below shows that the Native Americans that have been associated with this region. (National Conference of State Legislatures, 2010) (Bureau of Indian Affairs, 2015)

10.1.11.5 Significant Archaeological Sites of New Jersey

Based on a search of the National Park Service's database, there are currently eight archaeological sites listed on the NRHP for the state of in New Jersey.

New Jersey State Cultural Resources Tools and Databases

New Jersey State Historical Preservation Office (SHPO)

The New Jersey State Historical Preservation Office (SHPO) website hosts a number of resources for conducting further research on the pre-history of the state. Services and information that is available are Historic Preservation Office contact information, how to protect historic properties, information on tax incentives for preserving historic sites and buildings, information on cemeteries, information on the discovery of human remains, a historic property research center, a link to the National Register of Historical Places website, a preservation help center, guidelines on conducting archaeological and historical surveys in New Jersey, and information on preservation planning.

Archaeological Society of New Jersey (ASNJ)

The Archaeological Society of New Jersey (ASNJ) was established in 1931 to educate and help protect the many know and undiscovered historic and prehistoric archaeological sites in the state of New Jersey. The website makes available a wide variety of materials for those concerned about potential impacts to archaeological resources across the state. Resources include a timeline of the prehistoric and historic past of New Jersey, a lending library for conducting research. There are links to the Society of American Archaeology, Society for Historical Archaeology, Society for Industrial Archaeology, Eastern States Archaeological Federation, Middle Atlantic Archaeological Conference, and Council for North Eastern Archaeology

Below is a table showing the names of the sites, the city they are closest to, and type of site it is. Both prehistoric and historic archaeological sites are listed in Table 10.1.11-2. Based on the relative location of the sites listed within the table, there is a high probability that other previously unknown sites in their vicinity may be present, especially in areas that have not been previously disturbed. A complete listing of NRHP sites can be found on the National Parks Service NRHP website at http://www.nps.gov/nr/ (NPS, 2014e).

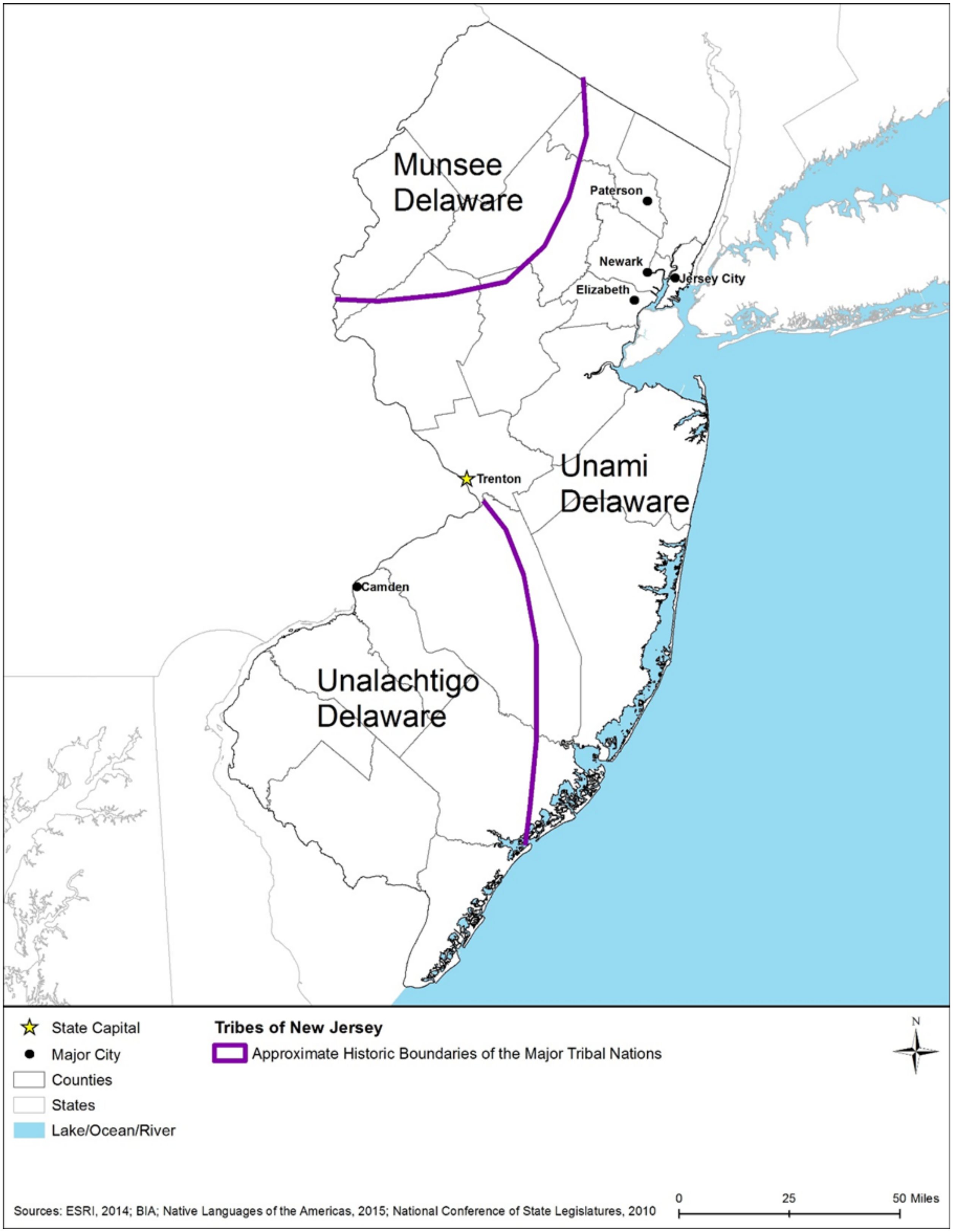

Figure 10.1.11-2: Native American Tribes in New Jersey

Table 10.1.11-2: Archaeological Sites on the National Register of Historic Places in New Jersey

Location (closest city)	Site Name	Type of Site
Trenton	Abbott Farm Archeological Site	Prehistoric
New Gretna	Bead Wreck Site	Historical (Shipwreck)
Vernon Township	Black Creek Site--28SX297	Historic - Aboriginal, Industry, Prehistoric
Long Branch City	Chauncy Jerome Jr. Shipwreck Site	Historical (Shipwreck)
Bordentown	Crosswicks Creek Site III	Prehistoric
Cape May	(USCS) Robert J. Walker (1844)	Historical (Shipwreck)
Highland Park	Raritan Landing Archeological District	Historic
Highland Park	Raritan Landing Archeological District (Boundary Increase)	Historic

Source: (NPS, 2014e)

10.1.11.6 Historic Context

New Jersey was settled by Europeans in the early 17th century as a part of the colony of New Netherlands. At the same time, Swedish settlers established New Sweden around the border of New Jersey and Delaware. England took control of New Jersey in 1664; however, the spread of different immigrant populations continued to impact architecture throughout the colony. "For a generation New Jersey was split into two proprietary colonies, East and West Jersey…(but) the two provinces were reunited into the royal colony of New Jersey in 1702" (New Jersey Historic Preservation Office, 2014). While industries such as ironworking were important, New Jersey developed as an agricultural colony. Early barns and agricultural structures still exist; however, architecture from the Colonial Era and early statehood is rare (New Jersey Historic Preservation Office, 2014).

"From 1776 through 1782, New Jersey can be fairly labeled as the crossroads of the American Revolution. With the British army headquartered in New York (and a major part of it in Philadelphia in 1777 to 78), military action in New Jersey was a constant activity" (New Jersey Historic Preservation Office, 2014). Several sites associated with the American Revolution still exist and serve as drivers of heritage tourism. These resources include the sites of major battlefields, such as Monmouth and Princeton Battlefields; shipwrecks in the surrounding waterways; and "Morristown, the sites of General Washington and the Continental army's winter encampment of December 1779 to June 1780" (New Jersey Historic Preservation Office, 2014).

During the early 19th century, New Jersey was still primarily rural, with much of its population engaged in agriculture. The transportation improvement movement, which began in the late 18th century, improved roads and affected settlement patterns. The expansion of steamboat technology (pre-1812), canals (1820s), and railroads (1830s) led to the urbanization of areas exposed to these new technologies. Much like surrounding states, New Jersey experienced an influx of Irish immigrants who worked as laborers constructing the railroads and canals (New Jersey Historic Preservation Office, 2014).

Northern and southern New Jersey remained different for much of the 19th century, with railroads not reaching the southern part of the state until the conclusion of the Civil War. While glass making and bog iron production facilities were in the south due to the presence of large forests that fueled production, most industries were in the northern part of the state. In 1854, Atlantic City was established after the Camden & Atlantic Railroad reached the coast. Southern New Jersey included multiple African Americans communities dating to before the Civil War, as slaves from Maryland, Delaware, and Virginia sought refuge in the state (New Jersey Historic Preservation Office, 2014).

Following the Civil War, New Jersey continued to industrialize, with streetcar suburbs developing towards the end of the 19th century. Railroad expansion changed farming practices, with fruits being grown in rural areas for urban markets and farms becoming increasingly specialized. During World War I (WWI), New Jersey was involved in the production of wartime goods. Road construction grew in importance as the automobile rose in popularity, sparking recreational tourism as remote areas were opened to visitors. During World War II (WWII), New Jersey reprised its role as a manufacturing hub, producing munitions, airplanes, and ships for the war (New Jersey Historic Preservation Office, 2014).

During the second half of the 20th century, New Jersey continued to experience a proliferation of suburban culture. The rapid decline of farms continued as suburbanization efforts sought to meet the demand for increased housing for returning veterans. Today, New Jersey is in the middle of the Northeastern-Mid-Atlantic “megalopolis,” which stretches from Boston to Washington, DC (New Jersey Historic Preservation Office, 2014).

New Jersey has 1,687 NRHP listed sites, as well as 58 NHLs (NPS, 2014f). New Jersey contains one National Heritage Area, the Crossroads of the American Revolution National Heritage Area (NPS, 2015k). Figure 10.1.11-3 shows the location of the NHA and NRHP sites within the state of New Jersey.[141]

[141] See Section 10.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

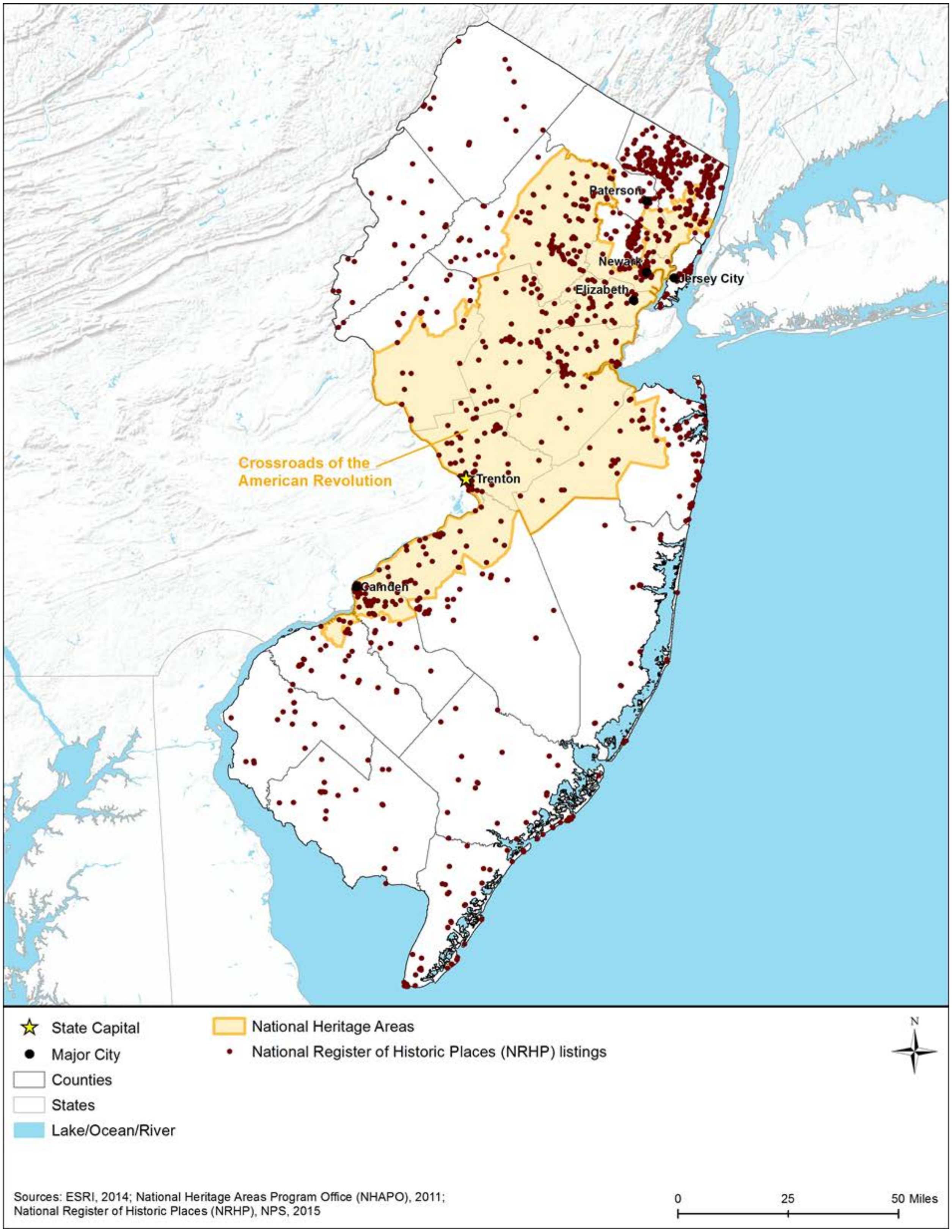

Figure 10.1.11-3: National Heritage Areas (NHA) and National Register of Historic Places (NRHP) Sites in New Jersey

10.1.11.7 Architectural Context

Figure 10.1.11 4 shows representative architectural styles present in New Jersey. Early architecture in New Jersey was reflective of its population. Certain areas of northern New Jersey experienced a Dutch influence, as the area was originally settled by Dutch colonists (New Jersey Historic Preservation Office, 2014). Building styles were similar to New York, including Dutch barns, half doors, and gambrel roofs or gable roofs with a kick (a curved flair that runs along the edge of the roof). Front facing gable structures with stepped gable parapets were built in urban areas (McAlester & McAlester, 2013). Gloucester and Salem Counties were settled by Swedish and Finnish settlers, where Swedish traits like log construction were employed (New Jersey Historic Preservation Office, 2014).

Early buildings would have likely been "earth fast" structures employing post-in-ground construction. This means that framing members were set directly on or into the ground, rather than on a stone foundation. These structures were prone to rot and generally have not survived. Many of the homes that have survived from the Colonial Era are constructed of brick (due to its superior durability), and would have belonged to wealthier colonists. New Jersey's Delaware Valley, one of the first areas of the state to be settled, has many patterned-brick buildings from the Colonial Era. These were often two stories in height, with a side-gabled roof, and featured intricate brick patterning; herringbone or checkerboard were common. New Jersey also has an excellent collection of sites associated with the American Revolution (New Jersey Historic Preservation Office, 2014).

Historic building trends in New Jersey were similar to those found throughout the Mid-Atlantic. Georgian architecture was popular prior to the American Revolution, followed by the Federal style, and then Greek Revival. Following the Civil War, Victorian Era styles such as Gothic Revival and Italianate became popular. During the mid-to-late 19th century, balloon framing became common and ultimately replaced heavy-timber framing. This was facilitated by the mass production of machine cut nails and milled dimensional lumber. African American communities dating to the mid-to-late 19th century exist as well, with some having been nominated as NRHP districts (New Jersey Historic Preservation Office, 2014).

The railroad had a tremendous effect on architecture in New Jersey. In the northeast, the amount of tracks grew dramatically as rail lines competed to reach New York City. Housing density increased, as did urban commercial architecture, resulting in some of the urban architecture that exists today. Suburban communities were made possible by streetcar technology, which allowed growth to expand outwards from urban cores. Factories that were constructed during the late 19th and early 20th centuries were used during WWI and WWII, and some of these structures remain today. Thomas Edison's Laboratory in West Orange, New Jersey is an example of an early factory (New Jersey Historic Preservation Office, 2014).

As the automobile surpassed the train in importance following WWII, automobile oriented suburban housing tracts erupted in popularity as a means to house returning veterans and their families. Communities like Levittown (now Willingboro Township) set the precedent for building housing on a massive scale. Much of New Jersey's traditionally rural landscape was destroyed during this period. Housing styles include Tudor Revival and Colonial Revival prior to WWII, minimal traditional, during the 1940s, and ranch neighborhoods in the 1950s and 1960s. Multifamily housing was common as well, particularly in more densely populated areas. Many of these resources are now potentially eligible for the NRHP, as are military, industrial, and commercial complexes associated with the growth of American corporations and the military industrial complex. Suburban growth into rural areas continues to be a threat to New Jersey's historic resources (New Jersey Historic Preservation Office, 2014).

Figure 10.1.11-4: Representative Architectural Styles of New Jersey

- Top Left – Benjamin P. Westervelt House (Cresskill, NJ) – (Historic American Buildings Survey, 1938)
- Center Left – Atlantic City – (Historic American Building Survey, Undated)
- Top Right – Dickinson House (Alloway, NJ) – (Historic American Buildings Survey, 1936)
- Bottom – Thomas A. Edison Laboratories (West Orange, NJ) – (Historic American Engineering Record, 1986)

10.1.12 Air Quality

10.1.12.1 Definition of the Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[142] of the area, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[143] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[144] This section discusses the existing air quality in New Jersey. The USEPA designates areas within the United States as attainment,[145] nonattainment,[146] maintenance,[147] or unclassifiable[148] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or alternatives.

10.1.12.2 Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_X). The NAAQS are various standards, either primary[149] or secondary,[150] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E.

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated

[142] Topography: The unique features and shapes of the land (e.g., valleys and mountains).

[143] Equivalent to 1 milligram per liter (mg/L).

[144] Averaging Time: "The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard" (USEPA, 2015f).

[145] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015g).

[146] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015g).

[147] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (USEPA, 2015g).

[148] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015g).

[149] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014e).

[150] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014e).

solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

In conjunction with the federal NAAQS, New Jersey maintains its own air quality standards, the New Jersey Ambient Air Quality Standards (NJAAQS). The state air quality standards mimic most NAAQs; however, some NJAAQS are higher than NAAQS (e.g., lead), and were last revised in 1991. NJAAQS do not incorporate either 1997 or 2008 O_3 standards. Table 10.1.12-1 provides an overview of the NJAAQS as defined by NJDEP Administrative Code (N.J.A.C.).

Table 10.1.12-1: New Jersey Ambient Air Quality Standards (NJAAQS)

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		$\mu g/m^3$	ppm	$\mu g/m^3$	ppm	
CO	8-hour	10,000	9	Same as Primary		
	1-hour	40,000	35	Same as Primary		
Lead	3-month	1.5	-	Same as Primary		
TSP[a]	24-hour	260	-	150	-	
	Annual	75	-	60	-	
O_3	8-hour		0.075	Same as Primary		
	1-hour	-	0.12		0.08	Lower than the NAAQS
NO_2	1 year	-	0.05	Same as Primary		Lower than the NAAQS
SO_2	Annual	80	0.03	60	0.02	
	24-hour	365	0.14	260	0.1	
	3-hour	-	-	1,300	0.5	

[a] Total Suspended Particulate Matter

Source: (NJDEP, 1991)

Title V Operating Permits/State Operating Permits

New Jersey has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2015h). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015h). New Jersey requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 10.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014d).

Table 10.1.12-2: Major Air Pollutant Source Thresholds

Any Pollutant	100 Tons per Year (TPY)
Single HAP	10 TPY
Total/Cumulative HAPs	25 TPY

Source: (USEPA, 2014d)

Exempt Activities

NJDEP designated select activities and sources as exempt from the operating permit requirements. However, these activities would still need to be considered in NEPA analyses and General Conformity applicability determination. According to N.J.A.C. 7:27-22, an exempt activity means any of the following:

- "The engine of any vehicle, including but not limited to any marine vessel, aircraft, any vehicle running upon rails or tracks, any motor vehicle, any forklift, any tractor, or any mobile construction equipment;
- A storage tank maintained under a pressure greater than one atmosphere provided that any vent serving such storage tank has the sole function of relieving pressure under emergency conditions;
- A fuel cell system of:
  - Any generating capacity size fueled by hydrogen without a fuel processor;
  - Less than 5,000 kilowatts generating capacity fueled by methane; or
  - Less than 500 kilowatts generating capacity fueled by fuels other than hydrogen or methane;
- Equipment at a battery charging station, except at a battery manufacturing plant." (NJDEP, 2015w)

"The following equipment, used at a construction site, is not required to obtain an Air Quality Permit:

- Cranes that have the capability of leaving the construction site (e.g., Mobile Construction Cranes), and the engine that powers that crane
- Portable internal combustion engines, located at the construction site, burning commercial fuels that provide temporary electrical energy specifically and exclusively for construction operations (e.g. lighting, elevators, electric pumps).
- Portable internal combustion engines, located at the construction site, burning commercial fuels that provide temporary mechanical energy specifically and exclusively for construction operations (e.g. pumps, compressors)
- Portable welding equipment and its associate electrical generating engine used specifically and exclusively for construction operations and located at the construction site.
- On-Highway construction vehicles such as dump trucks, font-end loaders etc., used on a construction site." (NJDEP, 2010b)

Temporary Emissions Sources Permits

New Jersey defines a temporary facility as "a major facility which, by design, is intended to be operated at more than one location and which is relocated more than once in five years."

(NJDEP, 2015w). NJDEP may issue an operating permit to an owner or operator of a temporary facility which authorizes operation in more than one location during the term of the operating permit, provided that all locations at which the facility may be operated are listed in the operating permit.

An operating permit issued for a temporary facility shall require the permittee to:

- Comply with all applicable requirements at all locations at which the temporary facility is operated;
- Comply with all other applicable provisions of N.J.A.C. 7:27-22; and
- Provide written notice, received at least 10 days in advance of each change in location.

State Preconstruction Permits

Under N.J.A.C. 7:27-8.3(a), "no person may construct, reconstruct, install, or modify a significant source or control apparatus serving the significant source without first obtaining a preconstruction permit" (NJDEP, 2015x). New Jersey defines a preconstruction permit to be a "permit to construct, install, or alter control apparatus or equipment issued by the [NJDEP] pursuant to N.J.S.A. 26:2C-1 et seq., in particular N.J.S.A. 26:2C-9.2, and implementing rules at N.J.A.C. 7:27-8" (NJDEP, 2015w).

The Chief of the Bureau of Air Permits for the State of New Jersey issued a memorandum containing guidance on what construction equipment requires an air permit to operate. The following equipment, used at a construction site, must obtain an air quality permit from NJDEP for any processing equipment including but not limited to:

- Asphalt production plants, portable or stationary, of any size.
- Cement batch plants, portable or stationary.
- Grinders, screeners, and crushers, which process materials including but not limited wood, concrete, rock, soil, construction demolition waste, etc.
- The engines used to operate the processing equipment in the above bulleted item, if that engine is sized 1 MMBtu/hr or greater.
- Materials-handling equipment used in the operation of the first three bulleted items including but not limited to belt conveyers, buckets elevators, pneumatic conveyors.
- Material storage bins or containers, in excess of 2,000 ft^3 capacity, storing solid materials. (NJDEP, 2010b)

General Conformity

Established under Section 176(c)(4) of the CAA, the General Conformity Rule ensures that the actions taken by Federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality outlined in the state implementation plan (SIP) (USEPA, 2013b). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), Federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis*[151] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 10.1.12-3). All New Jersey counties lie in the Ozone Transport Region (OTR). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 10.1.12-3: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (Volatile Organic Compound [VOC] or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Marginal and Moderate Nonattainment inside an OTR	100
	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
	Maintenance within an OTR	50
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

Source: (U.S. Government Publishing Office, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 10.1.12-3, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 10.1.12-3, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[152], the agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;

[151] Small amount or minimal.
[152] Conformity: Compliance with the State Implementation Plan.

- Show the emissions would be fully offset by implementing reductions from another source in the same area; and
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2010b).

State Implementation Plan (SIP) Requirements

New Jersey's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. New Jersey's SIP is a conglomeration of separate actions taken for each of the pollutants. All of New Jersey's SIP actions are codified under 40 CFR Part 52 Subpart HH. A list of all SIP actions for all six criteria pollutants can be found on NJDEP's website at http://www.state.nj.us/dep/baqp/sip/siprevs.htm (NJDEP, 2015y).

10.1.12.3 Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 10.1.12-1 and Table 10.1.12-4, below, present the nonattainment areas in New Jersey as of January 30, 2015. Table 10.1.12-4 contains a list of the counties and their respective current nonattainment status for each criteria pollutant. The year(s) listed in the table for each pollutant indicate when USEPA promulgated an ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g., $PM_{2.5}$, O_3, and SO_x). Unlike Table 10.1.12-4, Figure 10.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ are merged in the figure and presented as a single pollutant.

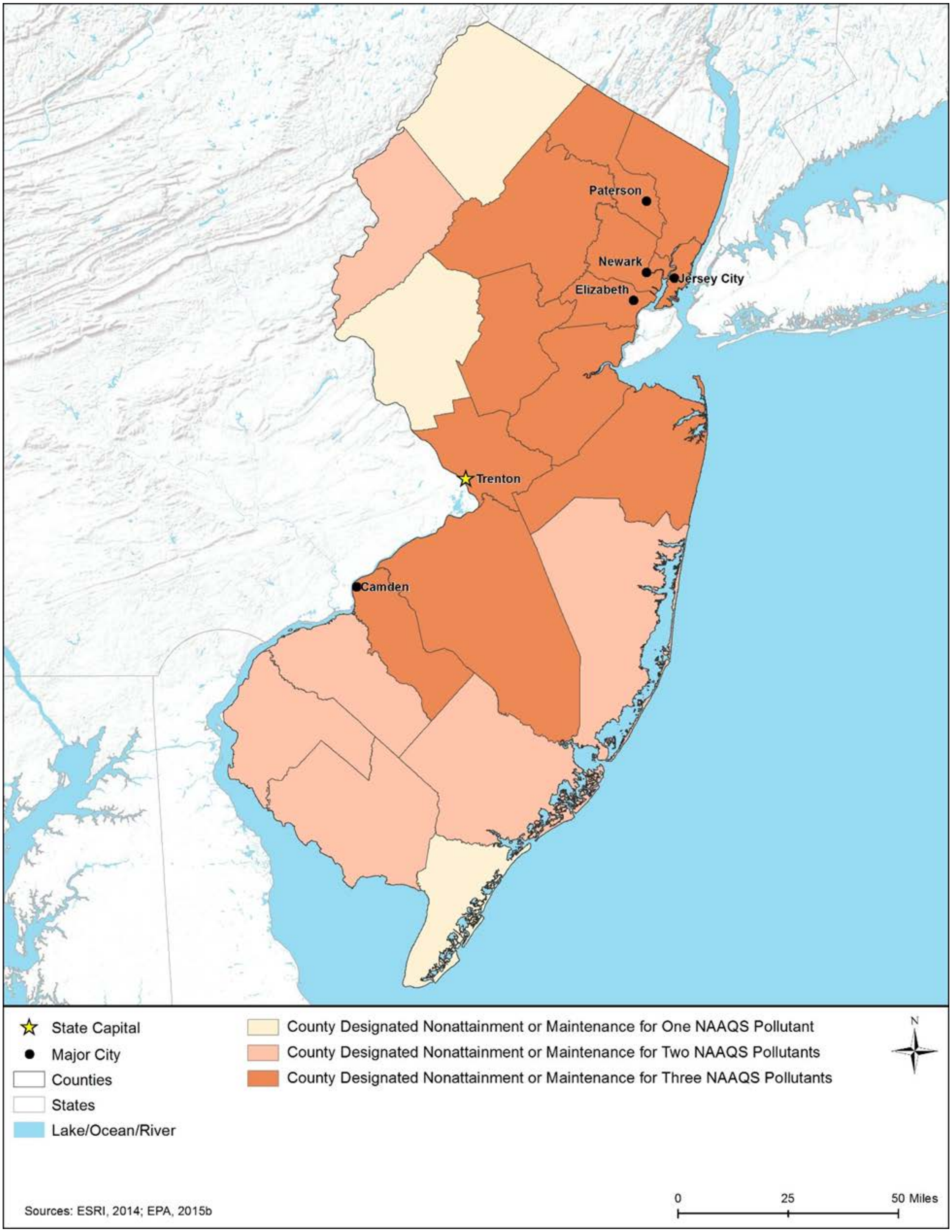

Figure 10.1.12-1: Nonattainment and Maintenance Counties in New Jersey

Table 10.1.12-4: New Jersey Nonattainment and Maintenance Areas by Pollutant and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_X	PM_{10}	$PM_{2.5}$		O_3		SO_X	
	1971	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Atlantic								X-4	X-5		
Bergen	M					M	M	X-4	X-5		
Burlington	M					M	M	X-4	X-5		
Camden								X-4	X-5		
Cape May								X-4	X-5		
Cumberland								X-4	X-5		
Essex	M					M	M	X-4	X-5		
Gloucester						M	M	X-4	X-5		
Hudson	M					M	M	X-4	X-5		
Hunterdon								X-4	X-5		
Mercer	M					M	M	X-4	X-5		
Middlesex	M					M	M	X-4	X-5		
Monmouth	M					M	M	X-4	X-5		
Morris	M					M	M	X-4	X-5		
Ocean	M							X-4	X-5		
Passaic	M					M	M	X-4	X-5		
Salem	M							X-4	X-5		
Somerset	M					M	M	X-4	X-5		
Sussex								X-4	X-5		
Union	M					M	M	X-4	X-5		
Warren								X-4	X-5	X-6	

Source: (USEPA, 2015i)

X-1 = Nonattainment Area (Extreme)
X-2 = Nonattainment Area (Severe)
X-3 = Nonattainment Area (Serious)
X-4 = Nonattainment Area (Moderate)
X-5 = Nonattainment Area (Marginal)
X-6 = Nonattainment Area (Unclassified)
M = Maintenance Area

Air Quality Monitoring and Reporting

NJDEP measures air pollutants at 40 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual New Jersey State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. The NJDEP reports real-time pollution levels of O_3 on their website to inform the public, as O_3 is the main pollutant of concern in New Jersey.

Throughout 2013, there were a total of 10 8-hour O_3 exceedance days. In 2012, there were a total of 23, 8-hour O_3 exceedance days. There were no days in 2012 or 2013 above the 0.12#ppm 1-hour Ozone standard which met the Healthy New Jersey objective (NJDOH, 2014). The 2013 Air Quality Report shows there were zero detections of either CO or TSP above the standards during 2013. New Jersey Annual Air Quality Reports summarize the state's air quality status by pollutant and these reports are available for download from the NJDEP Division of Air Quality website.

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR). These are different from the air quality classification levels defined in Table 10.1.12-1 as part of the NJAAQS. Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (USEPA, 2013c).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (Hawkins, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[153] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[154] (the normal useful range of EPA-approved Gaussian plume models" (USEPA, 1992).

New Jersey contains one Federal Class I area; all other land within the state is classified as Class II area (USEPA, 2012c). The Brigantine Wilderness Area, located in southeastern New Jersey along the Atlantic Coast, is a Class I area approximately 6,603 acres in size. If an action is considered a major source and consequently subject to PSD requirements, the air quality impact analysis need only analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 10.1.12-2 provides a map of New Jersey highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses.

[153] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.
[154] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

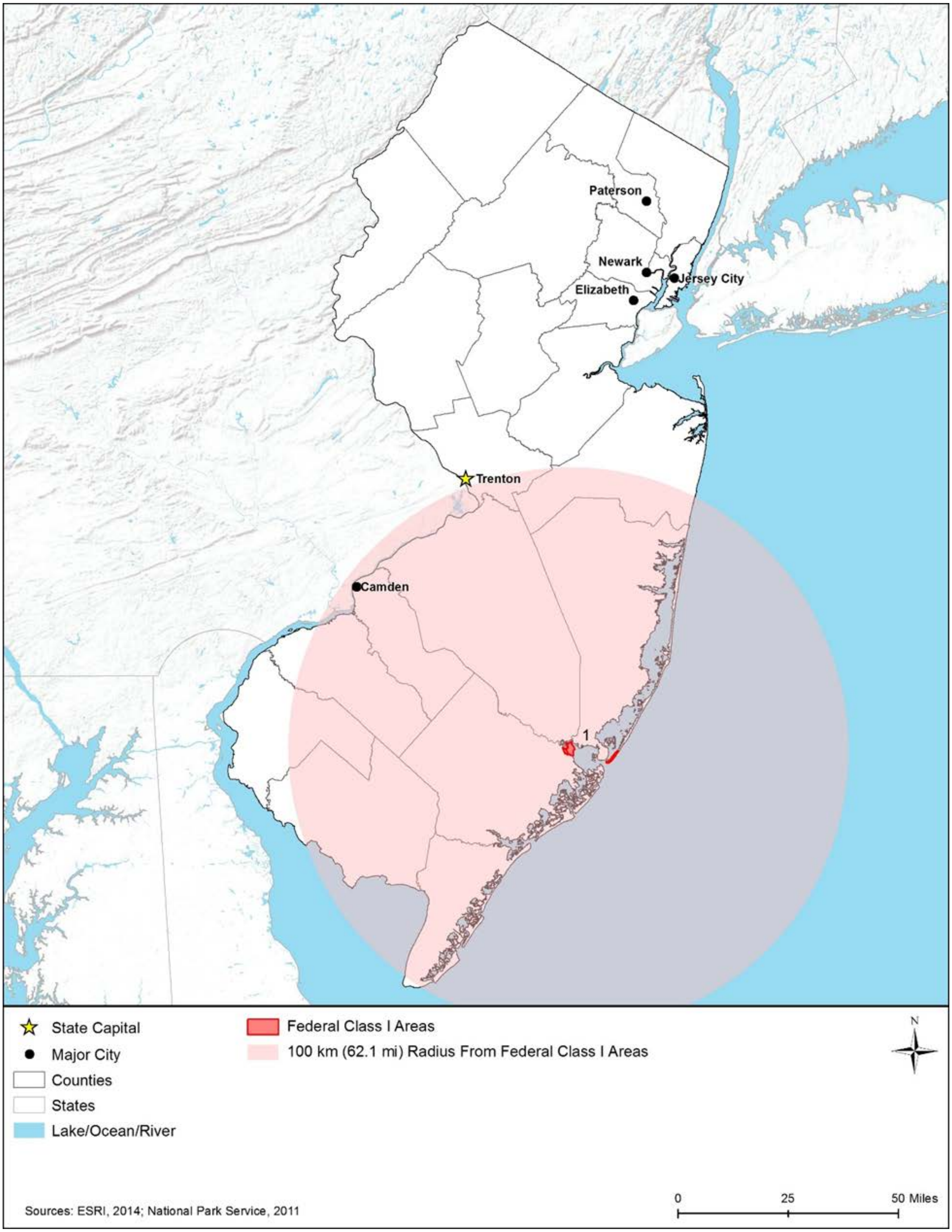

Figure 10.1.12-2: Federal Class I Areas in New Jersey

10.1.13 Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

10.1.13.1 Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012d). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety.

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain"). The normal audible frequency range is approximately 20 Hz to 20 kHz. (FAA, 2015h) The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2013).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (Federal Transit Authority, 2006):

- The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound;
- The total sound energy radiated by a source, usually reported as a sound power level;
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location);
- The duration of a sound; and
- The changes in frequency characteristics or pressure levels through time.

Figure 10.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.

Figure 10.1.13-1: Sound Levels of Typical Sounds

Prepared by: Booz Allen Hamilton, 2005

Source: (Sacramento County Airport System, 2015)

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels is categorized as follows (Federal Transit Authority, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causing an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB (USEPA, 1973). Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

10.1.13.2 Specific Regulatory Considerations

As identified in Appendix C, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, most states have no quantitative noise-limit regulations.

New Jersey has several statewide noise laws (Table 10.1.13-1). In addition, many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Newark, are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011). Table 10.1.13-1 provides an overview of New Jersey's state laws relating to noise.

Table 10.1.13-1: Relevant New Jersey Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Title 7	N.J.A.C.	Provides information and regulations concerning noise control in the state
§ 7:29-1.2	N.J.A.C	Defines highest noise levels not to exceed
§ 7:29-1.3	N.J.A.C	Provides noise levels standards for railroad noise
§ 7:29-1.4	N.J.A.C	Specifies instructions for the installation, usage and testing of stationary emergency devices

Source: (N.J.A.C, 2012)

10.1.13.3 Environmental Setting: Ambient Noise

The range and level of ambient noise in New Jersey varies widely based on the area and environment of the area. The population of New Jersey can choose to live and interact in areas that are large cities, rural communities and National and state parks. Figure 10.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of New Jersey may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to New Jersey. As such, this section describes the areas where the population of New Jersey can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (U.S. Department of the Interior, 2008). The areas that are likely to have the highest ambient noise levels in the state are: Newark, Jersey City, Paterson, Elizabeth, and Edison.

- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In New Jersey, Newark Liberty International (EWR), Atlantic City International Airport (ACY), and Trenton Mercer Airport (TTN) have more than 560,000 annual operations combined, with EWR accounting for approximately 402,000 operations annually (FAA, 2015i). These operations result in increased ambient noise levels in the surrounding communities. See Section 10.1.1, Public Safety Infrastructure, and Figure 10.1.1-1 for more information about airports in the state.

- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015c). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015c). See Section 10.1.1, Public Safety Infrastructure, and Figure 10.1.1-1 for more information about the major highways in the state.

- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (Federal Transit Authority, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (DOT, 2015d). New Jersey has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Newark to New York City, NY; Newark to Philadelphia, PA; and Atlantic City to Philadelphia, PA. There are also a number of other rail corridors that join these major rail lines and connect with other cities (New Jersey Railroads, 2013). See 10.1.1, Public Safety Infrastructure, and Figure 10.1.1-1 for more information about rail corridors in the state.

- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014g). New Jersey has 9 national parks and 11 National Natural Landmarks (National Parks Conservation Association, 2015) (NPS, 2015l). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 10.1.8, Visual Resources for more information about national and state parks for New Jersey.

10.1.13.4 Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014)**.** Most cities, towns, and villages in New Jersey have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors in the New Jersey.

10.1.14 Climate Change

10.1.14.1 Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (IPCC, 2007).

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012e). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e[155]), which equalizes for the

[155] CO2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons

different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units will be in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units will be in MMT CO_2e.

"Global concentrations of these four GHGs have increased significantly since 1750" (IPCC, 2007). "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 has increased from a pre-industrial value of about 715 parts per billion (ppb) to 1774 ppb in 2005. (IPCC, 2007) "Atmospheric concentrations of N_2O increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005" (IPCC, 2007). "Many halocarbons have increased from a near-zero pre-industrial concentrations, primarily due to human activities" (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, will be considered in this Draft PEIS (see Chapter Four, Environmental Consequences). Therefore, to form the baseline against which to assess possible impacts from the Proposed Action, the existing climate conditions in the project area will be described first by state and sub-region, where appropriate, and then future projected climate scenarios will be described by state and sub-region. The discussion will focus on the following climate change impacts: 1) temperature; 2) precipitation; 3) sea level; and 4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

10.1.14.2 Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. New Jersey has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 10.1.14-1, three key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

Table 10.1.14-1: Relevant New Jersey Climate Change Laws and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
Climate Adaptation Task Force (CATF)	State of New Jersey: Department of Environmental Protection Sustainability and Green Energy and Green Energy; and Sustainable Jersey	Identifies the best ways to support local efforts to become more climate resilient. The CATF has developed educational tools to help local governments understand climate change impacts, what climate adaptation is and how it will affect them. These tools include a glossary of climate-related terminology, and a set of New Jersey-specific climate trends and projections. The CATF is also developing risk assessment tools to support local government adaption planning. (NJDEP, 2012c)

of carbon dioxide equivalents (MMTCO2e). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2e$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2015j).

State Laws/Regulations	Regulatory Agency	Applicability
New Jersey Clean Energy Program	State of New Jersey: Department of Environmental Protection Sustainability and Green Energy	Offers a range of incentives and services to New Jersey residents, business owners and local governments to increase energy efficiency and reduce GHG emissions. The Program estimates that it reduces CO_2 by over 400,000 metric tons annually. (NJDEP, 2012d)
Global Warming Response Act	State of New Jersey: Department of Environmental Protection Sustainability and Green Energy	Requires New Jersey to reduce GHG emissions to 1990 levels by 2020, or approximately 20 percent, and by 80 percent below 2006 levels by 2050. (NJDEP, 2012e)

New Jersey is partnering with interested stakeholders to leverage existing resources and attract private sector investment in electric vehicles and other clean vehicle technologies by developing a Clean Fuel Standard. The Clean Fuel Standard is designed to reduce the GHG emission from transportation fuels. New Jersey is also facilitating widespread use of low- and zero-emission vehicles (NJDEP, 2012f). New Jersey is also one of nine states participating in the Regional Greenhouse Gas Initiative (RGGI). RGGI is a CO_2 emissions trading scheme, launched in 2008, which sets an annual cap on CO_2 emissions from power plants over 25 MW capacity within those nine states. The cap for 2015 was set at 88.7 million short tons of CO_2, with an annual reduction of 2.5 percent per year until 2020 (RGGI, 2015).

New Jersey Greenhouse Gas Emissions

Estimates of New Jersey's total GHG emissions vary. The Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level data on emission on CO_2 from fossil fuels by state. In addition, EIA maintains data on other GHGs such as methane (CH_4) and nitrous oxide (NO_x), but these are not broken down by state (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015k). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHG in different ways.

For the purposes of this Draft PEIS, the EIA data on CO_2 emissions from fossil fuels will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH_4, they will be described and cited.

According to the EIA, New Jersey emitted a total of 105.1 MMT of CO_2 in 2013. Transportation was the largest emitter, accounting for almost half of all CO_2 emissions (Table 10.1.14-2) (EIA, 2015c). Annual emissions between 1980 and 2013 are presented in Figure 10.1.14-1. Between 1980 and approximately 2008, New Jersey's GHG emissions gradually increased to a maximum of 37.5 MMT by 2005 where they stabilized and then began to decline. These declines have been led by reductions in emissions from coal by the electric power sector and petroleum products by the transportation sector. New Jersey in 2013 was ranked 16nd among the states for total CO_2 emissions in 2013 (EIA, 2015d), but was 38thth in the U.S. for per-capita CO_2 emissions (EIA, 2015d).

Table 10.1.14-2: New Jersey CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	2.4	Residential	14.7
Petroleum Products	64.8	Commercial	10.5
Natural Gas	37.8	Industrial	9.7
		Transportation	55.8
		Electric Power	14.4
TOTAL	**105.1**	**TOTAL**	**105.1**

Source: (EIA, 2015c)

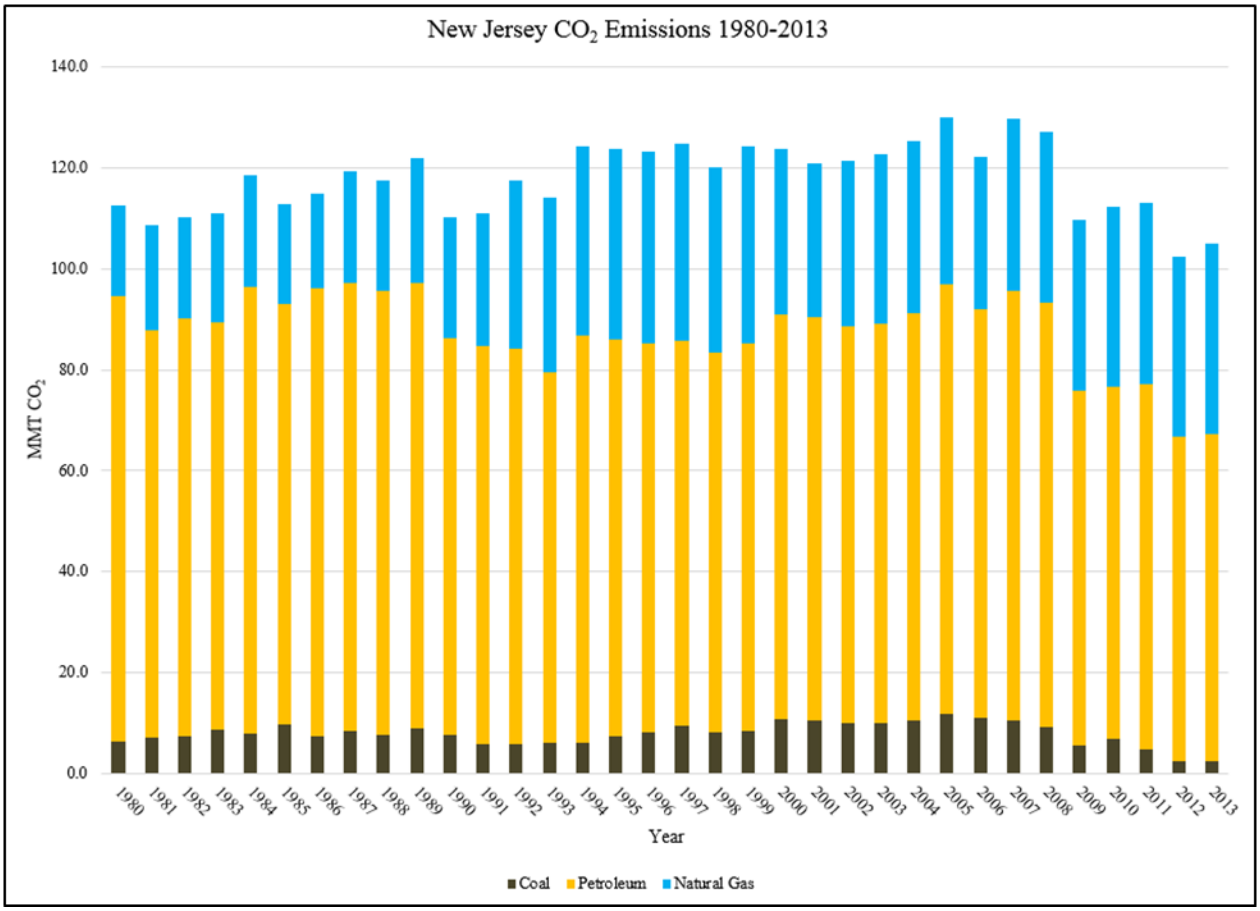

Figure 10.1.14-1: New Jersey CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015c)

The majority of New Jersey's GHG emissions (99.0 MMT) is CO_2 (EIA, 2014b). These emissions are the result of fossil fuel combustion associated with transportation, space heating and electricity generation. Other major GHGs emitted in New Jersey are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons. Total U.S. GHG greenhouse were 6,673 million metric tons (14.7 trillion pounds) in 2013 (USEPA, 2015k).

New Jersey's Department of Environmental Protection conducted a 2009 GHG emissions inventory for the state in 2012. This inventory has been updated one time, most recently in 2015 by Rutgers University for the year 2012 (Rutgers Climate Institute, 2015). The inventory considers CO_2 emissions for New Jersey across four source sectors: transportation (36.6 percent), residential (25.9 percent), industrial (11.5 percent) and commercial (26.0 percent) (EIA, 2014b). All sectors make major contributions to emissions in New Jersey. The state's overall GHG emissions in 2010 were 112.7 MMT and by 2012, GHG emissions had decreased to 104.6 MMT (Rutgers Climate Institute, 2015).

At 41 percent, transportation accounted for the majority of GHG emissions in 2012. This can be attributed to the "bridges, tunnels, bus terminals, airports, Port Authority Trans-Hudson (PATH) commuter rail system and marine terminals that are critical to the metropolitan New York and New Jersey region's trade and transportation capabilities." (Southern Research Institute and E.H. Pechan & Associates, Inc., 2009). New Jersey has extremely high population density and many people commute to New York City and Philadelphia. Every year since 2008, emissions have steadily decreased, a trend that follows a similar pattern in motor vehicle use as measured in Vehicle Miles Traveled (VMT). This decline may be the result of increasing vehicle fuel efficiency combined with overall rising gas and diesel prices discouraging driving (NJDEP, 2012g).

At 19 percent, electricity generation is the second-largest GHG emitting sector with decreasing emissions since 2008. (Rutgers Climate Institute, 2015) During this time, New Jersey power plants made the switch from coal to natural gas, which played a significant part in this decline. New Jersey has also made a deliberate effort to support the deployment of solar power, had more than 17,000 projects in 2012 (NJDEP, 2012g). In the same year, there was a significant decline in the quantity of electricity being used and imported which can play a major role in emissions (Rutgers Climate Institute, 2015).

Fossil fuels used for heating residential, industrial, and commercial sectors contribute 29 percent and continue to fluctuate from year to year. This is not uncommon because the weather is extremely variable from year to year. The last few years New Jersey has experienced unusual deviations from previous year, with cooler than normal summers and warmer winters (NJDEP, 2012g). One factor that has helped offset emission increases is the push for energy efficiency in appliances as well as residential and commercial facilities around the state. Meanwhile, industrial emissions contribute 11.5 percent and have remained consistent from 2009 to 2012 (Southern Research Institute and E.H. Pechan & Associates, Inc., 2009).

10.1.14.3 Environmental Setting: Existing Climate

The National Weather Service (NWS) defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude"

(NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly characteristics (NWS, 2011b).

The majority of New Jersey falls into climate group (C) (see Figure 10.1.14-2). In (C) climate groups, temperatures are generally warm, with humid summers and mild winters (NWS, 2011a) (NWS, 2011b). New Jersey's secondary classification indicates year-round rainfall, but it is highly variable; convective thunderstorms are dominant during summer months (NWS, 2011a) (NWS, 2011b). During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a) (NWS, 2011b). The tertiary classification is indicative of mild, hot summers (NWS, 2011a) (NWS, 2011b).

A small portion of northern New Jersey falls into climate group (D). Climates classified as (D) are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011a) (NWS, 2011b). In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NWS, 2011a) (NWS, 2011b). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011a) (NWS, 2011b). New Jersey's three sub-climate categories are described in the following paragraphs (NWS, 2011a) (NWS, 2011b).

Cfa – The Köppen-Geiger climate classification system classifies Ocean City, Atlantic City, and Trenton as (Cfa). (Cfa) climates are "moist subtropical mid-latitude climates that are generally warm, with humid summers and mild winters" (NWS, 2011a) (NWS, 2011b). New Jersey's secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months (NWS, 2011a) (NWS, 2011b). The tertiary classification indicates mild, hot summers with average temperature of warm months over 72 °F (NWS, 2011a) (NWS, 2011b). Average temperatures of the coldest months are under 64 °F (NWS, 2011a) (NWS, 2011b).

Dfa – The Köppen-Geiger climate classification system classifies portions of northern New Jersey, such as Ringwood, as (Dfa). Climates classified as (Dfa) are characterized by warm and humid temperatures, with hot summers and regular precipitation all year (see Figure 10.1.14-2) (NWS, 2011b). New Jersey's (Dfa) climate group is a continental, mid-latitude climate. New Jersey's secondary classification indicates substantial precipitation during all seasons. New Jersey's tertiary classification indicates hot summer months, with warmer temperatures averaging above 71.6 °F (NWS, 2011a) (NWS, 2011b).

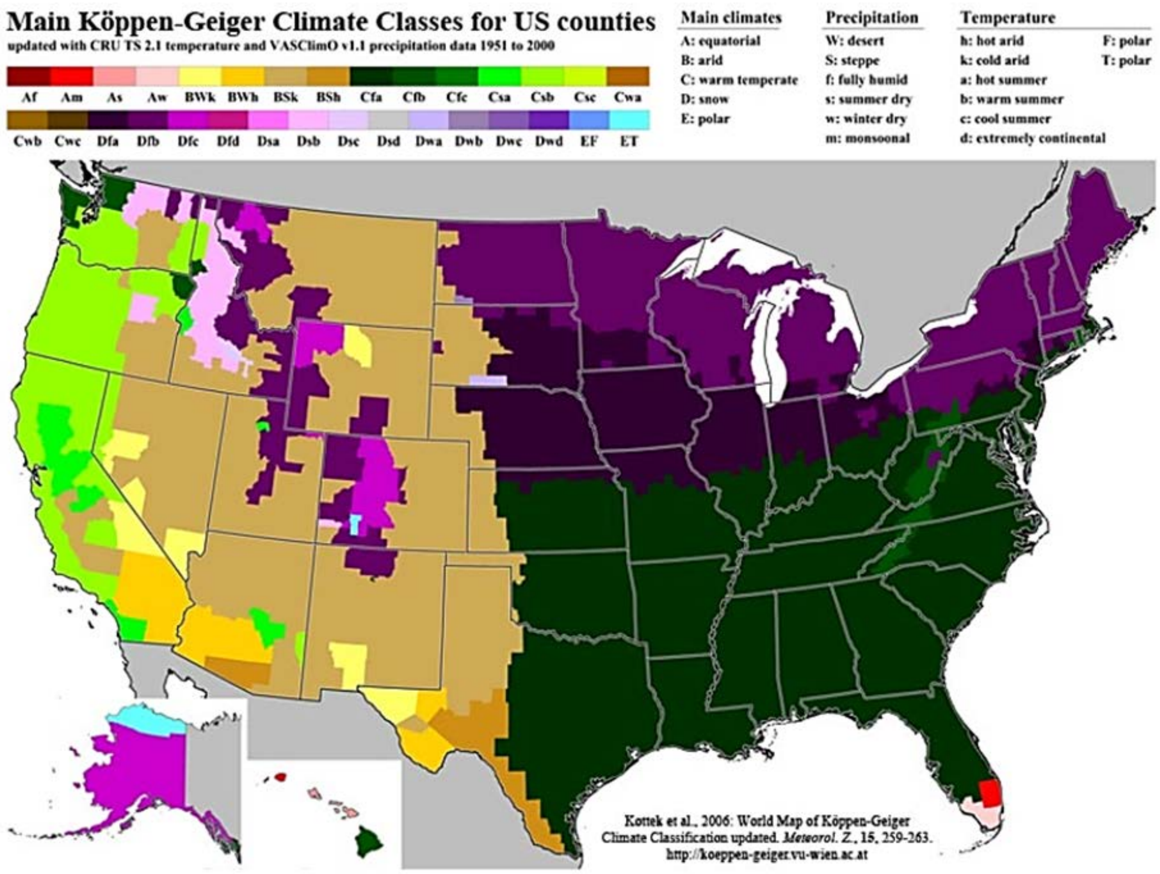

Figure 10.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, 2006)

Dfb – Portions of northern New Jersey, such as Sussex, are classified as (Dfb). Climates classified as (Dfb) are characterized as humid, with warm summers and snowy winters (see Figure 10.1.14-2) (NWS, 2011b). New Jersey's secondary classification indicates substantial precipitation during all seasons. New Jersey's tertiary classification indicates that at least four months out of the year averaging above 50 °F (NWS, 2011a) (NWS, 2011b).

This section discusses the current state of New Jersey's climate with regard to temperature, precipitation, sea level, stream flow, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in New Jersey's three climate regions, (Cfa), (Dfa), and (Dfb).

Air Temperature

Temperature variations between northern and southern New Jersey are "greatest in winter least in summer" (ONJSC, 2015a). "The dominant feature of the atmospheric circulation over North American, including New Jersey, is the broad, undulating flow from west to east across the middle latitudes of the continent" (ONJSC, 2015a). The "average number of freeze-free days in the northern highlands is 163, 179 in the central and southern interior, and 217 along the seacoast" (ONJSC, 2015a).

The highest temperature to occur in New Jersey was 110 °F on July 10, 1936 (SCEC, 2015). The coldest temperature to occur in New Jersey was on January 5, 1904 with a record low of negative 34 °F (SCEC, 2015). From late May to mid-September, temperatures of 90 °F or higher typically occur in most of the state (NOAA, 2015e). In June 2015, the statewide average "temperature of 70.6 °F was 0.5 °F above the 1981 – 2010 normal" for New Jersey (NOAA, 2015e) (SCEC, 2015).

The following paragraphs describe temperatures in New Jersey as they occur in the various climate classification zones:

Cfa – Trenton is located in central New Jersey, within the climate classification (Cfa). The average annual mean temperature in Trenton is approximately 53.5 °F (NOAA, 2015f). Average temperatures during winter months in Trenton are approximately 33.5 °F, while average temperatures during summer months are 73.4 °F (NOAA, 2015f). This central region of New Jersey has many "urban locations with large amounts of pollutants produced by the high volumes of automobile traffic and industrial processes" (ONJSC, 2015a). In addition to these pollutants, the high concentration of impermeable surfaces and buildings retain heat, contributing to a local heat island effect (ONJSC, 2015a). Similar to New York, central areas of New Jersey also experience heat islands due to the high concentrations of asphalt, concrete, and brick surfaces (ONJSC, 2015a).

Although they are found farther south in the state, Ocean City and Atlantic City are also located within the climate classification (Cfa). The average annual mean temperature in Atlantic City is approximately 55.6 °F (NOAA, 2015f). Average temperatures during winter months in Atlantic City are approximately 37.6 °F, while temperatures during summer months are 73.6 °F (NOAA, 2015f). During autumn and winter months, ocean temperatures are warmer than the surrounding land temperatures (ONJSC, 2015a). Therefore, coastal areas of New Jersey, such as Atlantic City, experience warmer winter temperatures as compared to interior regions of the state (ONJSC, 2015a). During spring and summer months, ocean temperatures help keep temperatures cooler along the coast (ONJSC, 2015a). Sea breezes also contribute significantly to New Jersey's coastal climate. Coastal sea breezes "often penetrate 5 – 10 miles inland," but can also travel as far as 25 – 40 miles inland (NOAA, 2015e) (NOAA, 2015f) (ONJSC, 2015a).

Dfa – Ringwood is located in northern New Jersey, within the climate classification (Dfa). The average annual mean temperature in this area is approximately 49.4 °F (NOAA, 2015f). Northern areas of New Jersey are a higher elevations than central and southern regions, and are characterized as having a "continental type of climate with minimal influence from the Atlantic Ocean" (ONJSC, 2015a). Strong winds in this region prevail from the southwest in the summer and the northwest in the winter (ONJSC, 2015a). These northern regions of New Jersey typically experience colder temperatures compared to other climate regions of the state (ONJSC, 2015a). In some cases, temperatures in the northern highlands can vary by more than 10 °F compared to the central and southern coastal regions. (NWS, 2011a) (NWS, 2011b) (NOAA, 2015e) (NOAA, 2015f) (ONJSC, 2015a) (ONJSC, 2015b).

Dfb –Similarly to New Jersey's (Dfa) climate, (Dfb) climates are also located in northern New Jersey. In this region, highlands and mountainous areas are a large contributing factor to the varying temperatures between northern New Jersey and the rest of the state (ONJSC, 2015a). Areas of northern New Jersey that are classified as (Dfb) typically experience warm summers, with temperatures ranging between the upper 70s to the mid-80s (NOAA, 2015e) (NOAA, 2015f). Sussex is located in northeastern New Jersey, within the climate classification (Dfb). In Sussex, the average annual mean temperature is approximately 49.4 °F (NOAA, 2015f). During winter months, temperatures typically average around 28.7 °F, while temperatures during summer months average around 69.2 °F. (NOAA, 2015e) (NOAA, 2015f) (ONJSC, 2015a)

Precipitation

The state's topography and proximity to the Atlantic Ocean strongly influence the distribution of rainfall in New Jersey (ONJSC, 2015a). During the spring and summer months, thunderstorms are primarily responsible for most of the rainfall throughout New Jersey (ONJSC, 2015a). Overall, New Jersey has an even distribution of precipitation throughout the year. (ONJSC, 2015a)

The following paragraphs describe precipitation in New Jersey as it occurs in the various climate classification zones:

Cfa – Ocean City, Atlantic City, and Trenton are located within the climate classification zone (Cfa). Annual precipitation averages vary slightly between coastal and inland cities (NOAA, 2015e) (NOAA, 2015f). For example, Trenton receives an average of 46.44 inches of precipitation per year; an average of 9.17 inches of precipitation during winter months; an average of 13.46 inches of precipitation during summer months; an average of 12.05 inches of precipitation during spring months; and an average 11.76 inches of precipitation during autumn months (NOAA, 2015e) (NOAA, 2015f). By comparison, Atlantic City receives an average of 40.01 inches of precipitation per year, with an average of 9.57 inches during winter months and an average of 9.91 inches during summer months (NOAA, 2015e) (NOAA, 2015f). On August 19 – 20, 1939, a 24-hour precipitation record was set with 14.81 inches of total accumulation (SCEC, 2015) (NOAA, 2015e) (NOAA, 2015f).

Dfa – Ringwood, located in northern New Jersey, is within a (Dfa) climate classification zone. This area on average receives approximately 48.75 inches of precipitation annually (NOAA, 2015f). Ringwood receives on average 10.06 inches of precipitation during winter months; 13.52 inches during summer months; 12.28 inches during spring months; and 12.89 inches autumn months (NOAA, 2015f). Areas of northern New Jersey, such as Ringwood, typically experience "twice as many thunderstorms" as the coastal regions of the state (ONJSC, 2015a). Annual snowfall in this region averages around approximately 40 – 50 inches, as compared to coastal zones of New Jersey, which average 10 – 15 inches of annual snowfall accumulation (NOAA, 2015e) (NOAA, 2015f) (ONJSC, 2015a).

Dfb – Sussex, also located in northern New Jersey, is within a (Dfb) climate classification zone. This area on average receives approximately 46.59 inches of precipitation annually (NOAA, 2015f). Sussex receives on average 10.02 inches of precipitation during winter months; 13.19 inches during summer months; 12.38 inches during spring months; and 12.26 inches during autumn months (NOAA, 2015f). Areas of northern New Jersey, such as Sussex, typically experience "twice as many thunderstorms" as the coastal regions of the state (ONJSC, 2015a). Annual snowfall in this region averages around approximately 40 – 50 inches, as compared to coastal zones of New Jersey, which average 10 – 15 inches of annual snowfall accumulation (NOAA, 2015e) (NOAA, 2015f) (ONJSC, 2015a).

Sea Level

New Jersey has approximately 127 miles of coastline located along the Atlantic Ocean and 83 miles of shoreline located along the Raritan and Delaware Bay. Development along the coast of New Jersey varies from densely populated and developed, to "sparsely populated agricultural communities on the Cape May peninsula" (Cooper, Beevers, & Oppenhimer, 2005). Over the last 50 years, coastal areas of New Jersey have grown from a population of 3,345,010 in 1950 to 5,281,247 in 2000 (Cooper, Beevers, & Oppenhimer, 2005). Much of this shoreline is at risk for damage from strong winds, heavy rainfall, flooding, and hurricanes. Since 1900, sea level along the New Jersey coastline has risen approximately 1 foot (at the Battery), mostly due to thermal expansion. In Atlantic City, sea level is rising at an estimated 3.98mm per year; in Cape May, sea level is rising at an estimated 3.98mm per year; and in Battery Park, sea level is rising at an estimated 2.77mm per year (Cooper, Beevers, & Oppenhimer, 2005). As sea level continues to rise, the risks associated with living along the coast also rise. Hurricane Sandy highlighted the risks and vulnerabilities of living near unprotected tidal shoreline. More than 60 percent of New Jersey's inhabitants live on or in close proximity to coastal and tidal shorelines (Cooper, Beevers, & Oppenhimer, 2005) (NPCC2, 2013) (NYSDEC, 2015b).

Severe Weather Events

Hurricanes in New Jersey are relatively common, with at least one major hurricane occurring approximately each decade (ONJSC, 2015a). In 1955, tropical systems Connie and Diane caused severe flooding throughout New Jersey (ONJSC, 2015a). During tropical storm Connie, a peak rainfall accumulation of 10.89 inches was recorded in Canister Reservoir (ONJSC, 2015a). During tropical storm Diane, a peak rainfall accumulation of 6.73 inches in Charlotteburg Reservoir was recorded, with 2 to 4 inches along the Delaware River (ONJSC, 2015a). Both systems resulted in six deaths in New Jersey and over 400 million dollars' worth of damage (ONJSC, 2015a).

In October 2012, Hurricane Sandy struck portions of coastal and inland New Jersey, bringing with it approximately one foot of rain in the south, record low barometric pressures, and a "record storm surge along the coast and in adjacent water bodies" (ONJSC, 2015a). As a result of sustained high winds, record rainfall, and low barometric pressures, New Jersey experienced the "worst coastal battering on record" (ONJSC, 2015a). Climatologists in New Jersey estimate that "inland winds had never been as strong or of a multi-hour duration in the modern era across central and northern areas" (ONJSC, 2015a). Hurricane Sandy caused the destruction and damage of thousands of homes, buildings, automobiles, and power lines, leaving an estimated 75 percent of customers without power. Hurricane Sandy also caused two dozen deaths (ONJSC, 2015a). According to many hurricane experts, warmer waters in the Atlantic Ocean and Gulf of Mexico are contributing to more frequent and damaging hurricanes than in previous decades, with a record of 15 hurricanes occurring in the North Atlantic in 2005 (ONJSC, 2015a) (NYOEM, 2015).

The following paragraphs describe severe weather events as they occur in the various climate classification zones:

Cfa – Areas of New Jersey classified as Cfa climates are subject to extensive hurricane damage and associated flooding. Although it is uncommon for hurricanes to travel inshore once they make landfall, storms can re-intensify if they come into contact and combine with pre-existing low-pressure storms (Ho, Su, Hanevich, Smith, & Richards, 1987). It was observed during Hurricane Sandy that properties inland, where building codes are less strict, may be more vulnerable to hurricanes and flooding than those in coastal areas. The majority of storm systems that move eastward across North America pass through or in close proximity to New Jersey. Coastal storms in New Jersey are often classified as nor'easters, and are most "frequent between October and April" (ONJSC, 2015a). Nor'easters in New Jersey bring strong winds and heavy rains to coastal and inland areas of New Jersey, in addition to flooding. Coastal storms are so common in New Jersey that "rarely does a winter go by without at least one significant coastal storm" (ONJSC, 2015a). In some areas of New Jersey, regions experience as many as five to ten storms per season. Hurricanes and tropical storms are also common to southern, central, and coastal (Cfa) regions of New Jersey, contributing significantly to average total precipitation values across the region. These storm systems routinely influence the climates of New Jersey (NOAA, 2004) (NOAA, 2015e) (ONJSC, 2015a).

Dfa – In addition to heavy snowfall and precipitation, areas of New Jersey classified as a (Dfa) climate are subject to heavy spring and summertime thunderstorms. Although fewer storms occur inland than they do along the coast, most areas in this region receive an average of 25 – 30 thunderstorms per year (ONJSC, 2015a). Thunderstorms in this region tend to reach "maximum development in the evening" (ONJSC, 2015a). In New Jersey's (Dfa) climate region, thunderstorms are "responsible for most of the rainfall" (ONJSC, 2015a).

Dfb – Similarly to Dfa climate regions of New Jersey, Dfb climate regions also commonly experience heavy spring and summertime thunderstorms. Northern Dfb climate regions in New Jersey also receive the majority of its rainfall from spring and summertime thunderstorms. Thunderstorms that begin in New York and Pennsylvania, "often move through northern New Jersey, where they often reach maximum development in the evening" (ONJSC, 2015a).

10.1.15 Human Health and Safety

10.1.15.1 Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation, vehicular traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 10.1.1, Infrastructure.

10.1.15.2 Specific Regulatory Considerations

Federal organizations, such as U.S. Occupational Safety Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In New Jersey, this resource area is regulated by the New Jersey Department of Labor and Workforce Development (NJDLWD), and NJDEP. The State of New Jersey has adopted all OSHA state and local government employment regulations in a Public Employees Occupational Safety and Health State Plan, except for standards regarding the hazard communication program, and fire brigades (OSHA, 2016a). Occupational safety regulations are enforced at the state level by NJDLWD and at the federal level by OSHA. Occupational and public health are regulated by the New Jersey Department of Health (NJDOH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 10.1.15-1 below summarizes the major New Jersey laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 10.1.15-1: Relevant New Jersey Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
N.J.A.C. Title 7, Chapter 1E	NJDEP	Identifies requirements for the prevention and control of environmental contamination at major facilities, including transportation and reporting.
N.J.A.C. Title 7, Chapter 1G	NJDEP	Identifies requirements for worker and community right to know, including reporting of releases and pollution prevention efforts.
N.J.A.C. Title 12, Chapter 100, Subchapter 7	NJDLWD	Ensures all chemical hazards are communicated to employers and employees as part of a comprehensive hazard communications program.

State Law/Regulation	Regulatory Agency	Applicability
N.J.A.C. Title 12, Chapter 110, Subchapter 5	NJDLWD	Requires recordkeeping and reporting of all occupational injuries and illnesses.

10.1.15.3 Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks are often performed at dangerous heights, inside trenches or confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016b). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, the general public who may be observing the work or transiting the area. (International Finance Corporation, 2007)

Trenches and confined spaces – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work in confined spaces. Installation and maintenance of underground utilities in urban areas or utility man-ways are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width) would occur. Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. The general public can be at risk of stepping or driving motor vehicles into open trenches, or falling into uncovered confined spaces. (OSHA, 2016c)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016c)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work. (International Finance Corporation, 2007)

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation (e.g., manholes) presents risk of fire or explosion. (Fiber Optic Association, 2015)

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (TWA) (see Section 10.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016c)

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require treatments, such as pesticide application in small quantities. Secondary hazardous materials, like exhaust fumes, may be a greater health risk than the primary hazardous material (i.e., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 2016c)

Aquatic environments – Installation of telecommunication lines may include laying, burying, or boring lines under waterways and wetlands, such as lakes, rivers, ponds, or streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia. (OSHA, 2016c)

Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings. (OSHA, 2016c)

Telecommunication Worker Occupational Health and Safety

The BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), and telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

As of May 2014, New Jersey employed 6,240 telecommunication line installers and repairers, and 6,230 telecommunication equipment installers and repairers (Figure 10.1.15-1) (BLS, 2015c). In 2013, the most recent year data are available, New Jersey had 7.3 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013b).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). New Jersey has not had any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data were first reported (BLS, 2015d)

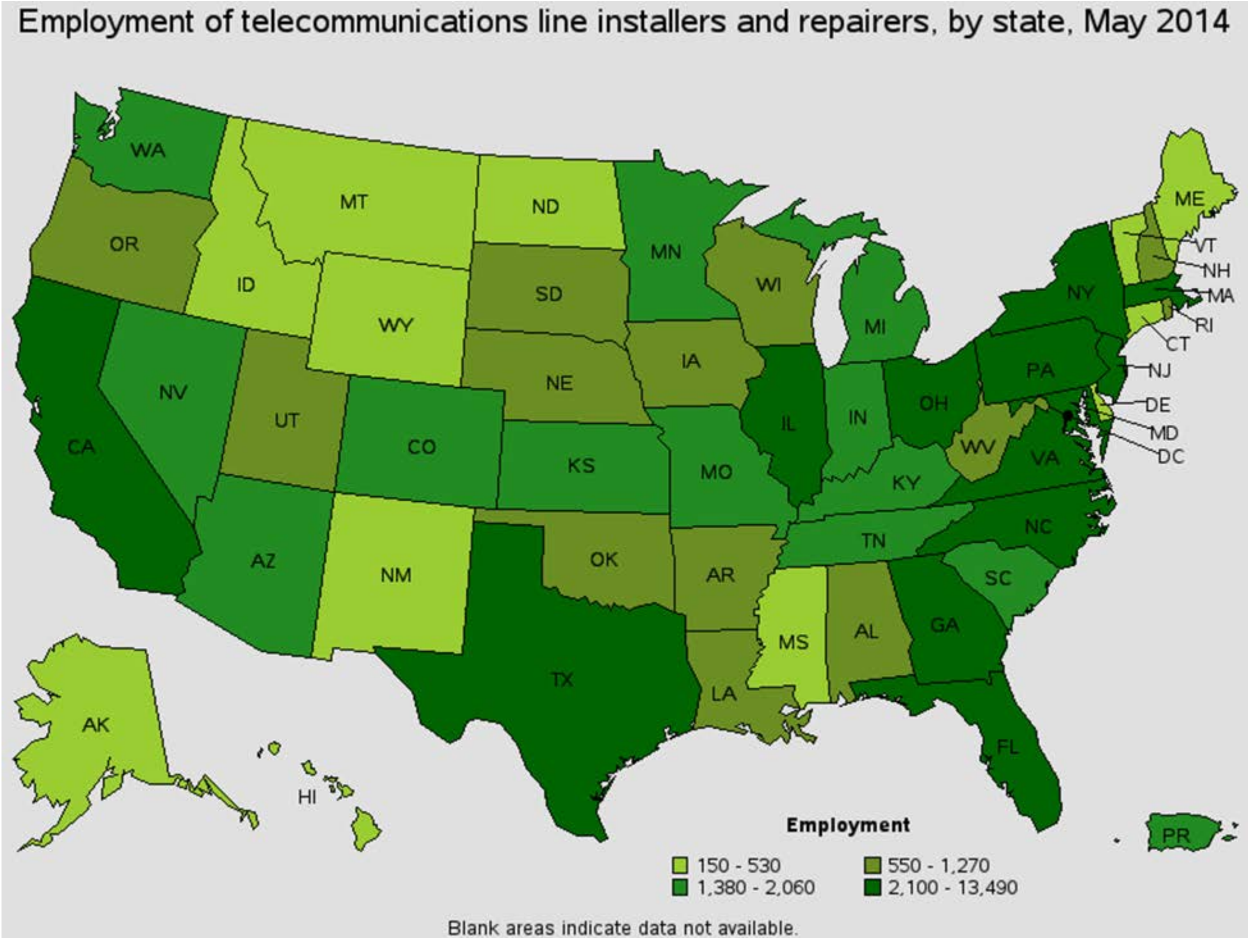

Figure 10.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per state, May 2014

Source: (BLS, 2015e)

Public Health and Safety

The general public are not likely to encounter occupational hazards at telecommunication sites, due to limited access. New Jersey has not recorded incidents of injuries from the public to these sites. Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

10.1.15.4 Environmental Setting: Contaminated Properties at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of site occupants at telecommunication sites, prior to creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[156] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

New Jersey's Site Remediation Program administers the Superfund Program, and is managed under by the NJDEP (NJDEP, 2013e). As of September 2015, New Jersey had 97 RCRA Corrective Action sites[157], 286 brownfield sites, and 114 proposed or final Superfund/NPL sites (USEPA, 2015l). Based on a September 2015 search of USEPA Cleanups in My Community (CIMC) database, there are nine Superfund sites (Caldwell Trucking, Diamond Alkali, NL Industries, Ringwood Mines, Roebling Steel, Universal Oil Products, Ventron/Velsicol, Vineland Chemical, and Welsbach & General Gas Mantle [Camden Radiation]) and one RCRA Corrective Action site (EI Dupont Denemours & Co.) in New Jersey where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists. (USEPA, 2015m)

Brownfield sites in New Jersey may enroll in a variety of programs managed by the NJDEP, Office of Brownfield Reuse, including the Brownfield Development Area Program, the Hazardous Discharge Site Remediation Fund Program, the Brownfield Reimbursement Fund Program, and the Landfill Redevelopment Program (NJDEP, 2013g). One example of a state Brownfield Site is the Keasbey Woodbridge Brownfield Development Area in Woodbridge, NJ. The site encompasses 270 acres along the Rariton River, including a former chemical manufacturing site. Site reclamation and redevelopment efforts are underway to transform the site into the Woodbridge Energy Center and a 186-acre Woodbridge Eco-Wetland Park. The redevelopment is estimated to be completed in 2016, with a project cost of $845 million (NJDEP, 2013f).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human

[156] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C, *Environmental Laws, Regulations, and Executive Orders* (USEPA, 2011b).
[157] Data gathered using U.S. EPA's Cleanups in My Community (CIMC) search on September 8, 2015, for all sites in New Jersey, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2015m).

exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of September 2015, New Jersey had 380 TRI reporting facilities. According to the USEPA, in 2013, the most recent data available, New Jersey released 11,062,272 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from petroleum and chemicals industries. This accounted for 0.27 percent of total nationwide TRI releases, ranking New Jersey 17 out of 56 states/territories. (USEPA, 2014f)

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment.

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 10.1.15-2 provides an overview of potentially hazardous sites in New Jersey.

In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known to be present at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 10.1.3, Geology. As of May 2015, there were no high priority AMLs (sites posing health and safety hazards) in New Jersey (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015).

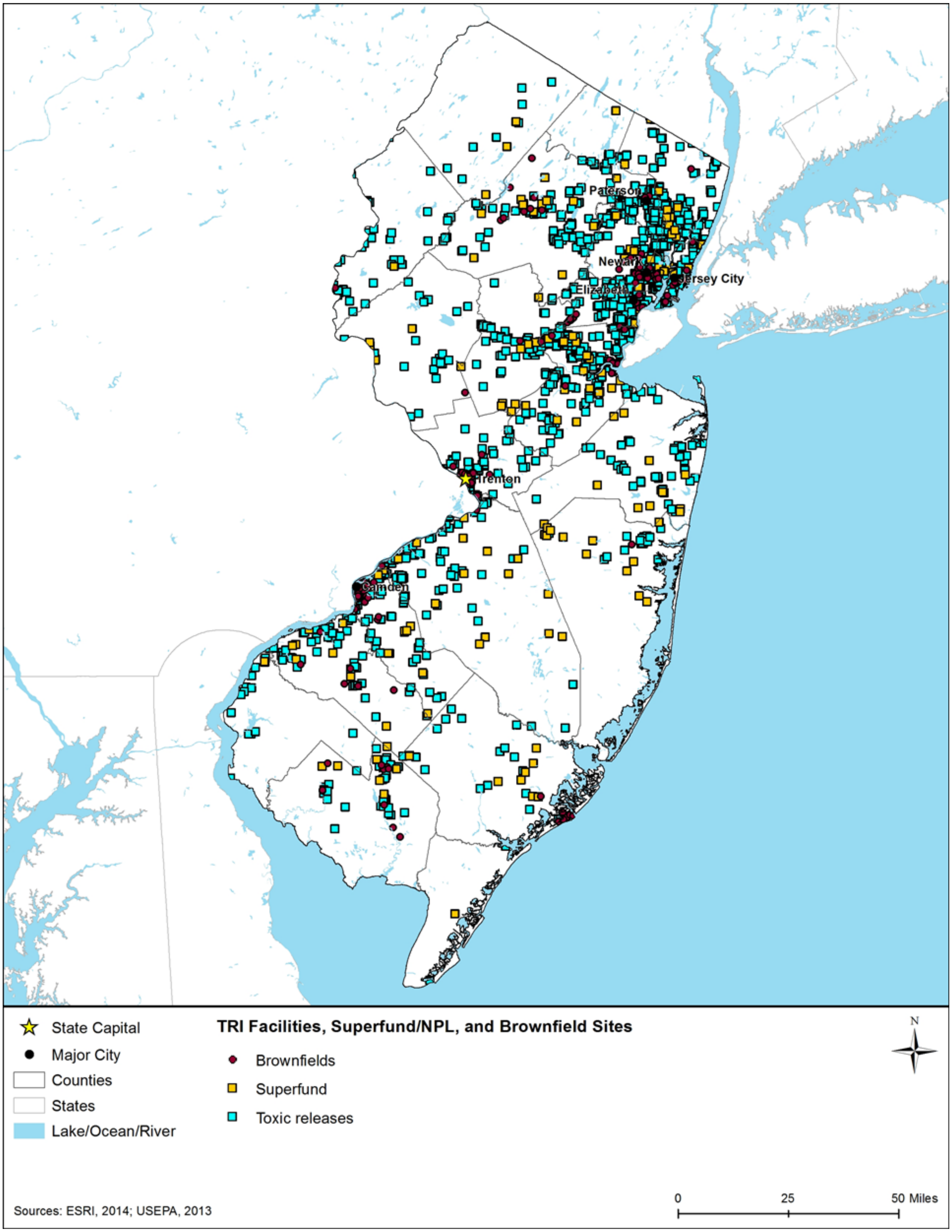

Figure 10.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in New Jersey (2013)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. According to BLS data, New Jersey had one occupational fatality each in 2011 and 2012 within the line installers and repairers occupations from exposure to "harmful substances or environments," although these were not specific to telecommunications (BLS, 2013d). By comparison, the BLS reported three fatalities in 2011 and three preliminary[158] fatalities in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015f). In 2014, BLS also reported four preliminary fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (BLS, 2014).

In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known to be present at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 10.1.3, Geology. As of May 2015, there were no high priority AMLs (sites posing health and safety hazards) in New Jersey (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015), therefore hazard relating to mines will not be discussed further.

Public Health and Safety

As described earlier, access to telecommunications sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunications sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

[158] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data is expected to be released in spring 2016 (BLS, 2015g).

The NJDOH partners with the federal Agency for Toxic Substances and Disease Registry and USEPA as part of the Environmental Health Hazard Assessment Project (EHHAP) to provide health assessments and consultations that identify and assess human exposure risks at contaminated sites. Public health assessments, consultations, and advisories which have been developed by the EHHAP are publicly available through the Investigation Reports Clearinghouse. (NJDOH, 2015) At the federal level, the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography.

Spotlight on New Jersey Superfund Sites: Ringwood Mines/Landfill

The Ringwood Mine/Landfill is a 500-acre site in the Borough of Ringwood, NJ (Passaic County). The site was used for iron ore mining operations from the mid-1700s until the early 1900s. In 1965 Ringwood Realty Corporation, a subsidiary of Ford Motor Company, purchased the majority of the acreage and used the site to dispose of paint sludge, drummed waste, and other trash from the nearby Ford factory in Mahwah, NJ. Between 1969 and 1973, Ringwood Realty Corporation sold or donated all of the acreage to various entities such as the Public Service Electric and Gas Company for use as a utilities right-of-way, to NJDEP for use as a state park, to a non-profit for residential development, and to the Borough of Ringwood for use as a landfill.

The site was added to the NPL in 1983 after detecting benzene, ethylbenzene, and xylene in water samples. Site contamination was highest at three locations used for mine tailings (Peters Mine Pit, Cannon Mine Pit, and the O'Connor Disposal Area). Over the next 6 years, Ford removed over 7,600 cubic yards of paint sludge, and 54 drum remnants (some containing PCBs). In 1994, Ringwood Mines/Landfill was removed from the NPL after all known contaminants were believed to have been mitigated. However, in 2006, the U.S. EPA restored the site to the NPL after residents reported additional paint sludge, leading to the removal of another 53,500 tons of paint sludge and soil.

Today, numerous chemical exposure risks are present at the site including PCBs, and volatile organic compounds found in paint sludge. In addition, due to the extensive mining operations, subsidence is an issue, and requires the use of vibration monitoring during remediation activities to reduce occupational injuries. Exposure risks to telecommunications workers are present in future industrial development at or near the site through ingestion and dermal contact with surface soils, or inhalation of dust. Perimeter fencing has been installed around remaining waste remediation areas to restrict access and exposure.

Figure 10.1.15-3. Photos of Posted Signage at Ringwood Mines/Landfill
Photo credit: USEPA

10.1.15.5 Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003).

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, or falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards might not have not been fully identified or assessed. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response and repair operations, their rescue and treatment might over-extend first responder staff and medical facilities that are delivering care to victims of the initial incident.

Currently, the NJDLWD and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. Of the 351 NRC-reported incidents for New Jersey in 2015 with known causes, only 16 were attributed to natural disaster (natural phenomenon), while the majority (335) were attributed to manmade disasters (equipment failure and operator error) (U.S. Coast Guard, 2015). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support.

In 2014, New Jersey reported 5 weather-related fatalities (1 due to wind and 4 of unknown causes) and 260 injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (NWS, 2015).

Spotlight on New Jersey Natural Disaster Sites: Hurricane Sandy

In October 2012, Hurricane Sandy devastated the northeast region of the U.S., primarily New Jersey and New York, causing at least 159 fatalities, damaging more than 650,000 homes, and damaging infrastructure in the tens of billions of dollars (Hurricane Sandy Rebuilding Task Force, 2014). In New Jersey, major disaster declaration public assistance grants totaled $1.8 billion (FEMA, 2015c).

In a situation report on October 30, 2012, immediately after the storm, the New Jersey State Emergency Operations Center reported boil water advisories in three municipalities, 650 reported rescue efforts in Moonachie, NJ, due to a breached levee, potable water shortages at Middlesex County hospitals, port and road closures, airport delays, mass transit suspensions, and offsite power outages at Oyster Creek Nuclear Generating Station (New Jersey State Emergency Operations Center, 2012). Damage to telecommunications infrastructure was also severely impacted, specifically on the wireless networks. During the peak of the storm, outages were reported at 25 percent of cell sites in the affected region, more than 50 percent in select New Jersey counties, blocking 911 calls for many residents (FCC, 2013b).

Figure 10.1.15-4: Before and After Restoration at Seaside Heights Pier Following Damage Sustained from Hurricane Sandy

Source: (FEMA, 2013b)

10.2 Environmental Consequences

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action Alternative provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

10.2.1 Infrastructure

10.2.1.1 Introduction

This section describes potential impacts to infrastructure in New Jersey associated with construction, deployment, and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.1.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 10.2.1-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

10.2.1.3 Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, railway companies, and harbormasters) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 10.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of first responders through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 10.2.1-1, such potential negative and positive impacts would be less than significant.

Table 10.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments)	Effect that is potentially significant, but with mitigation is less than significant	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments)	No effect on traffic congestion or delay, or transportation incidents
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Persisting indefinitely		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the project activities	Effect is potentially significant, but with mitigation is less than significant	Minor delays to access to care and emergency services that do not impact health outcomes	No impacts on access to care or emergency services
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state)		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Duration is constant during construction and deployment phase		Rare event during construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities	Effect that is potentially significant, but with mitigation is less than significant	Minimal change in the ability to communicate with and between public safety entities	No perceptible change in existing response times or the ability to communicate with and between public safety entities
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities	Effect that is potentially significant, but with mitigation is less than significant	Minor changes in level of service and communications while transitioning to the new system	No perceptible effect to level of service or communications while transitioning to the new system
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems	Effect that is potentially significant, but with mitigation is less than significant	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase	NA

NA = not applicable

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a Manner that Directly Affects Public Safety Communication Capabilities and Response Times

The Proposed Action and alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 10.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to compliment such practices and SOPs in a positive manner; therefore, only beneficial or complimentary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhance communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[159] Such leases would then have less than significant positive impacts on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 10.2.1-1.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the

[159] Telecommunications equipment for specific spectrum use can be built where other equipment for other spectrum use already exists. If the new equipment and spectrum is not fully utilized, the geographic region may experience "over-build," where an abundance of under-utilized equipment may exist in that geographic location. This situation can be caused by a variety of factors including changes in current and future use patterns, changes in spectrum allocation, changes in laws and regulations, and other factors.

transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States.

10.2.1.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and

transportation capacity and safety, and access to emergency services would not be impacted.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs)[160] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or replacement of existing telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.

[160] Points of Presence are connections or access points between two different networks, or different components of one network.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities can enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site specific plans.
  - Deployable Technologies: Deployable technologies such as Cell on Wheels (COWs), Cell on Light Trucks (COLTs), and System on Wheels (SOWs) are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road right-of-ways (ROWs) and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service.

10.2.1.5 Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[161]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility

[161] As mentioned above and in Section 2.1, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

services due to the limited amount of new infrastructure needed to accommodate the deployables.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

10.2.2 Soils

10.2.2.1 Introduction

This section describes potential impacts to soil resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.2.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 10.2.2-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

10.2.2.3 Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in New Jersey and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment can impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in New Jersey that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aqualfs, Aquepts, Aquults, Orthents, Udalfs, and Udepts (see Section 10.5.3.1, Soil Suborders and Figure 10.1.2-2).

Table 10.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils	Effect that is potentially significant, but with mitigation is less than significant	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years		Isolated, temporary, or short-term erosion that that is reversed over few months or less	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers	Effect that is potentially significant, but with mitigation is less than significant	Minimal mixing of the topsoil and subsoil layers has occurred	No perceptible evidence that the topsoil and subsoil layers have been mixed
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline	Effect that is potentially significant, but with mitigation is less than significant	Perceptible compaction and rutting in comparison to baseline conditions	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less	No perceptible change in baseline conditions

NA = not applicable

Based on the impact significance criteria presented in Table 10.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 17).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 10.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites, as well as the implementation of BMPs and mitigation measures (Chapter 17), minimal topsoil mixing is anticipated.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Heavy equipment can cause perceptible compaction and rutting of susceptible soils, particularly if BMPs and mitigation measures are not implemented.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2[162] database (see Section 10.1.2.4, Soil Suborders). The most compaction susceptible soils in New Jersey are hydric soils with poor drainage conditions, which include Aqualfs, Aquepts, and Aquults. These suborders are found in approximately 19 percent of New Jersey,[163] and are found throughout the state (see Figure 10.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 10.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant, due to the small extent of susceptible soils in the state.

[162] STATSGO Is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

[163] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

10.2.2.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to soil resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand-holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras would not impact soil resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore or inland bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.
- Wireless Projects

- New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soos as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility ROWs for deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant due to the temporary nature and small-scale of operations activities with the potential to create impacts. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.2.5 Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small-scale and short term nature of the deployment. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts, as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.2, Soils.

10.2.3 Geology

10.2.3.1 Introduction

This section describes potential impacts to New Jersey geology resources associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.3.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 10.2.3-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

10.2.3.3 Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards and landslides, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

As discussed in Section 10.1.3.8, the majority of New Jersey is not at risk to significant earthquake events. As shown in Figure 10.1.3-5, northeastern New Jersey and areas near New York City are at greatest risk to earthquakes throughout the state, though no earthquake over magnitude 6.0 on the Richter scale has ever occurred in the state. Based on the impact significance criteria presented in Table 10.2.3-1, seismic impacts would be less than significant if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor to moderate earthquakes in or near New Jersey, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Landslides

As discussed in Section 10.1.3.8, the majority of New Jersey is at low to moderate risk of experiencing landslide events. Based on the impact significance criteria presented in Table 10.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. The highest potential for landslides in New Jersey in portions of Sussex, Passaic, Essex, Union, and Somerset Counties, usually in areas associated with steeper slopes or adjacent to slopes that have been undercut by streams or human activity. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of New Jersey's major cities or suburbs, including Trenton, Camden, and Patterson, are in areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Table 10.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Seismic Hazard	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault	No likelihood of a project activity being located in an earthquake hazard zone or active fault
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable	Earthquake hazard zones or active faults do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within a landslide area	No likelihood of a project activity located within a landslide hazard area
	Geographic Extent	Landslide areas are highly prevalent within the state/territory		Landslide areas occur within the state/territory, but may be avoidable	Landslide hazard areas do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain)	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an area with a hazard for subsidence	Project activity located outside an area with a hazard for subsidence
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are		Areas with a high hazard for subsidence occur within the	Areas with a high hazard for subsidence do not occur within the state/territory

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
		highly prevalent within the state/territory		state/territory, but may be avoidable	
	Duration or Frequency	NA		NA	NA
Mineral and Fossil Fuel Resource impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources	Effect that is potentially significant, but with mitigation is less than significant	Limited impacts to mineral and/or fossil resources	No perceptible change in mineral and/or fossil fuel resources
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable	Mineral or fossil fuel extraction areas do not occur within the state/territory
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources		Temporary degradation or depletion of mineral and fossil fuel resources	NA
Paleontological Resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources	Effect that is potentially significant, but with mitigation is less than significant	Limited impacts to paleontological and/or fossil resources	No perceptible change in paleontological resources.
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory		Areas with known paleontological resources occur within the state/territory, but may be avoidable	Areas with known paleontological resources do not occur within the state/territory
	Duration or Frequency	NA		NA	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes	Effect that is potentially significant, but with mitigation is less than significant	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes
	Geographic Extent	State/territory		State/territory	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes		Temporary degradation or alteration of resources that is limited to the construction and deployment phase	NA

NA = not applicable

Land Subsidence

As discussed in Section 10.1.3.8, portions of coastal New Jersey are vulnerable to land subsidence. Based on the impact significance criteria presented in Table 10.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts; however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography, mine collapse, or inundation due to long-term land subsidence. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography or mine collapse, is subject to misalignment, alteration, or, in extreme cases, destruction. Significant long-term land subsidence, due to factors such as aquifer compaction, in coastal areas could lead to relative sea level rise[164] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas that are susceptible to sea level rise. However, where infrastructure is subject to landslide hazards, See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources as there are no fossil fuel extraction sites in New Jersey as stated in Section 10.1.3.7. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 10.2.3-1, impacts to mineral and fossil fuel resources is unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. As discussed in Section 10.1.3, widespread portions of northern New Jersey, especially north of Trenton, contain mineral and fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist.

Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 10.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 10.1.3.6, fossils are abundant throughout parts of New Jersey. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to fossil resources should be

[164] Relative Sea Level Rise: "[Sea level rise that] includes the combined movement of both water and land. Even if sea level was constant, there could be changes in relative sea level. For example, a rising land surface would produce a relative fall in sea level, whereas a sinking land surface would produce a relative rise in sea level" (USGS, 2015l).

considered on a site-by-site basis, and BMPs and mitigation measures (see Chapter 17) could further help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 10.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 17) could be implemented to help further avoid or minimize the potential impacts.

10.2.3.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on geology resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral resources and paleontological resources. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources, including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or perturbation of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact

geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact on the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale. These potential impacts are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.3.5 Alternatives Impact Assessment

The following section assesses potential impacts to geology associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the

Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to geology as a result of implementation of this alternative could be as described below.

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as the deployment would be temporary and likely would attempt to avoid locations that were subject to increased seismic activity, landslides, and land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.3, Geology.

10.2.4 Water Resources

10.2.4.1 Introduction

This section describes potential impacts to water resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.4.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 10.2.4-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 10.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, Safe Drinking Water Act (SDWA)	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts	Activities do not impact groundwater or aquifers
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent		Potential impact is temporary, not lasting more than six months.	NA

* - Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).
NA = not applicable

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10.2.4.3 Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Almost all New Jersey's surface waterbodies (rivers, streams, lakes, estuaries, and bays, and coastal shoreline) are impaired (see Table 10.1.4-2 and Figure 10.1.4-3). For example, the USEPA has identified Lake Hopatcong and Weequahic Lake as areas of concern, due mainly to nonpoint source pollution[165] from agriculture and residential land use, soil erosion, and high concentrations of nutrients causing excessive algae production (USEPA, 2014b). All of New Jersey's ocean and near coastal waters are impaired. Discharges of PCBs have resulted in fish consumption advisories for many species (NJDEP, 2014b). Groundwater quality within the state is generally good.

Deployment activities can contribute pollutants in a number of ways but the primary manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that can increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment can contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a State Pollutant Discharge Elimination System (SPDES) or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids

[165] Nonpoint source pollution: A source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015a).

running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, and Safe Drinking Water Act), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 10.2.4-1, water quality impacts would likely be less than significant, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[166] were to occur near or below the existing water table (depth to water), then dewatering would be anticipated at the location. Residual contaminated groundwater could be encountered during dewatering activities. Construction activities would need to comply with New Jersey dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to the Proposed Action, there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 10.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state. In areas where groundwater is close to the surface, such as in the southern portion of the state, near the shore, for example, site-specific analysis, BMPs, and mitigation measures could have to be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 10.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet’s likely

[166] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

deployment activities, on the watershed or subwatershed level, occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events. Additionally, any effects would be temporary, lasting no more than one season or water year,[167] or occur only during an emergency.

Examples of activities that would have less than significant impacts include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures would reduce the risk of additional impacts to floodplain degradation (see Chapter 17).

Drainage Pattern Alteration

Flooding and erosion from land disturbance can changes drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing can change drainage patterns. Clearing or grading activities, or the creation of walls or berms, can alter water flow in an area or cause changes to drainage patterns. Drainage can be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage can cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns can be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 10.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river, create a substantial and measurable increase in the rate and amount of surface water, or change the hydrologic regime, and any effects would be short-term, impacts to

[167] A water year is defined as “the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months” (USGS, 2014j).

drainage patterns would be less than significant. BMPs, mitigation measures, and avoidance could be implemented to further reduce any potentially significant impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals can alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow can increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 10.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 10.1.4.7, approximately forty percent of New Jersey's freshwater supply (both domestic and public) is drawn from groundwater (Bartholomay, Carter, Qi, Squillace, & and Rowe, 2007), with groundwater providing 75 percent of the freshwater supply in the Coastal Plain (USGS, 2013d). Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Generally, the water quality of New Jersey's aquifers is suitable for drinking and daily water needs. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater generation.
- Storage of petroleum or chemical products.
- Use of pesticides, herbicides, or insecticides during or after construction of a commercial, industrial, or recreational use.
- Commercial generation, treatment, storage, or disposal of hazardous wastes

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 10.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent.

10.2.4.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, infrastructure implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to water resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the

existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
- Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some

staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance. Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. BMPs to help mitigate or reduce any potential impacts are described in Chapter 17.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along existing roads and utility ROWs. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected.

10.2.4.5 Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to water resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if the deployment occurred on paved surfaces if there is any runoff into the surface water. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving; however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Implementing the BMPs and mitigation measures identified in Chapter 17 could further avoid or reduce potential impacts. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be less than significant impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies; however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small-scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.4, Water Resources.

10.2.5 Wetlands

10.2.5.1 Introduction

This section describes potential impacts to wetlands in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.5.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 10.2.5-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

Table 10.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect effects: [2] change in function(s)[3] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.)	Effect that is potentially significant, but with mitigation is less than significant	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No changes in wetland function or type
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Long-term or permanent		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA

NA = Not Applicable

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands
[2] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type
[3] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, Threatened/Endangered (T/E) species habitat, biodiversity, recreational/social value.

10.2.5.3 Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

There are approximately 920,000 acres of palustrine and estuarine wetlands throughout New Jersey (USFWS, 2014a). Palustrine (freshwater) wetlands are found on river and lake floodplains across New Jersey, particularly within the Mid-Atlantic Coastal watershed, and estuarine (tidal) wetlands along the Atlantic coastline and portions of the Hudson, Delaware, Raritan, Passaic, and Hackensack Rivers, as shown in Section 10.1.5, Wetlands, Figure 10.1.5-1 (NJDEP, 2002).

Based on the impact significance criteria presented in Table 10.2.5-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would not violate applicable federal (e.g., CWA Section 404), state, and local regulations.

In New Jersey, as discussed in Section 10.1.5, Wetlands, regulated high quality wetlands include vernal pools and wetlands associated with the Hackensack Meadowlands and New Jersey Pinelands (Figure 10.1.5-3). There are approximately 3,000 to 5,000 vernal pools scattered across the state (Tesauro, 2002). The Hackensack Meadowlands is part of the largest brackish wetland complex in the New York/New Jersey Harbor estuary, comprised of approximately 8,400 acres of wetlands. Based on the ecological significance of the site, the USFWS considers the Hackensack Meadowlands a regionally significant habitat complex in the New York/New Jersey Harbor Area (USFWS, 1996a). The New Jersey Pinelands complex is in the southeastern portion of the state and consists of over 1 million acres of upland, aquatic, and wetland habitats, including the Pinelands National Reserve. With wetlands making up about one-third of the

Pinelands total land area, they are necessary for water quality and the productivity of New Jersey's estuaries. (USFWS, 1996b).

If any of the proposed deployment activities were to occur in these high quality wetlands, potentially significant impacts could occur. High quality wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands.

Potential Other Direct Effects

Direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 10.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Examples activities that could have other direct effects to wetlands in New Jersey include:

- Vegetation Clearing: removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- Ground Disturbance: Increased amounts of stormwater runoff in wetlands can alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- Direct Hydrologic Changes (flooding or draining): Greater frequency and duration of flooding can destroy native plant communities, as can depriving them of their water supply. Hydrologic changes can make a wetland more vulnerable to pollution. Increased water depths or flooding frequency can distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.

- Direct Soil Changes: Changes in soil chemistry can lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of sphagnum bogs and alkaline conditions of calcareous fens.
- Water Quality Degradation (spills or sedimentation): The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) can reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff can interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[168] Change in Function(s)[169] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and can cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Examples of functions related to wetlands in New Jersey that could potentially be impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they can lower flood peaks by providing detention of storm flows.
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils can eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding can harm some wetland plant species, it promotes others. Shifts in plant

[168] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.

[169] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

communities because of hydrologic changes can have impacts on the preferred food supply and animal cover.

- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 10.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant. Since the majority of the almost 1 million acres of wetlands in New Jersey are not considered high quality, deployment activities could have less than significant indirect impacts on wetlands in the state. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands.

In areas such as the New Jersey Pinelands, where all wetlands are considered high quality, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts.

10.2.5.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit

points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.

- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
- Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of

drones, balloons, blimps, or piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are not expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROWs. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.5.5 Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility ROWs would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities; including mowing and application of herbicides. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on wetlands, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.5, Wetlands.

10.2.6 Biological Resources

10.2.6.1 Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in New Jersey associated with deployment and operation of the Proposed Action and its alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 10.2.6-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 10.2.6.3, 10.2.6.4, and 10.6.2.5, respectively, are presented as a range of possible impacts.

Refer to Section 10.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in New Jersey.

Table 10.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristic	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), Migratory Bird Treaty Act (MBTA), and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with mitigation is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within New Jersey for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within New Jersey for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances, including those from Radio Frequency (RF) emissions, that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances, including exposure to RF emissions, are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional or site specific effects observed within New Jersey for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long term loss of migratory pattern/path, or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.

Type of Effect	**Effect Characteristic**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional effects observed within New Jersey for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.

Type of Effect	Effect Characteristic	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
	Geographic Extent	Regional effects observed within New Jersey for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances, including exposure to RF emissions, that lead to stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated or short-term effects that are reversed within one breeding season.	NA
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with mitigation is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout New Jersey		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

NA = not applicable

10.2.6.2 Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in New Jersey are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 10.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs would be recommended to minimize or avoid potential impacts.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality can include stress related to disturbance. The alteration of soils or hydrology within a localized area can result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing or decreasing hydrology in an area as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action, given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species can have a dramatic effect on natural resources and biodiversity.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

The potential to introduce invasive plants within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology,[170] and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to terrestrial vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

[170] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public right-of-ways (ROWs) or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Installation of Optical Transmission or Centralized Transmission Equipment: : If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, the vegetation loss, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers or Backhaul Equipment: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or

access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to terrestrial vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the small-scale of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected deployment activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant due to the small-scale of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to terrestrial vegetation as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain less than significant due to the relatively small-scale of FirstNet activities at individual locations. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred

Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small-scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.3, Terrestrial Vegetation.

10.2.6.3 Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in New Jersey and New Jersey's near offshore environment (i.e., less than two miles from the edge of the coast) are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 10.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

<u>Terrestrial Mammals</u>

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in New Jersey. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors (FHWA, 2015d). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

If bats, and particularly maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to "poor" fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & and Manville, 2011).

Avian mortalities or injuries can also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds can occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for nesting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of New Jersey are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. If siting considerations and BMPs and mitigation measures are implemented (Chapter 17), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA can be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

The majority of New Jersey's amphibian and reptile species are widely distributed throughout New Jersey. Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Three species of marine turtles – all listed as threatened or endangered under the ESA – occur in New Jersey's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 10.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of New Jersey are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. There are areas in New Jersey that have experienced extensive land use changes from urbanization and agriculture. However, there are portions of the state that are forested and remain relatively unfragmented.

Additionally, habitat loss can occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for New Jersey's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout New Jersey and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures.

Birds

The direct removal of most bird nests is prohibited under the MBTA. USFWS and NJDEP can provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact on passerine[171] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration can have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs, including nest avoidance during construction-related activities, would help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for New Jersey's reptiles and amphibians typically consist of wetlands and, in some cases the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 10.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to New Jersey's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[172]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 10.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) can reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur result to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur.

[171]Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.
[172] See Section 10.2.5, Wetlands, for a discussion of BMPs for wetlands.

Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Birds

Repeated disturbance, especially during the breeding and nesting season, can cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Terrestrial invertebrates can experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Potential effects to migration patterns of New Jersey's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula[173]. Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts can vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

[173] A location chosen by an animal for hibernation.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group, shorebirds migrating through New Jersey undertake some of the longest-distance migrations of all animals. New Jersey is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. New Jersey has 123 IBAs spread throughout the state that serve as important stopover areas for migratory birds (National Audubon Society, Inc., 2015). Many migratory routes are passed from one generation to the next. Impacts can vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in New Jersey. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor. Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, (Berven & Grudzien, 1990) found that a small percentage of juvenile wood frogs can migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of New Jersey's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as the moose, has the potential to negatively affect body condition and reproductive success of mammals in New Jersey.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature. BMPs and mitigation measures as defined through consultation with USFWS, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spotted turtle (*Clemmys guttata*) leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species can have a dramatic effect on natural resources.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers.

Terrestrial Mammals

In New Jersey, Eurasian boars (*Sus scrofa*) adversely impact several native large and small mammals, including bear (*Ursus americanus*), turkey (*Meleagris gallopavo*), waterfowl and deer. They feed on young mammals, destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and humans. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. Invasive species effects to terrestrial mammals could be minimized following BMPs in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for an invasive species, and less favorable for native species and their habitats. For example, in New Jersey, mute swans (*Cygnus olor*) can impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior. Further, this invasive bird can lead to declines in water quality from increased fecal coliform loading in the water, and declines in submerged aquatic vegetation that support native fish and other wildlife (Swift, Clarke, Holevinski, & Cooper, 2013). FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in New Jersey; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and also spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects pose a large threat to forest and agricultural resources. (USFS, 2015) Species such as the gypsy moth (*Lymantria dispar*), hemlock woolly adelgid (*Adelges tsugae*), Asian longhorn beetle (*Anoplophora glabripennis*), and emerald ash borer (*Agrilus planipennis*) are of particular concern in New Jersey and are known to cause irreversible damage to native forests. Emerald ash borer and Asian longhorn beetle are regulated in New Jersey. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs would help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

<u>Activities Likely to Have No Impacts</u>

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to wildlife resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.

  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to

accept submarine cables could potentially impact wildlife (see Section 10.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to wildlife. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely be less than significant. See Chapter 17, BMPs and

Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this alternative could be as described below.

<u>Deployment Impacts</u>

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Operational Impacts</u>

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.4, Terrestrial Wildlife.

10.2.6.4 Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in New Jersey and New Jersey's near offshore environment are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012f).

Based on the impact significance criteria presented in Table 10.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but minimal for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats can be addressed through BMPs and mitigation measures.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be less than significant, and BMPs and mitigation measures to protect water resources (see Section 10.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be less than significant, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be less than significant, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance and if RF hazards are deemed insignificant.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environments.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation;

effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result

in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emission.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, *Proposed Action Infrastructure*, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance, if conducted near water resources that support fish, including application of herbicides, may result in less than significant effects to fisheries and aquatic habitats including exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant due to the small-scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small-scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant due to the limited nature of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.5, Fisheries and Aquatic Habitats.

10.2.6.5 Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in New Jersey and New Jersey's offshore environment associated with deployment and operation of the Proposed Action and alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 10.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Table 10.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	No Effect
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 10.2.6-2, any direct injury or mortality of a listed species at the individual-level could be potentially significant as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles, invertebrates, and plants with known occurrence in New Jersey are described below. There are no listed amphibians or fish in New Jersey, therefore they will not be discussed in this section.

<u>Terrestrial Mammals</u>

The Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*) are found throughout the state. Direct mortality or injury to the bat species could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or when nests are either disturbed or destroyed. Impacts would likely be isolated, individual events. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Birds</u>

Three federally listed birds, the red knot (*Calidris canutus rufa*) piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii dougallii*), are known to occur within coastal areas of New Jersey. Depending on the project types and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. If proposed project sites are unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Reptiles and Amphibians</u>

No federally listed amphibians would be affected by the Proposed Action in New Jersey.

The federally listed threatened bog turtle (*Clemmys muhlenbergii*) occurs within wetland and floodplain areas. Direct mortality to reptiles could occur in construction zones either by excavation activities or by vehicle strikes. Impacts would likely be isolated, individual events.

Three federally listed sea turtles, the green sea turtle (*Chelonia mydas*); the hawksbill sea turtle (*Eretmochelys imbricate*); and the leatherback sea turtle (*Dermochelys coriacea)* are also known to occur in the coastal area and offshore environment of New Jersey. None of these turtles nest in the New Jersey area. Direct mortality or injury from watercraft and vessels strikes are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Invertebrates</u>

One federally listed mollusk, the Dwarf wedgemussel (*Alasmidonta heterodon*), and one endangered terrestrial invertebrate, the Northeastern beach tiger beetle (*Cinindela dorsalis dorsalis*), occur in New Jersey. Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Distribution of these species is limited to in or near the Delaware River and Sandy Hook. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Plants</u>

Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Plant species include: American chaffseed (*Schwalbea americana)*; Knieskern's beaked-rush (*Rhynchospora knieskernii*); sensitive joint vetch (*Aeschynomene virginica*); swamp pink (*Helonias bullata*); seabeach amaranth (*Amaranthus pumilus*); and small whorled pogonia (*Isotria medeoloides*). In general, distribution of these species is limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which can affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles and marine reptiles, amphibians, invertebrates, and plants with known occurrence in New Jersey are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

The piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and roseate tern (*Sterna dougallii dougalli*) are the only federally listed bird species that are known to nest in New Jersey on sandy beaches and coastlines. The majority of FirstNet deployment activities would not occur on beaches; therefore, impacts to these bird species are not anticipated. Noise, light, or human disturbance within nesting areas could cause piping plovers, red knots, or roseate terns to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

There are no federally listed amphibian in New Jersey.

The federally listed threatened bog turtle (*Clemmys muhlenbergii*) occurs within wetland and floodplain areas. Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity. Land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

The three federally listed sea turtles found in the offshore areas of New Jersey are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for the federally listed mollusk known to occur in New Jersey. Impacts associated with deployment activities are expected to result in less than significant changes to water quality. Habitat loss and degradation, primarily from coastal and shoreline development could impact the Northeastern Beach Tiger Beetle. Impacts associated with habitat loss and degradation are expected to be less than significant because the majority of FirstNet activities are not expected to take place in shoreline habitats suitable for the species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, invertebrates, and plants with known occurrence in New Jersey are described below.

Mammals

Direct mortality or injury to the federally listed bats could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to this species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015i). It is clear that behavioral responses are strongly affected by the context of exposure and by the animal’s experience, motivation, and conditioning. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation can cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in adverse effects to federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed amphibians in New Jersey.

Disturbances during deployment activities are not anticipated to stress federally listed sea turtles. Habitat loss or alteration, particularly from fragmentation or invasive species, could adversely affect nesting and foraging sites of the bog turtle, resulting in reduced survival and productivity; however, disturbances during deployment activities are not anticipated to stress federally listed reptiles. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Invertebrates</u>

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mollusk resulting in population stress and lower productivity. Habitat disturbance or loss may result in stress and avoidance by the Northeastern Beach Tiger Beetle. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Plants</u>

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extant. FirstNet activities are generally expected to be small-scale in nature, therefore large-scale impacts are not expected; however, it is possible that small-scale changes could lead to potentially significant adverse effects for certain species. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. However, the threatened and endangered species that occur in New Jersey do not have critical habitat in the state.

<u>Terrestrial Mammals</u>

No designated critical habitat occurs for mammals in New Jersey. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

<u>Birds</u>

No critical habitat has been designated for piping plover, red knot, or roseate tern populations that are known to occur in New Jersey; therefore, no effect to these federally listed birds from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

<u>Reptiles and Amphibians</u>

There are no federally listed amphibians in New Jersey, therefore no destroyed critical habitat.

No designated critical habitat occurs for reptiles in New Jersey. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in New Jersey. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

No designated critical habitat occurs for plants in New Jersey. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.

   - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
   - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
   - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
   - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g. reptiles, mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs are not implemented.
   - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 10.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related to security/safety lighting and fencing may produce direct injury/mortality, reproductive

effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to threatened and endangered species as a result of implementation of this alternative could be as described below.

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

<u>Operational Impacts</u>

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

10.2.7 Land Use, Recreation, and Airspace

10.2.7.1 Introduction

This section describes potential impacts to land use, recreation, and airspace resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.7.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 10.2.7-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 10.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands	Effect that is potentially significant, but with mitigation is less than significant	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses	Effect that is potentially significant, but with mitigation is less than significant	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses	No conflicts with adjacent existing or planned land uses
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with BMPs and Mitigation Measures Incorporated	Less Than Significant	No Impact
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities	Effect that is potentially significant, but with mitigation is less than significant	Restricted access to recreation land or activities	No disruption or loss of access to recreational lands or activities
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites	Effect that is potentially significant, but with mitigation is less than significant	Small reductions in visitation or duration of recreational activity	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace	Effect that is potentially significant, but with mitigation is less than significant	Alteration to airspace usage is minimal	No alterations in airspace usage or flight patterns
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase	NA

NA = not applicable

10.2.7.3 Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of rights-of-way or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROW or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scale and consistent with the surrounding land uses in the area; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

Access to public or private recreation land or activities could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Enjoyment of recreation land could be temporarily impacted by crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 10.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period of time, FirstNet would not impact airspace resources.

10.2.7.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on Federal Aviation Regulation (FAR) 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 10.1.7.5 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and*

Preservation of the Navigable Airspace (see Section 10.1.7; Obstructions to Airspace Considerations).

- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore or inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part

77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 10.1.7.5 Obstructions to Airspace Considerations).

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 10.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: See *Activities Likely to Have Impacts* below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet Above Ground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 10.1.7.5 Obstructions to Airspace Considerations.
- Satellites and Other Technologies

- Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
  - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
  - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
  - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.
- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact land use, it is anticipated that this activity would have no impact on land use.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.

    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore or inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: No impacts are anticipated – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
    - Airspace: No impacts are anticipated – see previous section.
- Wireless Projects

- New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
  - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets the other criteria listed in Section 10.1.7.5 Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of New Jersey's airports.
- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
  - Land Use: No impacts are anticipated – see previous section.
  - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
  - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: No impacts are anticipated – see previous section.

    - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near New Jersey airports (See obstruction criteria in Section 10.1.7 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally, FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above. Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. The degree of change in the visual environment (see Section 10.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.7.5 Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected; however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 10.1.7, Land Use, Recreation, and Airspace.

10.2.8 Visual Resources

10.2.8.1 Introduction

This section describes potential impacts to visual resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.8.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 10.2.8-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact.

Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

10.2.8.3 Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In New Jersey, residents and visitors travel to many national historical parks, reserves, and state parks, such as the Pinelands National Reserve to view rare plant and animal species and enjoy the scenic beauty of its forests. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. New Jersey's Coastal Management Program and Coastal Zone Management Rules contain multiple policy goals that reference the preservation, protection, and conservation of aesthetic resources (State of New Jersey, 2015f). If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 10.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small-scale of likely FirstNet activities, impacts are expected to be less than significant.

Table 10.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character	Effect that is potentially significant, but with mitigation is less than significant	Intermittently noticeable change in aesthetic character that is marginally negative	No visible effects
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase	Transient or no visible effects
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions	Effect that is potentially significant, but with mitigation is less than significant	Lighting alters night-sky conditions to a degree that is only intermittently noticeable	Lighting does not noticeably alter night-sky conditions
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase	Transient or no visible effects

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 10.2.8-1, lighting that illuminates the night sky on a regional basis, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies.

10.2.8.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact visual resources. However, impacts to the

aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lighting.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the National Park Service (NPS) to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit.

10.2.8.5 Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative. Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant. These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.8, Visual Resources.

10.2.9 Socioeconomics

10.2.9.1 Introduction

This section describes potential impacts to socioeconomics in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.9.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 10.2.9-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 10.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible impact on property values and/or rental fees	No impacts to real estate in the form of changes to property values or rental fees
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible economic change	No change to tax revenues, wages, major industries, or direct spending
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level	Effect that is potentially significant, but with mitigation is less than significant	Low level of job creation at the state/territory level	No job creation due to project activities at the state/territory level
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender)	Effect that is potentially significant, but with mitigation is less than significant	Minor increases in population or population composition	No changes in population or population composition
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = not applicable

10.2.9.3 Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to changes in Tax Revenues, Wages, Major Industries, or Direct Spending;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary considerably across New Jersey. Median values of owner-occupied housing units in the 2009–2013 period ranged from approximately $395,000 in the Twin Rivers/Hightstown area, to approximately $145,000 in the Bridgeton area. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in pending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partners(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment is a direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet partner(s) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment games are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across New Jersey. The average unemployment rate in 2014 was 6.6 percent, higher than the national rate of 6.2 percent. Counties with unemployment rates below the national average (that is, better employment performance) were all located in the northern portion of the state. However, several northeastern counties had unemployment rates above the national average. All counties in the southern portion of the state had unemployment rates above the national average, some considerably so.

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system designers may be located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 10.2.9-1 because they would not constitute a "high level of job creation *at the state or territory level.*"

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

10.2.9.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 10.2.9-1.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact socioeconomic resources, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
    - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be

small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help

support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
  - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant, as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation Impacts

Activities with the Potential to Have Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. All operational activities would be conducted by public or private sector employees, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.9.5 Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomics resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential adverse impacts are anticipated to be less than significant as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 10.1.9 Socioeconomics.

10.2.10 Environmental Justice

10.2.10.1 Introduction

This section describes potential impacts to environmental justice in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.10.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 10.2.10-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 10.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated	Effect that is potentially significant, but with mitigation is less than significant	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation	No direct effects on environmental justice communities, as defined by EO 12898
	Geographic Extent	Effects realized within counties at the Census Block Group level		Effects realized within counties at the Census Block Group level	Effects realized within counties at the Census Block Group level
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = not applicable

10.2.10.3 Description of Environmental Concerns

Effects associated with other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997) Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences.

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this Draft PEIS. The areas shown in the environmental justice screening map of Existing Environment (Section 10.1.10) as having Moderate Potential or High Potential for environmental justice populations would particularly warrant further screening. As discussed in Section 10.1.10, notable concentrations of areas with High Potential for environmental justice populations occur in the New Jersey portion of the New York/Newark area and in the Twin Rivers/Hightstown and Trenton areas. There are multiple pockets of High Potential for environmental justice populations in other parts of the state. Areas of Moderate Potential for environmental justice populations are distributed throughout the state. Further analysis using the data developed for the screening analysis in Section 10.1.10 may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015e; USEPA, 2014g).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

10.2.10.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to environmental justice under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and

therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance. Impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
    - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in

environmental justice communities, they would be considered environmental justice impacts.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Activities to Have No Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons.

Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.10.5 Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to environmental justice communities resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant as operations are expected to be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 10.1.10.

10.2.11 Cultural Resources

10.2.11.1 Introduction

This section describes potential impacts to cultural resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.11.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 10.2.11-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

10.2.11.3 Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 10.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout New Jersey, some deployment activities may be in these areas, in which case BMPs (see Chapter 17) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Table 10.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, but Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[2]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects APE		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties
	Geographic Extent	Direct and/or indirect effects APE		Direct and/or indirect effects APE	Direct and/or indirect effects APE

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, but Not Adverse**	**No Effect**
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties	No direct or indirect effects to historic properties
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

[1] Whereas mitigation measures for other resources discussed in this Draft PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/Tribal Historic Preservation Office (THPO) and other consulting parties, including Indian tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's Area of Potential Effects (APE) are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these can be avoided or minimized through BMPs (see Chapter 17).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to Native Americans. It is anticipated that FirstNet would identify potential impacts to such areas through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

10.2.11.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing

huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could impact cultural resources. Impacts to cultural resources could also potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological sites (limited nearshore or inland bodies of water tend to be located in areas with high probabilities for archaeological deposits), and the associated structures could have visual effects on historic properties.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.
- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas of New jersey that have larger numbers of historic public buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment sites. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally, as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties; however, due to the small-scale of expected activities, these actions could affect but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA.

10.2.11.5 Alternatives Impact Assessment

The following section assesses potential impacts to cultural resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either sire access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur; however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.11, Cultural Resources.

10.2.12 Air Quality

10.2.12.1 Introduction

This section describes potential impacts to New Jersey's air quality from deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.12.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on New Jersey's air quality were evaluated using the significance criteria presented in Table 10.2.12-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to New Jersey's air quality addressed in this section are presented as a range of possible impacts.

10.2.12.3 Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unknown timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Areas exist in New Jersey that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone is a state-wide issue (see Section 10.1.12, Air Quality and Figure 10.1.12-1). The majority of the counties in New Jersey are designated as maintenance areas for one or more of the following pollutants: CO and PM (Table 10.1.12-4); all counties in the state are designated nonattainment for ozone (Figure 10.1.12-1).

Based on the significance criteria presented in Table 10.2.12-1, impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in New Jersey; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout New Jersey (Figure 10.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

Table 10.2.12-1: Impact Significance Rating Criteria for New Jersey

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term		Short term	Temporary

NA = not applicable

10.2.12.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Impact Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.
    - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
    - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
    - Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.
- Wireless Projects
    - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to

install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.

- Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
- Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited nature of the deployment. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors additional air quality impacts may occur, however, they would be less than significant as they would still be limited in nature.

10.2.12.5 Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

10.2.13 Noise

10.2.13.1 Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in New Jersey. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.13.2 Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 10.2.13-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential noise impacts to New Jersey addressed in this section are presented as a range of possible impacts.

10.2.13.3 Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment.

Based on the significance criteria presented in Table 10.2.13-1, noise impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

Table 10.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local		County or local	County or local
	Duration or Frequency	Permanent or long-term		Short term	Temporary

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise-sensitive receptors. However, given that much of the concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

10.2.13.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical

networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above.

10.2.13.5 Alternatives Impact Assessment

The following section assesses potential noise impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise levels would quickly return to baseline levels. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

10.2.14 Climate Change

10.2.14.1 Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in New Jersey associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.14.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action’s installations and infrastructure were evaluated using the significance criteria presented in Table 10.2.14-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT in 2013 (USEPA, 2015n), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the Proposed Action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 10.2.14-1: Impact Significance Rating Criteria for Climate

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less Than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less Than Significant	Impact Level: No Impact
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed	Effect that is potentially significant, but with mitigation is less than significant	Only slight change observed	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities
	Geographic Extent	Global impacts observed		Global impacts observed	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure	Effect that is potentially significant, but with mitigation is less than significant	Only slight change observed	No measurable impact of climate change on FirstNet installations or infrastructure
	Geographic Extent	Local and regional impacts observed		Local and regional impacts observed	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA

NA = not applicable

10.2.14.3 Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. By mid-century, the total number of days above 90 ºF is projected to increase in the majority of the northeastern states especially the southern portion of the region. Under both low and high GHG emissions scenarios, the frequency, intensity, and duration of heat waves (sequential days with temperatures over 90 ºF) is also expected to increase, with the most intense heat waves occurring under higher emissions scenarios. Increases in temperature will also impact precipitation events, sea level rise, and ocean water acidity (USGCRP, 2014a).

Air Temperature

Figure 10.2.14-1 and Figure 10.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for New Jersey from a 1969 to1971 baseline.

Cfa **–** Figure 10.2.14-1 shows that by mid-century (2040 to 2059) temperatures in the entire state of New Jersey under a low emissions scenario will increase by approximately 4 °F, and under a low emissions scenario for the period (2080 to 2099) temperatures in the Cfa region will increase by approximately 5° F (USGCRP, 2009).

Figure 10.2.14-2 shows that by mid-century temperatures will increase by approximately 5° F in the entire state of New Jersey under a high emissions scenario. By the end of the century (2080 to 2099) temperatures in the Cfa region of New Jersey under a high-emissions scenario will increase by approximately 8 °F (USGCRP, 2009).

Dfa **–** Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfa region under both low and high emissions scenarios (USGCRP, 2009).

Dfb **–** Temperatures in this region under a low emissions scenario are expected to increase by mid-century (2040 to 2059) at the same rate as the Cfa and Dfa regions. The majority of the (Dfb) region’s temperature is expected to rise at the same rate as Cfa and Dfa in a low emissions scenario by the end of the century. However, temperatures in the northwestern most portion of the state may increase up to 6° F by the end of the century (USGCRP, 2009).

Temperatures in the (Dfb) region under a high emissions scenario for the period (2040 to 2059) temperatures will increase at the same rate as the Cfa and Dfa regions. Temperatures in the (Dfb) region under a high emissions scenario for the period (2080 – 2099) will increase by approximately 9° F (USGCRP, 2009).

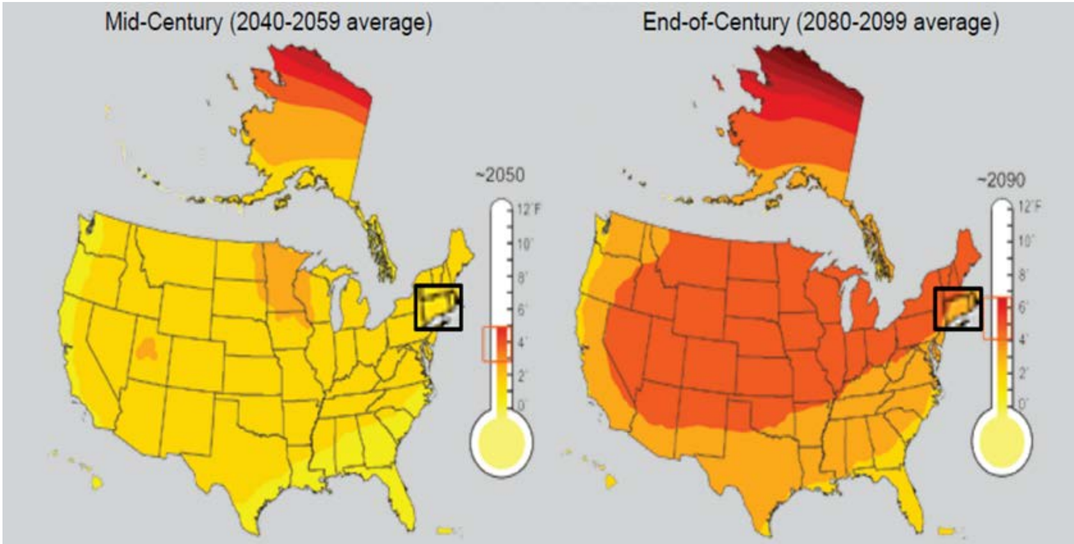

Figure 10.2.14-1: New Jersey Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

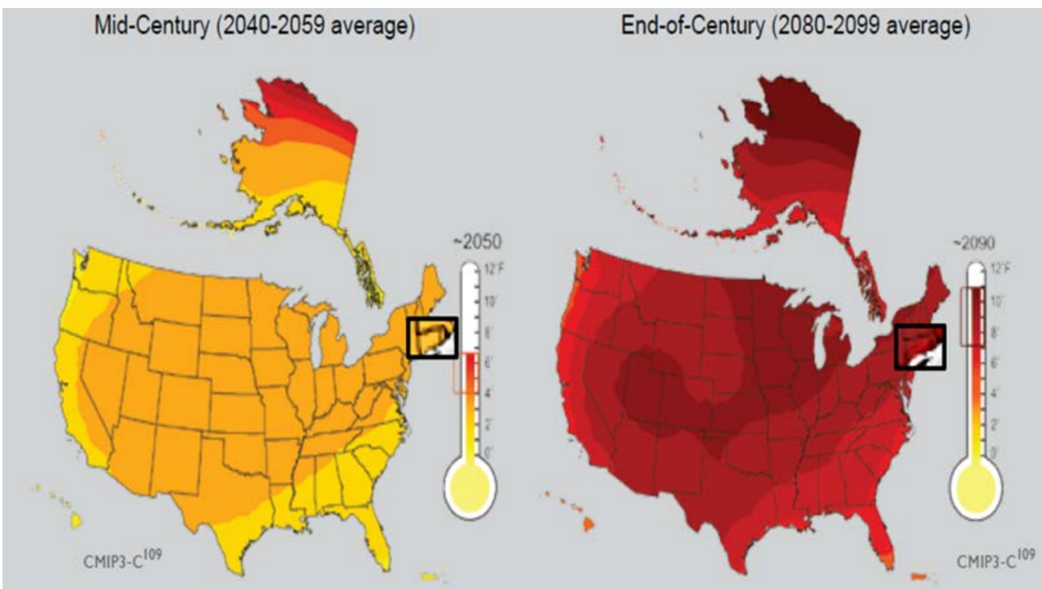

Figure 10.2.14-2: New Jersey High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

By late in the century under a high emissions scenario, winters in the northeast are projected to be much shorter with fewer cold days and more precipitation. Winter and spring precipitation is projected to increase, and the frequency of heavy downpours is projected to continue to increase as the century progresses. Seasonal drought risk is also projected to increase in summer and fall as higher temperatures lead to greater evaporation and earlier winter and spring snowmelt (USGCRP, 2009).

Figure 10.2.14-3 and Figure 10.2.14-4 show predicted seasonal precipitation change for an approximate thirty year period of 2071 to 2099 compared to a 1970 to 1999 approximate thirty year baseline. Figure 10.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (USGCRP, 2014b).

Figure 10.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. Continued increases in emissions would lead to large reductions in spring precipitation in the northeast. Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability (USGCRP, 2014b).

Cfa - Figure 10.2.14-5 shows that in a rapid emissions reduction scenario in the 30-year period for 2071 to 2099, precipitation will increase by 10 percent in winter, spring and summer for the entire state of New Jersey. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014b).

Figure 10.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 20 percent over the period 2071 to 2099. In summer, precipitation under this scenario could increase as much as 10 percent. No significant change in fall and summer rainfall is anticipated over the same period (USGCRP, 2014b).

Dfa **–** Precipitation changes for the Dfa region are consistent with projected changes for the Cfa region of New Jersey in both low and high GHG emissions scenarios.

Dfb **–** Precipitation changes for the Dfb region are consistent with projected changes for the Cfa and Dfa regions of New Jersey in both low and high emissions scenarios.

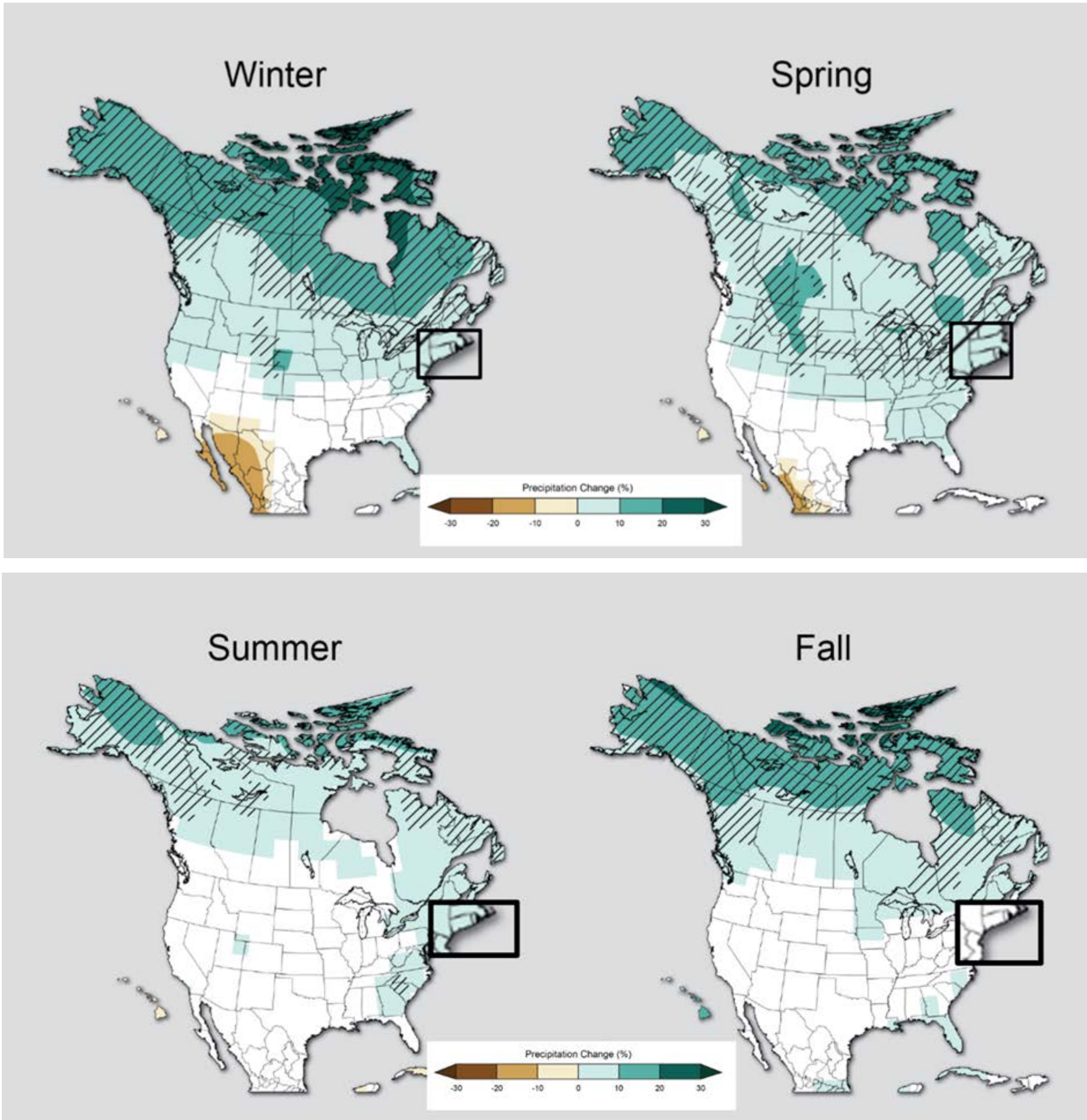

Figure 10.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

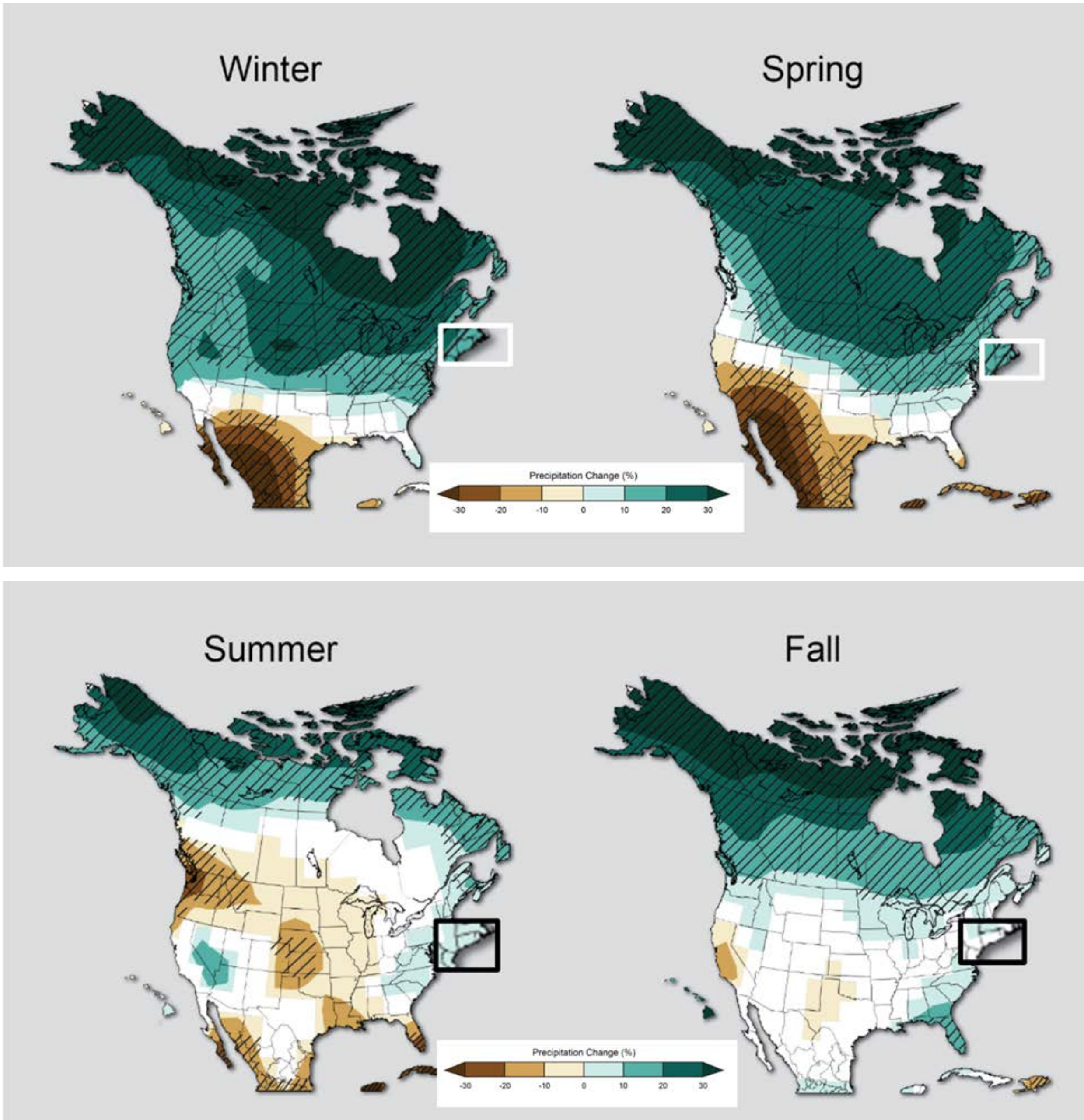

Figure 10.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors will continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012e). When water warms, it also expands, which contributes to sea level rise in the world's oceans. "Several studies have shown that the amount of heat stored in the ocean has increased substantially since the 1950s" (USEPA, 2012e). "Ocean heat content also influences sea level and currents" (USEPA, 2012e).

The amount of sea level rise will vary in the future along different stretches of the U.S. coastline and under different absolute global sea lever rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment (NCA) potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA; USGS; SERPD; and USACE, 2012). Figure 10.2.14-5 and Figure 10.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 10.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 10.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

Cfa – Figure 10.2.14-5 presents an 8 inch global average sea level rise above 1992 levels resulting in a .7 to 1 foot sea level rise in 2050 along the coast of New Jersey. Figure 10.2.14-6 indicates that a 1.24 foot sea level rise above 1992 level would result in a 1.3 to 1.7 foot sea level rise in 2050 along the coast of New Jersey.

Dfa and Dfb – These New Jersey regions are not affected by sea level rise.

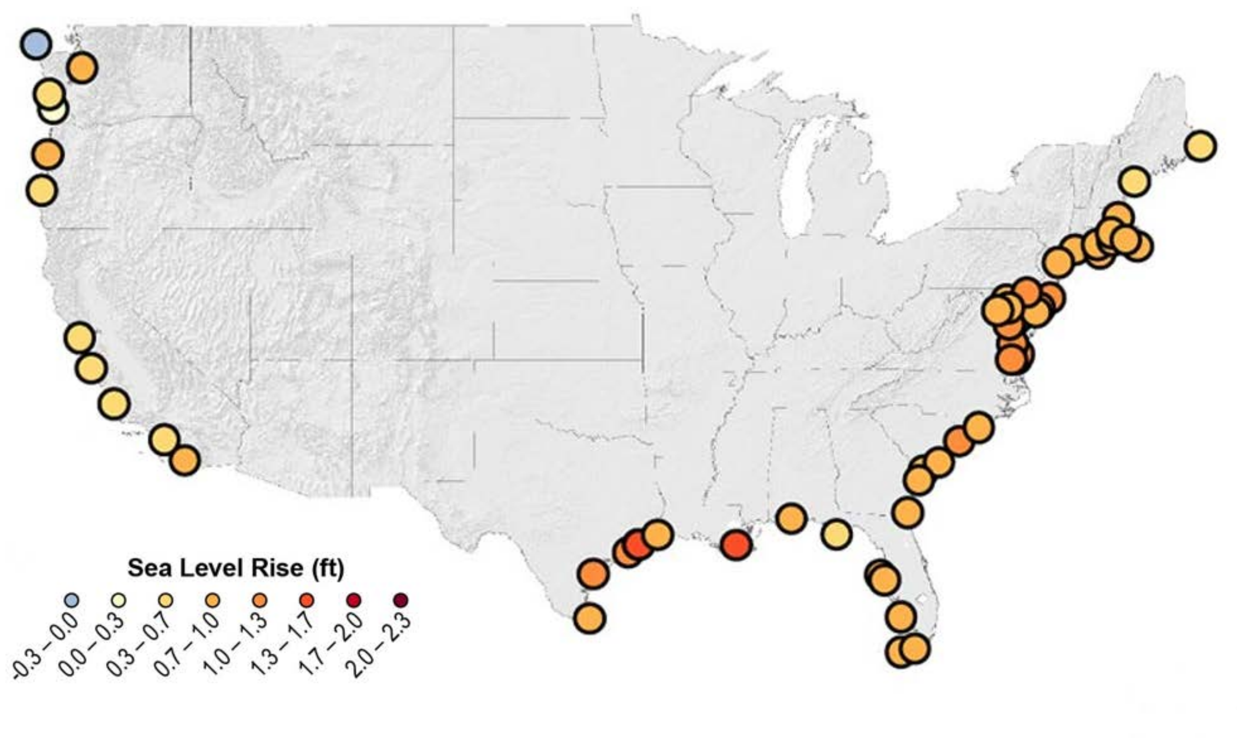

Figure 10.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

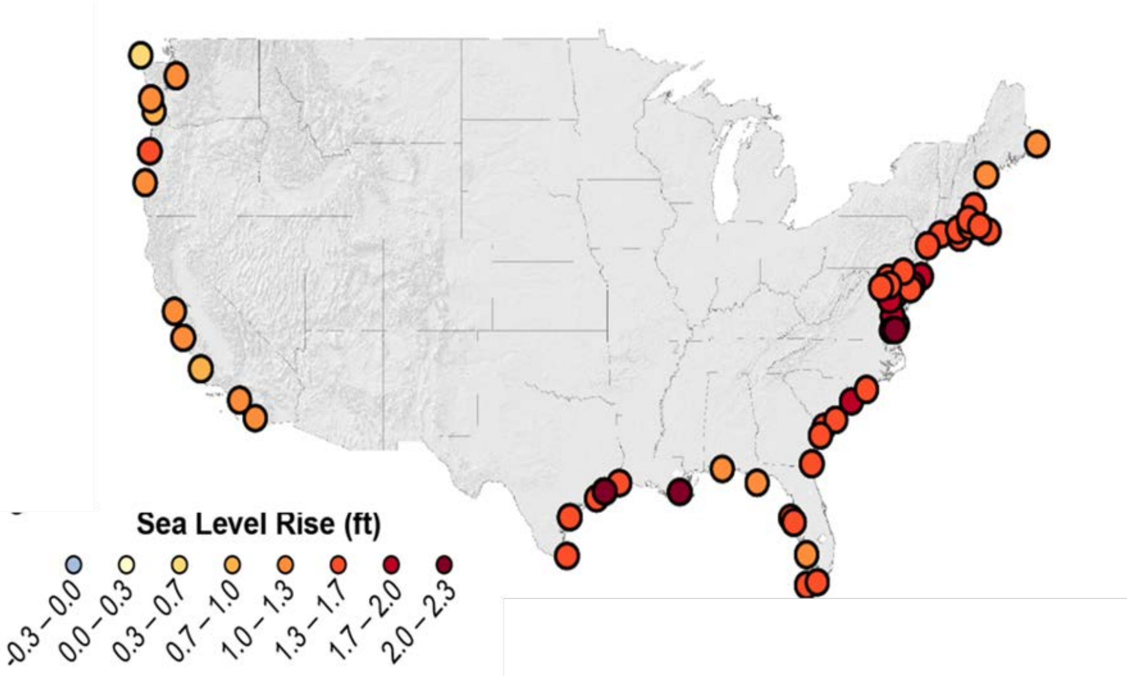

Figure 10.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change (USGCRP, 2014d).

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (USGCRP, 2014d). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would likely provide greater certainty (USGCRP, 2009).

10.2.14.4 Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 10.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Multiquip, 2015). Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015e). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the U.S. where the electricity was generated (USEPA, 2014h). Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a “worst-case” for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

Climate change-related sea level rise is already affecting New Jersey, and projections indicate that sea level will have risen 1.1 to 1.9 feet by 2050, and by 2.8 to 4.6 feet by 2100, versus a 2000 baseline. Higher sea levels are eroding beaches and inundating coastal wetlands, with negative implications for natural ecosystems, tourism, infrastructure, and dependent communities (State of New Jersey, 2013) (USGCRP, 2014e). Climate change is expected to increase the frequency and intensity of heavy downpours as the 21st century progresses (USGCRP, 2014f). This will have consequences for both natural and built environments. For natural ecosystems, it would result in increased nutrient and sediment inputs to already stressed receiving waters, and negative impacts on both flora and fauna (USGCRP, 2014e). Average summer temperatures, the number of heating degree days, and the intensity and duration of summer heat waves in New Jersey are all increasing, with negative consequences for public health and air quality, particularly in heavily urbanized areas in the Newark-New York City region (State of New Jersey, 2013) (USGCRP, 2014f).

Impact of Climate Change on FirstNet Installations and Infrastructure

Climate change impacts on FirstNet installations and infrastructure will vary from state to state, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location. The coastal areas of New Jersey are at risk for stronger hurricanes as a result of climate change. Sea level rise would increase the height, areal extent, and persistence of coastal flooding during these events (USGCRP, 2014g) (New Jersey Climate Adaptation Alliance, 2015c) which, together with high winds, would potentially threaten FirstNet infrastructure and installations. The projected increase in heavy downpours under climate change scenarios could have negative impacts on FirstNet installations and infrastructure located on or near the coast, as well as in floodplains and other areas prone to flooding (USGCRP, 2014f) (State of New Jersey, 2013).

Stronger storms may also increase the potential for damage from high winds and wind-borne debris. To mitigate these impact, FirstNet would seek to locate fixed assets such as cell towers out of flood plains and other at-risk areas, or elevate them such that they can continue operating during storm events. Energy sources such as powerlines and stand-by generators would be similarly elevated or otherwise protected. Towers would also be rated for stronger hurricane-force winds and hardened to protect them from strikes by wind-borne debris.

Extended periods of extreme heat combined with increased demand for electricity for air conditioning in the summer months may impede the operation of the electricity grid, particularly in the congested areas around New York City (DOE, 2015), and also potentially overwhelm the capacity of onsite equipment needed to keep microwave and other transmitters cool. Based on the impact significance criteria presented in Table 10.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

10.2.14.5 Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

The following section assesses potential GHG emission impacts associated with implementation of the Preferred Alternative in New Jersey, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wireless Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified ROW or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities. .
  - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes

or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.

- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However this would be highly dependent on their size, number, and the frequency and duration of their use. Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e. months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

10.2.14.6 Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Potential Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be few GHG emissions associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Emissions would arise from use of power generators as the main power source. Emissions from the use of one fossil-fuel-powered generator would not be significant based on the defined significance criteria, since activities would be temporary and short-term. These potential impacts could be further reduced through implementation of the required BMPs and mitigation measures. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period of time. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.14, Climate Change.

10.2.15 Human Health and Safety

10.2.15.1 Introduction

This section describes potential impacts to human health and safety in New Jersey associated with deployment of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.15.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 10.2.15-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 10.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, Toxic Substances Control Act (TSCA), EPCRA	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Man-Made Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

NA = not applicable

10.2.15.3 Description of Environmental Concerns

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 10.2.14-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. For example, if fuel is spilled from an onsite fuel tank. The spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The general public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2016d).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and then

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes, chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (OSHA, 2016d). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2016d). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure.

The New Jersey Department of Labor and Workforce Development (NJDLWD) is authorized by U.S. OSHA to administer the state program which oversees employee safety in all state and local government workplaces. The FirstNet Proposed Action and site work will not be performed by state or local employees. The involvement of state and local employees will be limited to emergency responders (e.g., police, fire, emergency medical transporters, etc.) and local government permitting authorities. NJDLWD is not authorized by OSHA to administer the state's private sector program for occupational safety or federal employers. Therefore, NJDLWD defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA.

Hazardous Materials and Hazardous Waste

The presence of environmental contamination at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Based on the impact significance criteria presented in Table 10.2.14-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination using federal resources such as the USEPA Cleanups in My Community database, through the NJDEP, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable New Jersey state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great NJDEP may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

FirstNet is intended to improve connectivity among public safety entities during disasters, thereby improving their ability to respond more safely and effectively during such events. The addition of towers, structures, facilities, equipment, and other deployment activities is expected to allow for expedited responses during natural and manmade disasters. The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 10.2.14-1, human health impacts could be significant if FirstNet deployment sites are located in areas are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

10.2.15.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and maintenance activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to human health and safety under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain

environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore or inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and

management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human

health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.15.5 Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable land-based infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to human health and safety as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small-scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.15, Human Health and Safety.

NJ APPENDIX A – COMMUNITIES OF CONCERN

Table A-1. S1 Ranked Terrestrial Communities of Concern in New Jersey

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Pitch Pine/Bear Oak/Black Chokeberry Woodland	Ridge and Valley	Ridgetop pine barrens	Extremely limited distribution within the Appalachian Highlands
Black Spruce/(Highbush Blueberry, Black Huckleberry)/Peat moss Woodland	Northeastern Highlands, Ridge and Valley, Northern Piedmont	Black spruce bog generally in kettle holes, basins, or other well-defined depressions	Documented occurrences limited to northwest Appalachian Highlands
Atlantic White-cedar/Winterberry Forest	Northeastern Highlands, Northern Piedmont, Ridge and Valley	Atlantic white-cedar swamp that occurs on peat in poorly drained depressions	Limited to extreme northern New Jersey
Atlantic White-cedar/Great Rhododendron Forest	Northeastern Highlands, Northern Piedmont	Saturated peatland forest dominated by Atlantic white-cedar with a dense shrub layer dominated by great rhododendron	Limited to the northern Appalachian Highlands
Red Maple-Black Gum-Sweetgum-Swamp Cottonwood Forest	Atlantic Coastal Pine Barrens	Association typically found at headwaters of streams	Limited to the outer portion of the Atlantic Coastal Plain
Pitch Pine/Dwarf Huckleberry/Pine-barren Sand-reed Woodland	Atlantic Coastal Pine Barrens, Middle Atlantic Coastal Plain	Pitch pine saturated woodland	Limited to the outer portion of the Atlantic Coastal Plain
American Holly/Northern Bayberry Forest	Atlantic Coastal Pine Barrens	Holly forest on the lee sides of dunes	Extremely limited occurrences within the outer portion of the Atlantic Coastal Plain
Atlantic White-cedar-Red Maple Lower New England/Northern Piedmont Forest	Northeastern Highlands, Atlantic Coastal Pine Barrens	Mixed Atlantic white-cedar swamp	Limited to within the northern Appalachian Highlands
Eastern Red-cedar/Northern Bayberry Woodland	Atlantic Coastal Pine Barrens	Community mostly on sand dunes, and upper edges of salt marshes	Limited occurrences throughout the Atlantic Coastal Plain
Pitch Pine/Blackjack Oak/Broom Crowberry Shrubland	Atlantic Coastal Pine Barrens	Fire adapted dwarf pine plains community	Restricted to the outer portion of the Coastal Plain

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Black Cherry/Wax Myrtle/Common Greenbrier Shrubland	Atlantic Coastal Pine Barrens	Temperate deciduous[174] maritime shrubland, usually on the lee side of dunes	Restricted to the coastline of the Outer Coastal Plain
Bear Oak Shrubland	Atlantic Coastal Pine Barrens	Scrub oak-dominated shrub thickets on sandy soils, outcrops, or rocky summits	Limited occurrences throughout the Atlantic Coastal Plain

Source: (Breden, 2001)

[174] Deciduous: "Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally" (EPA 2015k).

ACRONYMS

Acronyms	Definitions
AAQS	Ambient Air Quality Standards
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACY	Atlantic City International Airport
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act of 1979
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BYA	Billion Years Ago
CAA	Clean Air Act
CAFRA	Coastal Areas Facility Review Act
CATF	Climate Action Task Force
CCMP	Comprehensive Conservation and Management Plan
CEQ	Council On Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFA	Controlled Firing Areas
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Methane
CIMC	Cleanups In My Community
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
CWNJ	Conserve Wildlife New Jersey
DEP	Department of Environmental Protection
DOC	Department of Commerce

Acronyms	Definitions
DOE	Department of Energy
DOT	Department of Transportation
DPS	Division of Public Safety
DRBC	Delaware River Basic Commission
DSHW	Division of Solid and Hazardous Waste
DWSG	Division of Water Supply and Geoscience
EFH	Essential Fish Habitats
EHHAP	Environmental Health Hazard Assessment Project
EIA	Energy Information Agency
EJAC	Environmental Justice Advisory Council
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EOP	Emission Offset Provisions
EPCRA	Community Right To Know Act
ESA	Endangered Species Act
EWR	Newark Liberty International Airport
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FAR	Federal Aviation Regulations
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFC	Fossil Fuel Combustion
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager
FRA	Federal Railroad Administration
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FTA	Federal Transit Administration
GAO	Government Accountability Office
GHG	Greenhouse Gas
GWDS	Groundwater Discharges
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Area
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
JEMS	Joint Emergency Medical System
JFK	John F. Kennedy International Airport

Acronyms	Definitions
LBS	Locations-Based Services
LRR	Land Resource Regions
LTE	Long Term Evolution
LULUCF	Land Use Change, and Commercial Forestry
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MICU	Mobile Intensive Care Units
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MOA	Memorandum of Agreement
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MYA	Million Years Ago
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NCA	National Climate Assessment
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NJAAQS	New Jersey Ambient Air Quality Standards
NJDA	New Jersey Department of Agriculture
NJDEP	New Jersey Department of Environmental Protection
NJDFW	New Jersey Department of Fish and Wildlife
NJDLWD	New Jersey Department of Labor and Workforce Development
NJDOH	New Jersey Department of Health
NJDOT	New Jersey Department of Transportation
NJICS	New Jersey Interoperability Communications Service
NJMC	New Jersey Meadowlands Commission
NJNHP	New Jersey Natural Heritage Program
NJOEM	New Jersey Office of Environmental Management

Acronyms	Definitions
NJOHSP	New Jersey Office of Homeland Security and Preparedness
NJPDES	New Jersey Pollutant Discharge Elimination System
NJTA	New Jersey Turnpike Authority
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NNL	National Natural Landmark
NOAA	National Ocean and Atmospheric Administration
NOTAM	Disseminated Via Notices To Airmen
NOx	Nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	National Public Safety Broadband Network
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NST	National Institute of Standards and Technology
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWS	National Weather Service
NYC	New York City
NYOEM	New York Office of Environmental Management
NYSDEC	New York State Department of Environmental Conservation
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OETS	Office of Emergency Telecommunications Services
OSHA	Occupational Safety and Health Act
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PANYNJ	Pennsylvania – New York – New Jersey
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PHL	Philadelphia International Airport
POP	Point of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research

Acronyms	Definitions
PSD	Prevention of Significant Deterioration
PSDP	Public Safety Dispatch Point
PSS	Scrub-Shrub Wetlands
PUB	Palustrine Unconsolidated Bottom
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RFI	Request for Information
RGGI	Regional Greenhouse Gas Initiative
ROW	Right-of-Way
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SEPTA	Southeastern Pennsylvania Transportation Authority
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SHRI	Statewide Historic Resource Inventory
SIP	State Implementation Plan
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SOx	Oxides of Sulfur
SPDES	State Pollutant Discharge Elimination System
SPEN	State Police Emergency Network
SPGP	State Program General Permit
SPL	Sound Pressure Level
SSA	Sole Source Aquifer
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWPPP	Storm Water Pollution Prevention Plan
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TPY	Tons per Year
TRI	Toxics Release Inventory
TSP	Total Suspended Particulate Matter
TTN	Trenton Mercer Airport
TWA	Time Weighted Average
UAS	Unmanned Aircraft Systems
UASI	Urban Area Security Initiative

Acronyms	Definitions
UHF	Ultra-High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
UVA	University of Virginia
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
WCS	Wetlands Classification Standard
WNS	White Nose Syndrome
WSLS	Wetlands and Subaqueous Lands Section
WWI	World War I
WWII	World War II
YOY	Young of the Year

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