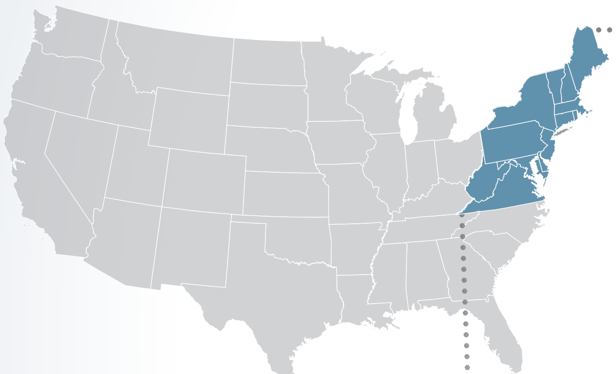
Nationwide Public Safety Broadband Network
Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 5 - CHAPTER 7



Connecticut
Delaware
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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 5 - CHAPTER 7

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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
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April 2016

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7. MARYLAND

During colonial times, Maryland served primarily as a penal colony and haven for English Catholics. Maryland became the seventh state to ratify the Constitution in 1788 (Maryland Office of the Secretary of State, 2015). Maryland is bordered by Pennsylvania to the north, Delaware to the east, West Virginia to the west, Virginia to the south, and the Chesapeake Bay through the middle of the state. The Atlantic Ocean borders the state on the east and the District of Columbia (D.C.) borders Maryland. This chapter provides details about the existing environment of Maryland as it relates to the Proposed Action.

General facts about Maryland are provided below:

- **State Nickname**: The Old Line State
- **Land Area:** 9,707 square miles; **United States (U.S.) Rank**: 42 (U.S. Census Bureau, 2015a)
- **Capital:** Annapolis
- **Counties:** 23 (U.S. Census Bureau, 2015b)
- **Estimated Population:** Over 5.9 million people; **U.S. Rank:** 19 (U.S. Census Bureau, 2015a)
- **Most Populated Cites:** Baltimore, Frederick, Annapolis, and Bethesda (U.S. Census Bureau, 2015b)
- **Main Rivers:** Patuxant River, Potomac River, Youghiogeeny River, Monotacy River, Chester River, Choptank River, Pocomoke River, Susquehanna River, and Nanticoke River
- **Bordering Waterbodies:** Chesapeake Bay and the Atlantic Ocean
- **Mountain Ranges:** Allegheny Mountains, Blue Ridge Mountains, and a portion of the Appalachian Mountains.
- **Highest Point:** Hoye-Crest (3,369 ft) (USGS, 2015a)

7.1. AFFECTED ENVIRONMENT

7.1.1. Infrastructure

7.1.1.1. Definition of the Resource

This section provides information on key Maryland 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 7.1.1.3 provides an overview of Maryland's traffic and transportation infrastructure, including road and rail networks and waterway facilities. Maryland's 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 Maryland are presented in more detail in Section 7.1.1.4. Section 7.1.1.5 describes Maryland's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Maryland utilities, such as power, water, and sewer, is presented in Section 7.1.1.6.

7.1.1.2. Specific Regulatory Considerations

Multiple Maryland laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 7.1.1-1 identifies the relevant laws and regulations for Maryland infrastructure. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

[1] The term "public safety entity" means an entity that provides public safety services. (7 U.S. Code [U.S.C.] § 140126)

Table 7.1.1-1: Relevant Maryland Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Executive Order 01.01.2003.18: Establishment of the Governor’s Office of Homeland Security	Governor's Office of Homeland Security; Maryland Emergency Management Agency	Directs homeland security across the state and coordinates with federal, state, and local governments; coordinates state assistance to supplement local efforts in responding to natural or manmade disasters; coordinates the operation and maintenance of a Statewide Public Safety Interoperability Radio System
Code of Maryland (COMAR): Title 20, Public Service Commission	Public Service Commission; People's Counsel	Promotes adequate, economical, and efficient delivery of utility services including gas, electricity, water, sewage, and telecommunications; prescribes standards for public service companies and gas master meter operators; oversees rates and tariffs; forebears from regulating voice over internet protocol (VoIP) or cellular services
COMAR: Title 11, Department of Transportation	Maryland Department of Transportation (MDOT)	Develops plans, manages, constructs, maintains, and repairs state highways, airports, ports, and railroads

Sources: (Thomson Reuters, 2015) (Maryland.gov, 2015)

7.1.1.3. Transportation

This section describes the traffic and transportation infrastructure in Maryland, including specific information related to the road networks, airport facilities, rail networks, harbors (this PEIS defines “harbor” as a body of water deep enough to allow anchorage of a ship or boat), 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 Maryland are based on a review of maps, aerial photography, and federal and state data sources.

The Maryland Department of Transportation (MDOT) 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 responsibilities of MDOT are divided amongst five administrations and one Authority.

- The State Highway Administration’s core function is to “maintain, improve and develop state highways and roads;”
- The Maryland Transportation Authority’s core function is to “maintain and improve Maryland bridges, tunnels, and tolls;”
- The Motor Vehicle Administration’s core function is to “ensure driving Maryland citizens have appropriate documentation to drive a vehicle legally;”
- The Maryland Aviation Administration’s (MAA) core function is to “provide safe and functioning airports for Maryland citizens;”
- The Maryland Port Administration’s core function is to “provide necessary employees to oversee the loading and unloading of port vessels;” and
- The Maryland Transit Administration’s core function is to “provide transit (light rail and metro), bus, and mobility services to Maryland citizens” (MDOT, 2015a).

Maryland has an extensive and complex transportation system across the entire state. The State's transportation network consists of:

- Over 32,000 miles of state and local roadways and over 5,000 bridges (MDOT, 2014),
- 1,157 miles of rail network that includes passenger rail and freight (MDOT, 2009),
- 219 aviation facilities that includes both public and private airports (FAA, 2015a), and
- 29 harbors (US Harbors, 2015) and 1 major port (MDOT, 2014).

Road Networks

As identified in Figure 7.1.1-1, the major urban center of the state is Washington-Baltimore-Arlington. Maryland has six major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel to local towns is conducted mainly via state and county routes (Maryland State Highway Administration, 2015). Table 7.1.1-2 lists the interstates and their start/end points in Maryland. 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).

Table 7.1.1-2: Maryland Interstates

Interstate	Southern or western terminus in MD	Northern or eastern terminus in MD
I-68	WV line at Friendsville	I-70 at Hancock
I-70	PA line at Hancock	Baltimore
I-81	WV line at Williamsport	PA line at Maugansville
I-83	Baltimore	PA line at Freeland
I-95	VA line on the Woodrow Wilson Bridge	Delaware (DE) line at Elkton
I-97	U.S. 50 in Parole	I-695 in Ferndale

In addition to the Interstate System, Maryland 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 7.1.1-1 illustrates the major transportation networks, including roadways, in Maryland. Section 7.1.8, Visual Resources, describes the National and State Scenic Byways found in Maryland from an aesthetic perspective. National Scenic Byways are roads with nationwide interest; these byways are designated and managed by the U.S. Department of Transportation's Federal Highway Administration (FHWA).

Maryland has six National Scenic Byways:

- Baltimore's Historic Charles Street: 12 miles through the heart of Baltimore (FHWA, 2015a);
- Chesapeake Country Scenic Byway: 85.5 miles in Maryland's Eastern Shore (FHWA, 2015b);
- Harriet Tubman Underground Railroad Byway: 125 miles through Maryland's Eastern Shore (FHWA, 2015c);
- Historic National Road: 824.2 miles through Illinois, Indiana, Maryland, Ohio, Pennsylvania, and West Virginia (FHWA, 2015d);
- Journey Through Hallowed Ground Byway: 180 miles through central Maryland, Pennsylvania, and Virginia (FHWA, 2015e); and

- Religious Freedom Byway: 195 miles in southern Maryland (FHWA, 2015f).

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by MDOT. Maryland has 12 State Scenic Byways that crisscross the entire state: Mountain Maryland, Chesapeake and Ohio Canal, Antietam Campaign, Old Main Streets, Mason and Dixon, Falls Road, Horses and Hounds, Lower Susquehanna, Star-Spangled Banner, Booth's Escape, Roots and Tides, and Cape to Cape (State of Maryland Tourism, 2015c).

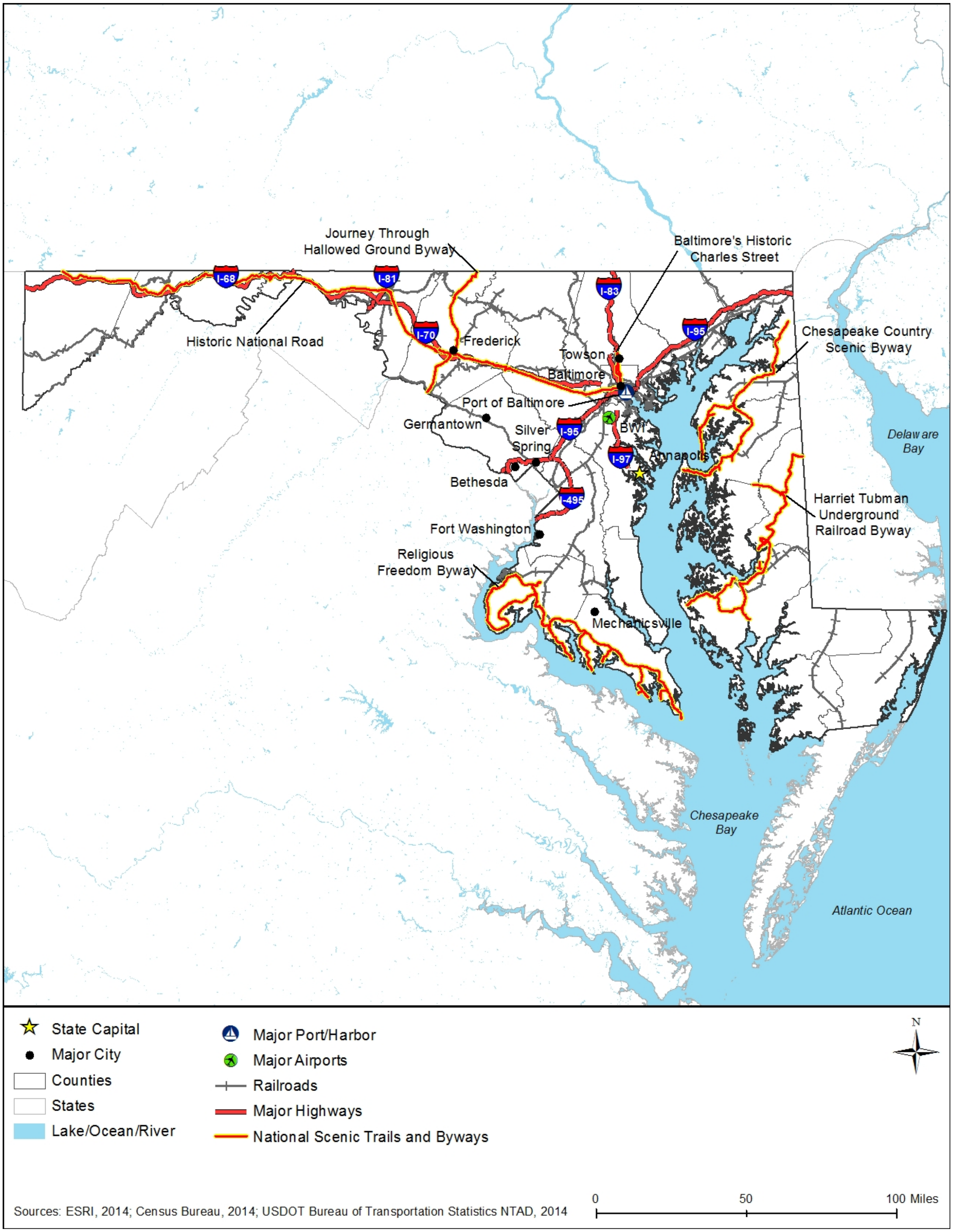


Figure 7.1.1-1: Maryland Transportation Networks

Airports

Air service in Maryland is provided by four major international airports, one of which is in Maryland. The Baltimore-Washington International (BWI) Thurgood Marshall Airport is located in Baltimore, owned, and operated by the MAA. In 2014, BWI airport served over 22.31 million passengers (MAA, 2015a). In 2013, BWI airport moved over 229,000 pounds of freight and over 240,000 pounds of cargo (MAA, 2015b). Other major international airports serving Maryland include:

- Ronald Reagan Washington National Airport (DCA) in Arlington, VA: Owned and operated by the Metropolitan Washington Airports Authority (MWAA). In 2014, the airport moved over 20.8 million passengers and over 3.9 million pounds of freight (MWAA, 2015a);
- Washington Dulles International Airport (IAD) in Dulles, VA: Owned and operated by the MWAA. In 2014, the airport moved over 21.5 million passengers and over 565.2 million pounds of freight (MWAA, 2015b); and
- Philadelphia International Airport (PHL) in Philadelphia, PA: Owned and operated by the City of Philadelphia. In 2014, the airport moved 30.7 million passengers and annually moves approximately 432,752 tons of cargo (Philadelphia International Airport, 2015).

Figure 7.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 7.1.7, Airspace, provides greater detail on airports and airspace in Maryland.

Rail Networks

Maryland is connected to an extensive rail network of passenger rail (Amtrak), public transportation (commuter rail and subway systems), and freight rail. Maryland's railroad network is comprised of approximately 1,157 miles of tracks, which includes freight rail and passenger rail (MDOT, 2009). Figure 7.1.1-1 illustrates the major transportation networks, including rail lines, in Maryland.

Amtrak runs numerous lines throughout Maryland, including the Acela Express and Northeast Regional, which is a popular line, with routes running from Washington, D.C. to Boston in 6 hours 40 minutes and 7 hours 50 minutes, respectively. In fiscal year 2013, Amtrak carried two million passengers who arrived or departed from Maryland stations (MDOT, 2014). Table 7.1.1-3 provides a complete list of Amtrak lines that run through Maryland.

The Maryland Area Regional Commuter (MARC) is operated by the Maryland Transit Administration (MTA), a division of MDOT. It provides service between Union Station and stations in Maryland, including Baltimore, and West Virginia along three lines: the Penn, Camden, and Brunswick Lines. MARC stops at 43 stations (MTA, 2015a) and carried an average of 36,685 passengers daily in fiscal year 2013 (MTA, 2013). In fiscal year 2013, MARC carried approximately 9.1 million passengers (MDOT, 2014).

Table 7.1.1-3: Amtrak Train Routes Serving Maryland

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Maryland
Acela Express	Boston, MA	Washington, D.C.	6 hours 40 minutes	Baltimore
Capitol Limited	Washington, D.C.	Chicago, IL	18 hours	Rockville
Cardinal/Hoosier State	New York, NY	Chicago, IL	26 hours 30 minutes	Baltimore
Carolinian/Piedmont	New York, NY	Charlotte, North Carolina	13 hours 30 minutes	Baltimore
Crescent	New York, NY	New Orleans, Louisiana	30 hours	Baltimore
Northeast Regional	Boston, MA	Virginia Beach, VA	12 hours 30 minutes	Baltimore
Silver Service/Palmetto	New York, NY	Tampa/Miami, FL	28+ hours	Baltimore
Vermonter	St. Albans, VT	Washington, D.C.	13 hours 45 minutes	Baltimore

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

The Washington Metropolitan Area Transit Authority (WMATA) runs Washington, D.C.'s public transportation system, called Metro. The system includes Metrorail and Metrobus. Metrorail is Washington, D.C.'s subway system with 91 stations that are either above or below ground; the system extends into the Maryland suburbs of Washington, D.C. Metrorail has 118 miles of track and is the nation's second largest heavy rail transit system (WMATA, 2013). In total, Metrorail served approximately 209 million passengers in 2013 (WMATA, 2013). In 2012, 124 million trips were made on the Maryland portion of the WMATA system (MDOT, 2014).

The MTA also runs Baltimore's Metro Subway system. The Metro Subway is 15.5 miles long, with 14 stations on one, long line (MTA, 2015b). In addition, the MTA runs a light rail line from Hunt Valley to BWI airport and Glen Burnie (MTA, 2015c). In 2012, Baltimore's Light Rail and Metro Subway handled 23.8 million trips (MDOT, 2014).

In 2008, over 24 million tons of freight moved to or from Maryland via freight rail; that same freight was valued at over $6.9 million (M) dollars (MDOT, 2013a).

Harbors and Ports

Maryland's coastal nature lends itself to the development of many small harbors and marinas across the state. The Maryland Department of Natural Resources' (MDNR) Clean Marina Initiative is designed to keep these areas pollution free. The Initiative "promotes marinas, boatyards, and yacht clubs of any size that meet legal requirements and voluntarily adopt pollution prevention practices." Currently, about a quarter of the states roughly 600 marinas have been certified through the program. This includes facilities such as the Port Annapolis Marina, the Somers Cove Marina and the National Harbor Marina (MDNR, 2015a).

Maryland has over 25 harbors located throughout the state and one main port. The state's largest shipping port is the Port of Baltimore, overseen by the MDOT Port Administration. Because of its location as an inland east coast port, the Port of Baltimore is critical to U.S. trade. This facility is within a day of a third of the U.S. population, and is the closest east coast port to most of the Midwest (MPA, 2015). Shown in Figure 7.1.1-1, the Port of Baltimore can be reached via both I-95 and I-395. United States Census Data from 2013 listed the Port of Baltimore as the ninth largest importer, by value of trade. The Port imported goods worth $31.7 billion (B), weighing 9.9 billion kg. It was also the ninth largest exporter that year, and was responsible for the export of 1.7 billion kg of goods, worth $2.09B (U.S. Census Bureau, 2015c). Although considerably smaller, the Port of Annapolis was responsible for some trade as well. In 2013, it imported $8.5M in goods, and exported $18.2M (U.S. Census Bureau, 2015c).

7.1.1.4. Public Safety Services

Maryland 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. Table 7.1.1-4 presents Maryland'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 7.1.9, Socioeconomics.

Table 7.1.1-4: Key Maryland Indicators

Maryland Indicators	
Estimated Population (2014)	5,976,407
Land Area (square miles) (2010)	9,707.24
Population Density (persons per sq. mile) (2010)	594.8
Municipal Governments (2013)	157

Sources: *(U.S. Census Bureau, 2015a) (National League of Cities, 2007)*

Table 7.1.1-5 presents Maryland's public safety infrastructure, including fire and police stations. Table 7.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 7.1.1-5: Public Safety Infrastructure in Maryland by Type

Infrastructure Type	Number
Fire and Rescue Stations	840
Law Enforcement Agencies	110
Fire Departments	577

Sources: (National Fire Department Census, 2015) (Reaves, 2011)

Table 7.1.1-6: First Responder Personnel in Maryland by Type

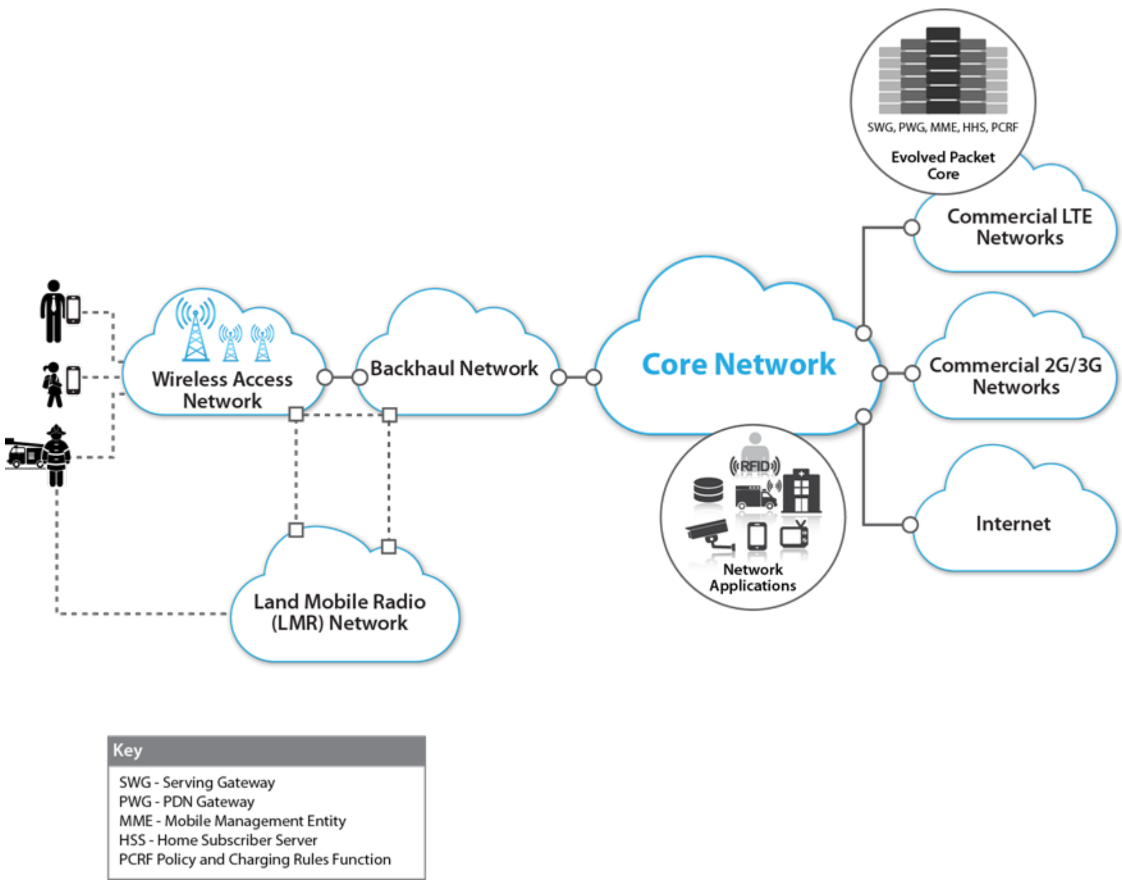
First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	1,260
Fire and Rescue Personnel	29,485
Law Enforcement Personnel	46,221
Emergency Medical Technicians and Paramedics	4,680

Sources: (National Fire Department Census, 2015) (BLS, 2015a) (Reaves, 2011)

7.1.1.5. Telecommunications Resources

Telecommunication resources in Maryland can be divided into two primary categories: specific public safety communications infrastructure and commercial telecommunications infrastructure (FCC, 2015b) (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 Maryland is widespread and similar to other states in the U.S. Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 7.1.1-2 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 7.1.1-2: 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 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 Maryland. 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 network communications in Maryland reflect a combination of older Low-Band and High-Band Very High Frequency (VHF)[2] analog[3] radios operating across multiple frequencies as well as 700 MHz and 800 MHz analog and digital[4] wireless radios and infrastructure. In addition, the Maryland's Department of Information Technology was the recipient of a 2010 Broadband Technology Opportunities Program (BTOP) grant for the construction and deployment of fiber infrastructure. The BTOP grant supported the deployment of 1,324 miles of fiber and upgraded network speeds to 10 Gigabit per Second (Gbps). As a

[2] VHF band covers frequencies ranging from 30 MHz to 300 MHz. (NTIA, 2005)
[3] Analog networks are those based on circuit-switching, which establishes a connection and then maintains it through the whole communication. Although now digitized, the nation's original telephone system is an example of an analog network.
[4] Digital networks are those that allow for simultaneous digital transmission of voice, data, video, and other network services over the traditional public-switched telephone network, or over new 3G, 4G, or LTE wireless networks.

result of this federal grant, 250 Public Safety Community Anchor Institutions (CAIs) were connected with high-speed fiber.

Statewide Networks

In 2009, Maryland committed to a Project 25 (P-25) statewide network upgrade project to be implemented in four phases from 2012-2017. The purpose of the project is to provide digital service capability, greater interoperability, and better operational efficiencies in public safety and state agency networks. Figure 7.1.1-3 provides a summary of the statewide deployment plan which began with an initial adoption by the MDOT and State Police users along the I-95 corridor from the Delaware to Baltimore to the Bay Bridge (Bryson, 2015). Dubbed Maryland First Responders Interoperable Radio System Team (FiRST), the P-25 network went live in 2012 with a staged deployment approach providing interoperable coverage at 700 MHz and compliance with the Federal Communications Commission's (FCC) narrowband regulatory requirements for 700 MHz public safety networks.

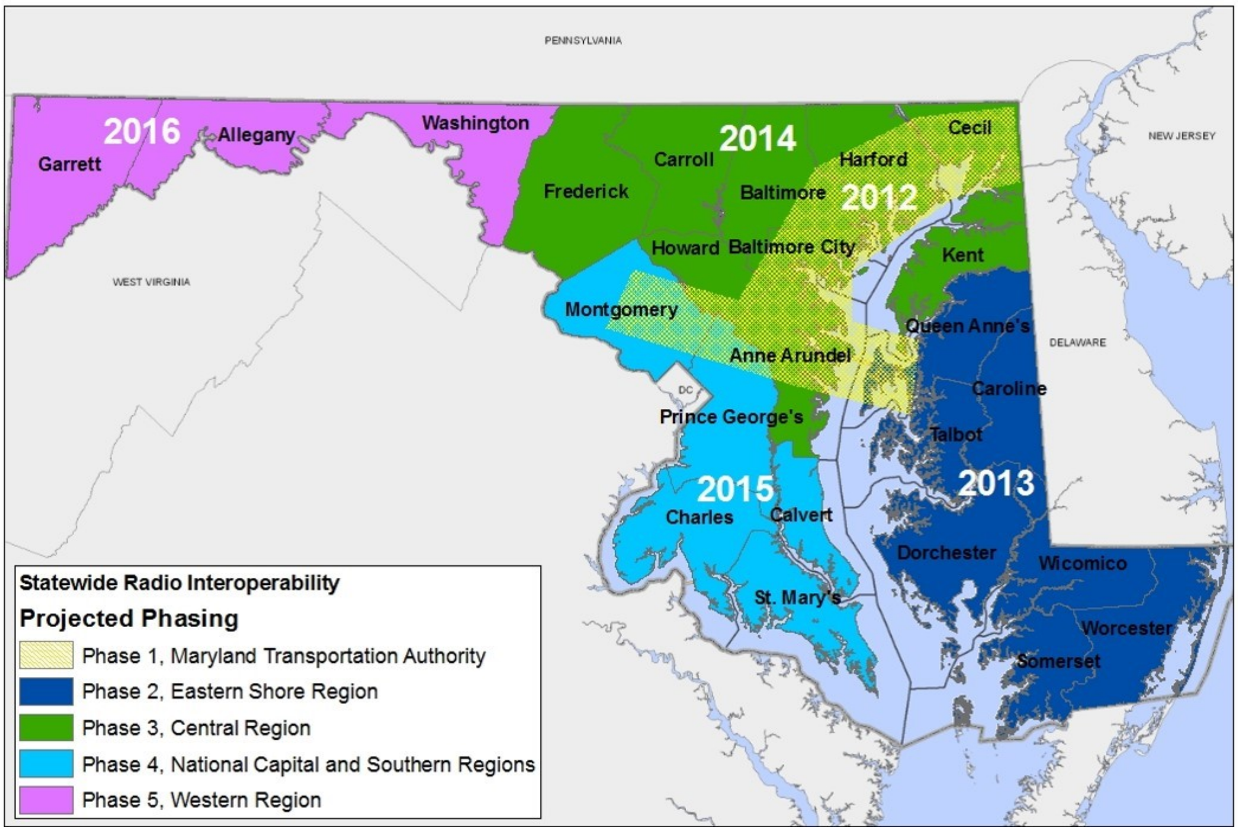


Figure 7.1.1-3: FiRST Regional Deployment Plan

Source: (FiRST Interoperability, 2014)

In Maryland, responsibility and governance over public safety communications is organized such that the statewide 700 MHz network is centrally overseen by a Radio Control Board with technical and operational responsibility for the network within Maryland's Department of

Information Technology[5] (FiRST Interoperability, 2014). Public safety responsibility for local network coverage and operations is at the city/town and county level. Most local jurisdictions are leveraging the State's infrastructure for the 700-megahertz (MHz) P-25 system. A newer option has been introduced in Maryland where local agencies and cities/counties have the option to use the FiRST statewide system as a back-up for redundancy in case of outage. The Maryland Institute for Emergency Medical Services System oversees EMS Ultra High Frequency (UHF)[6] in use within Maryland's five EMS regions. Regarding interoperability, according to the Maryland's Statewide Communications Interoperability Plan (SCIP) (2008): "Maryland's Statewide Interoperability Executive Committee (SIEC) along with Maryland and Regional Interoperability Groups (i.e. Maryland Eastern Shore Interoperability Network (MESIN) group, the Central Maryland Area Regional Communications (CMARC) group, and others regional groups in Southern MD, Western MD, and the National Capital Region (NCR) will have the responsibility of developing and implementing regional strategies to provide radio communications interoperability within the regions in accordance with the technical requirements of this SCIP plan" (State of Maryland, 2008).

Regional Networks

Maryland currently has five regional networks operating in the state providing specific coverage and public safety communications within their specific regions as well as mutual aid and cross-agency voice communications. Figure 7.1.1-4 provides a graphical representation of these regions. (GOHS, 2015)

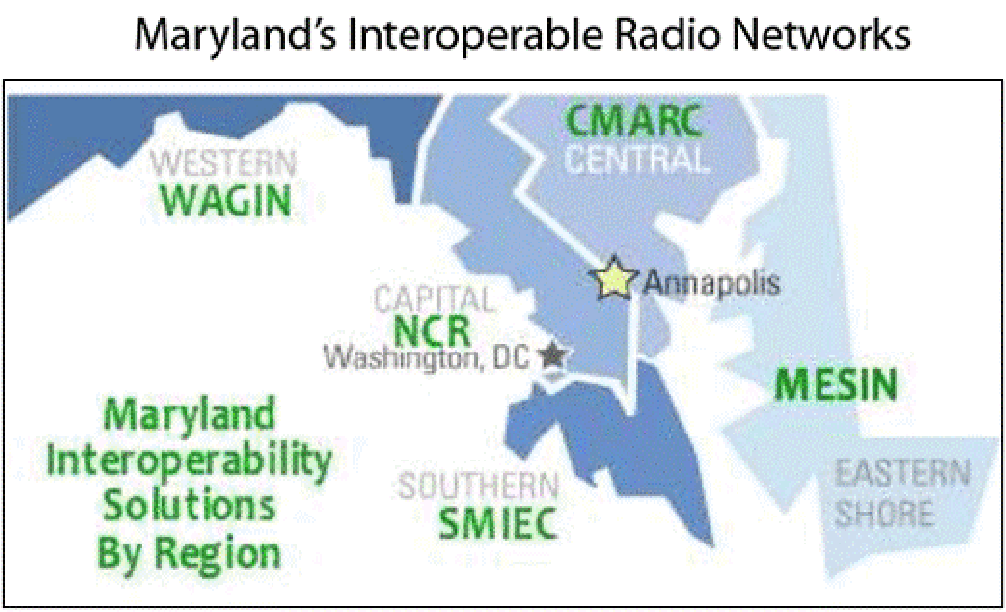


Figure 7.1.1-4: Maryland's Current Regional Interoperable Networks

Source: (GOHS, 2015)

[5] With the exception of Region 1 which falls under the Maryland Transportation Authority.

[6] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

The Governor's Office of Homeland Security summarizes the accomplishments regarding regional interoperability as follows: "While the statewide radio system is under construction, first responders in every county in Maryland are now connected to one of five regional systems that provide radio interoperability within their region. In July 2012, counties in Southern Maryland completed construction of the Southern Maryland Interoperable Emergency Communications (SMIEC) Network, joining the previously completed CMARC, MESIN, National Capital Region (NCR), and Washington Allegany Garrett Interoperability Network systems." (GOHS, 2015)

Maryland is part of the NCR Homeland Security Program and its continued deployment of the 700 MHz P-25 Phase 2 network, FiRST (as described above). FiRST has increased Maryland's ability to interoperate with other NCR local, state, and federal agency users. Figure 7.1.1-5 presents the jurisdictions included in the National Capital Region (NCR Homeland Security, 2015). The selection of 700 MHz as the State's choice for interoperability standardization was especially important given the State's geography, spectrum congestion, potential for interference from adjacent operators, the lack of available spectrum at 800 MHz (the State's primary alternative for selection of a common spectrum), and the interoperability with other NCR systems (Bryson, 2015). Due to the need to coordinate with Pennsylvania, Delaware, Virginia, and the District of Columbia, allocation of channels to Maryland's 700 MHz FiRST network was complex and highly challenging. The approach involved the combined use of a general pool of shared 700 MHz channels combined with state-specific channels in a split of 15% shared vs. 85% state (Bryson, 2015).

Figure 7.1.1-5: Jurisdictions in NCR Program Homeland Security Program

Source: (NCR Homeland Security, 2015)

Public Safety Answering Points (PSAPs)

According to the FCC's Master PSAP registry, there are 31 Primary PSAPs in the State of Maryland (FCC, 2015a). These centers are operated by a combination of State Police, local police, county emergency services, and military emergency communications dispatch facilities throughout the state.

Commercial Telecommunications Infrastructure

Maryland'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 Maryland'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, Maryland's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks. Table 7.1.1-7 presents the number of providers of switched access[7] lines, Internet access[8], and mobile wireless services including coverage.

Table 7.1.1-7: Telecommunications Access Providers and Coverage in Maryland as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	164	98% of households
Internet access	65	73% of households
Mobile Wireless	17	98% of population

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

[7] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services. (POTS)" (FCC, 2014a)
[8] Internet access includes DSL, cable modem, fiber, satellite, and fixed wireless providers.

Table 7.1.1-8 shows the wireless providers in Maryland along with their geographic coverage. The following four maps, Figure 7.1.1-6 to Figure 7.1.1-9, show: the combined coverage for the top two providers AT&T and Verizon Wireless; Sprint's and T-Mobile's coverage; U.S. Cellular's and Cricket Wireless's coverage; and other company's coverage, respectively.

Table 7.1.1-8: Wireless Telecommunications Coverage by Providers

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	100%
Verizon Wireless	93.25%
Sprint	66.81%
T-Mobile	40.18%
Cricket Wireless	31.82%
U.S. Cellular	11.76%
Other[a]	15.36%
Believe Wireless Broadband	6.88%

Source*:* (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Shentel (Sprint Affiliate), Bloosurf, NTELOS, Freedom Wireless Broadband, LLC, NTELOS, Eastern Shore Communications, LLC, Brookwood Ventures LLC, Altius Broadband, Vector Data Systems LLC, and Easton Utilities Commission

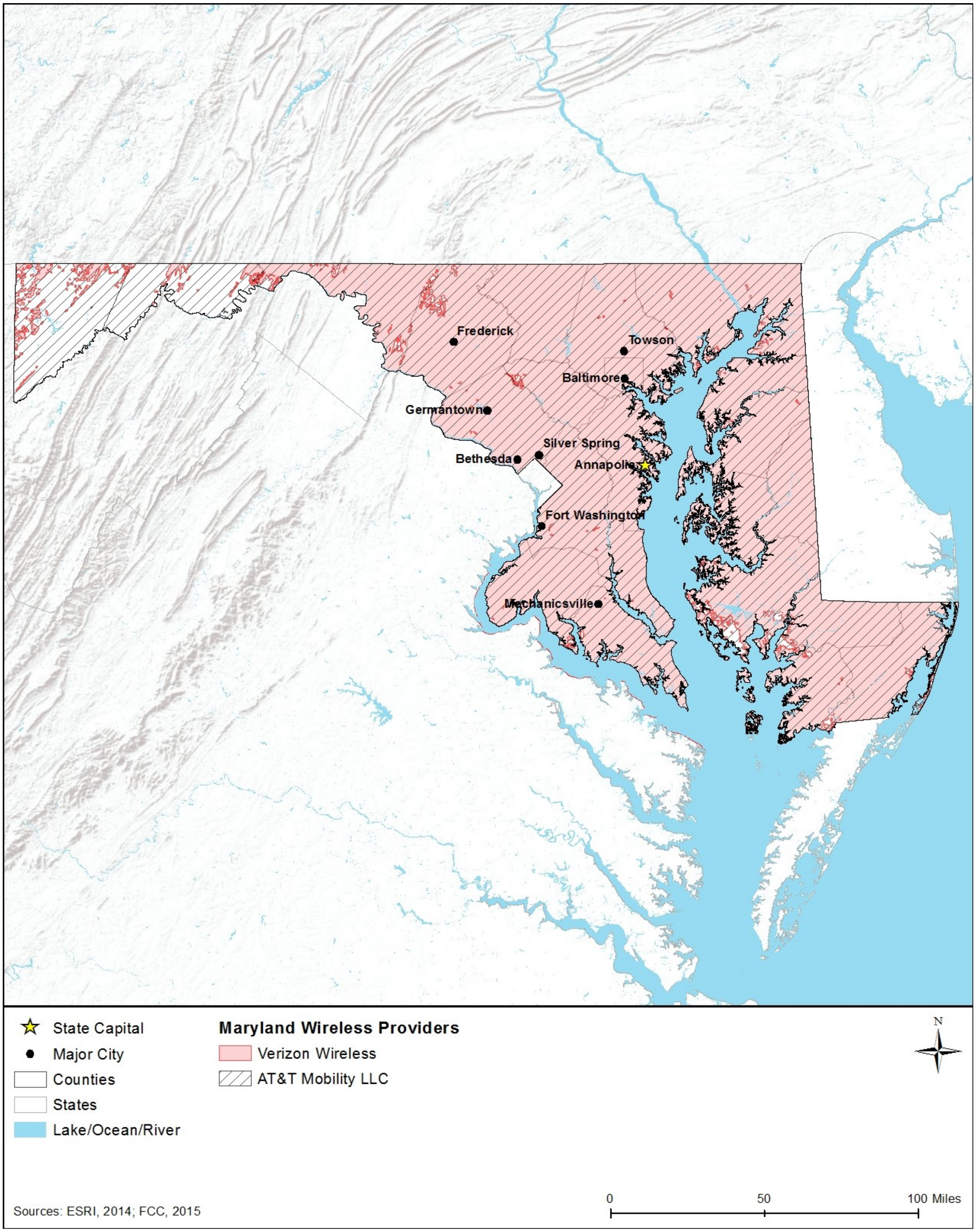


Figure 7.1.1-6: AT&T and Verizon Wireless Availability in Maryland

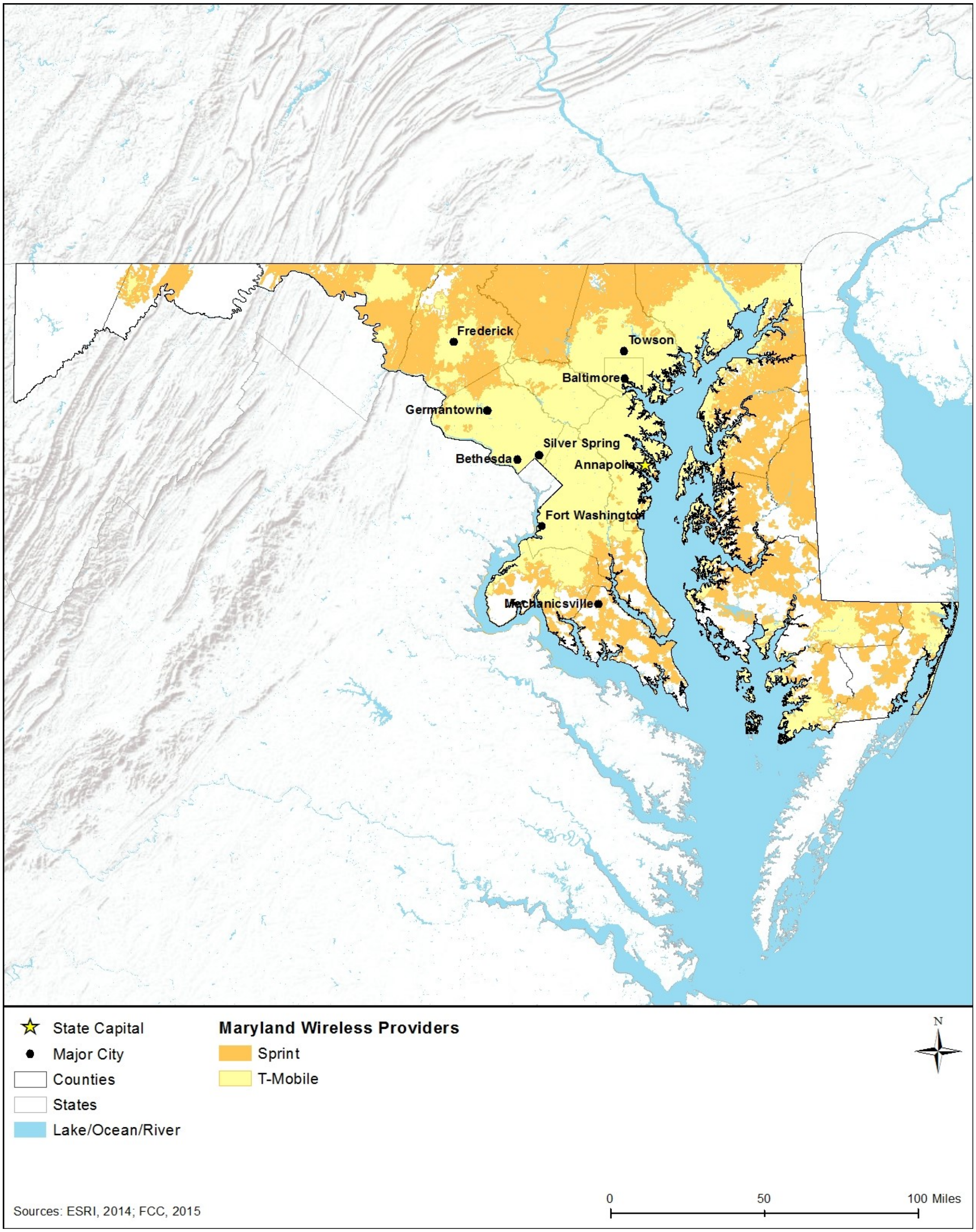


Figure 7.1.1-7: Sprint and T-Mobile Wireless Availability in Maryland

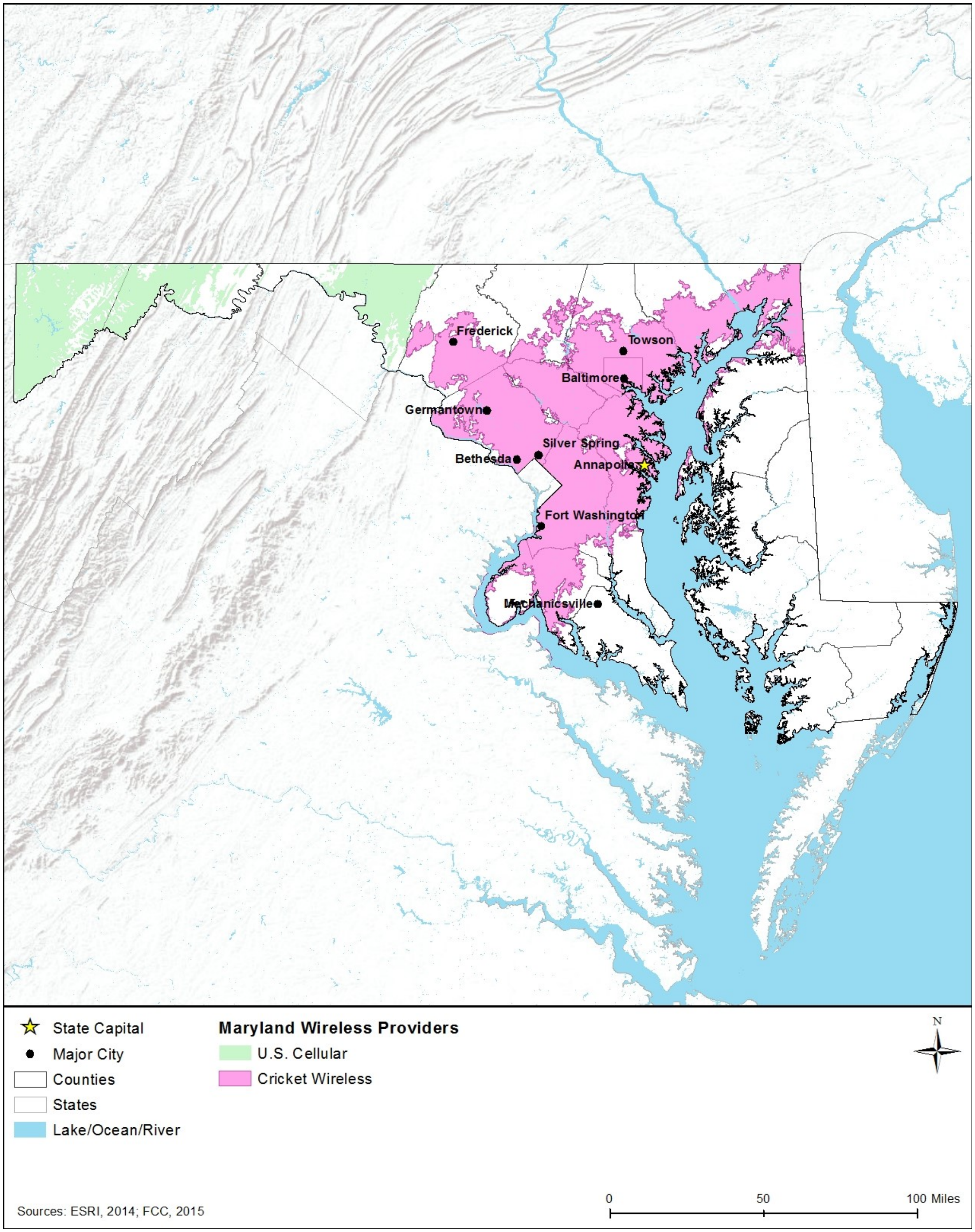


Figure 7.1.1-8: U.S. Cellular and Cricket Wireless Availability in Maryland

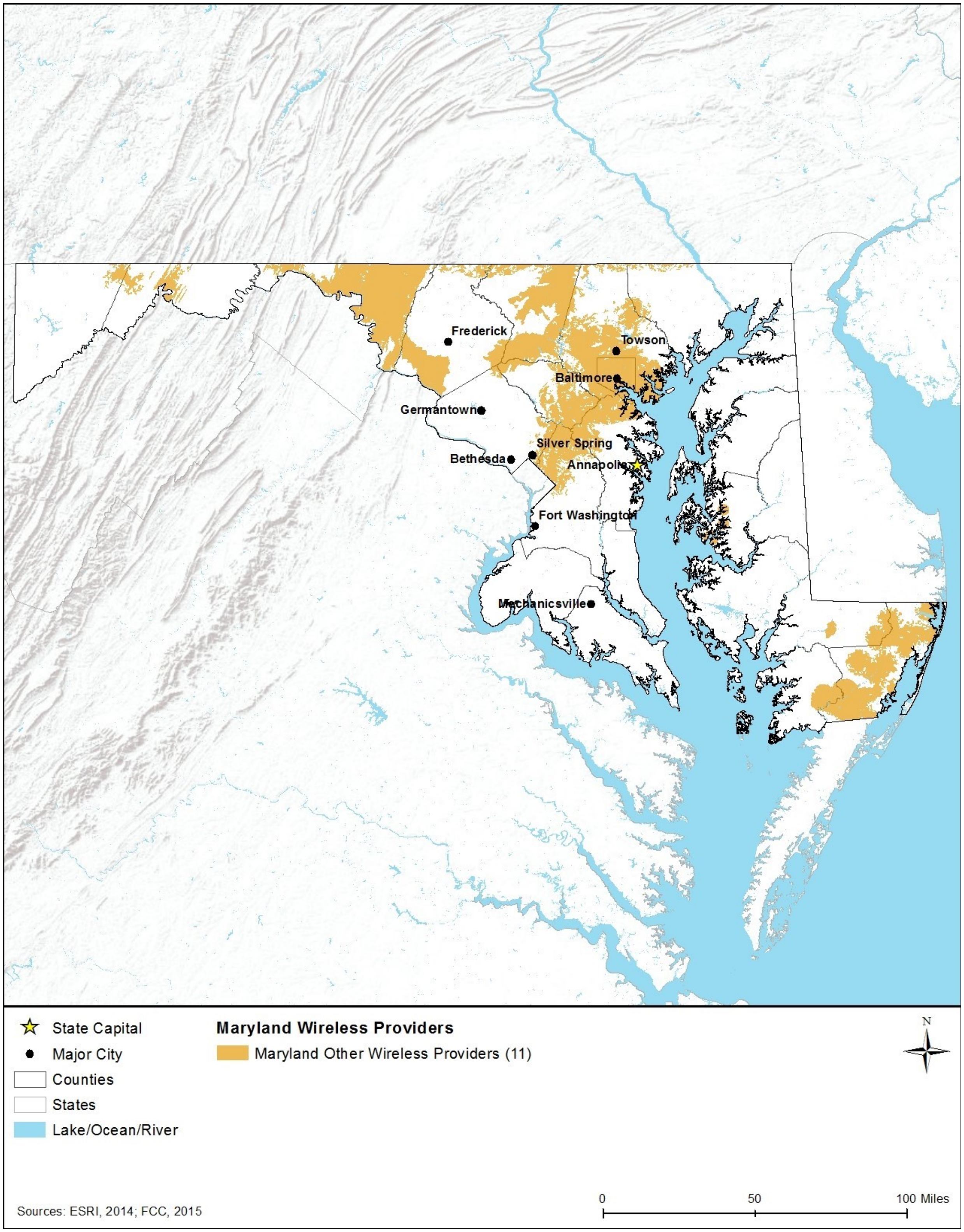


Figure 7.1.1-9: Other Company Wireless Availability in Maryland

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 7.1.1-10 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 7.1.1-10: Types of Towers

Telecommunications tower infrastructure can be found throughout Maryland, although tower infrastructure is concentrated in the higher and more densely populated areas. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b). [9] Table 7.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in Maryland. Figure 7.1.1-11 shows the location of those 842 structures, as of June 2015.

[9] 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 7.1.1-9: Number of Commercial Towers in Maryland by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	181	100ft and over	0
75ft – 100ft	155	75ft – 100ft	0
50ft – 75ft	195	50ft – 75ft	12
25ft – 50ft	149	25ft – 50ft	34
25ft and below	23	25ft and below	0
Subtotal	**703**	**Subtotal**	**46**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	14	100ft and over	1
75ft – 100ft	9	75ft – 100ft	3
50ft – 75ft	4	50ft – 75ft	3
25ft – 50ft	3	25ft – 50ft	2
25ft and below	0	25ft and below	1
Subtotal	**30**	**Subtotal**	**10**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	4	100ft and over	10
75ft – 100ft	13	75ft – 100ft	0
50ft – 75ft	15	50ft – 75ft	0
25ft – 50ft	5	25ft – 50ft	0
25ft and below	1	25ft and below	0
Subtotal	**38**	**Subtotal**	**10**
Constructed Tanks[d]			
Tanks	5		
Subtotal	**5**		
Total All Tower Structures		**842**	

Source: (FCC, 2015c)

[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, 2013)
[b] Free standing or guyed structure used for communication purposes. (FCC, 2013)
[c] Multiple constructed structures per antenna registration. (FCC, 2013)
[d] Any type of tank – water, gas, etc. with a constructed antenna. (FCC, 2013)

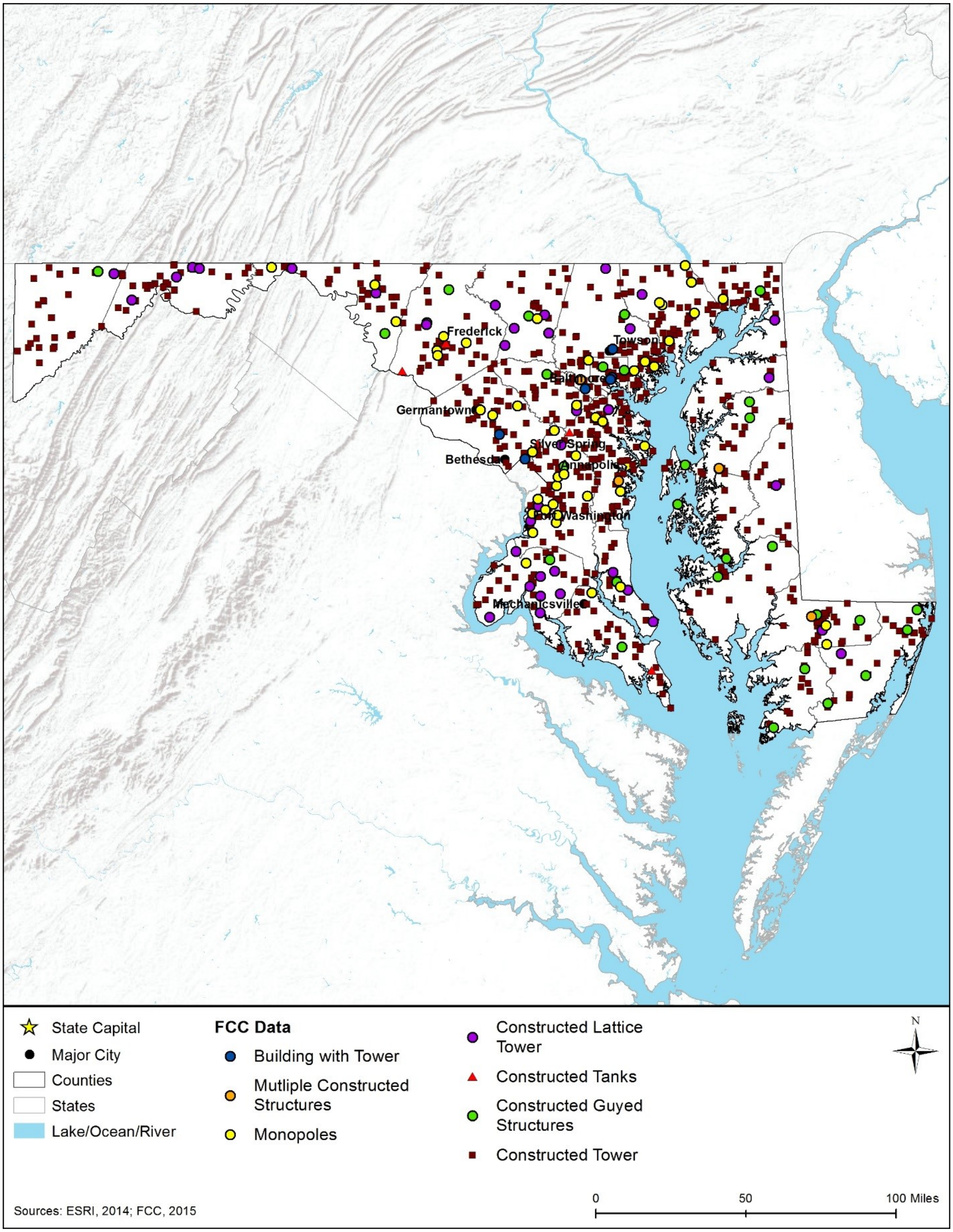
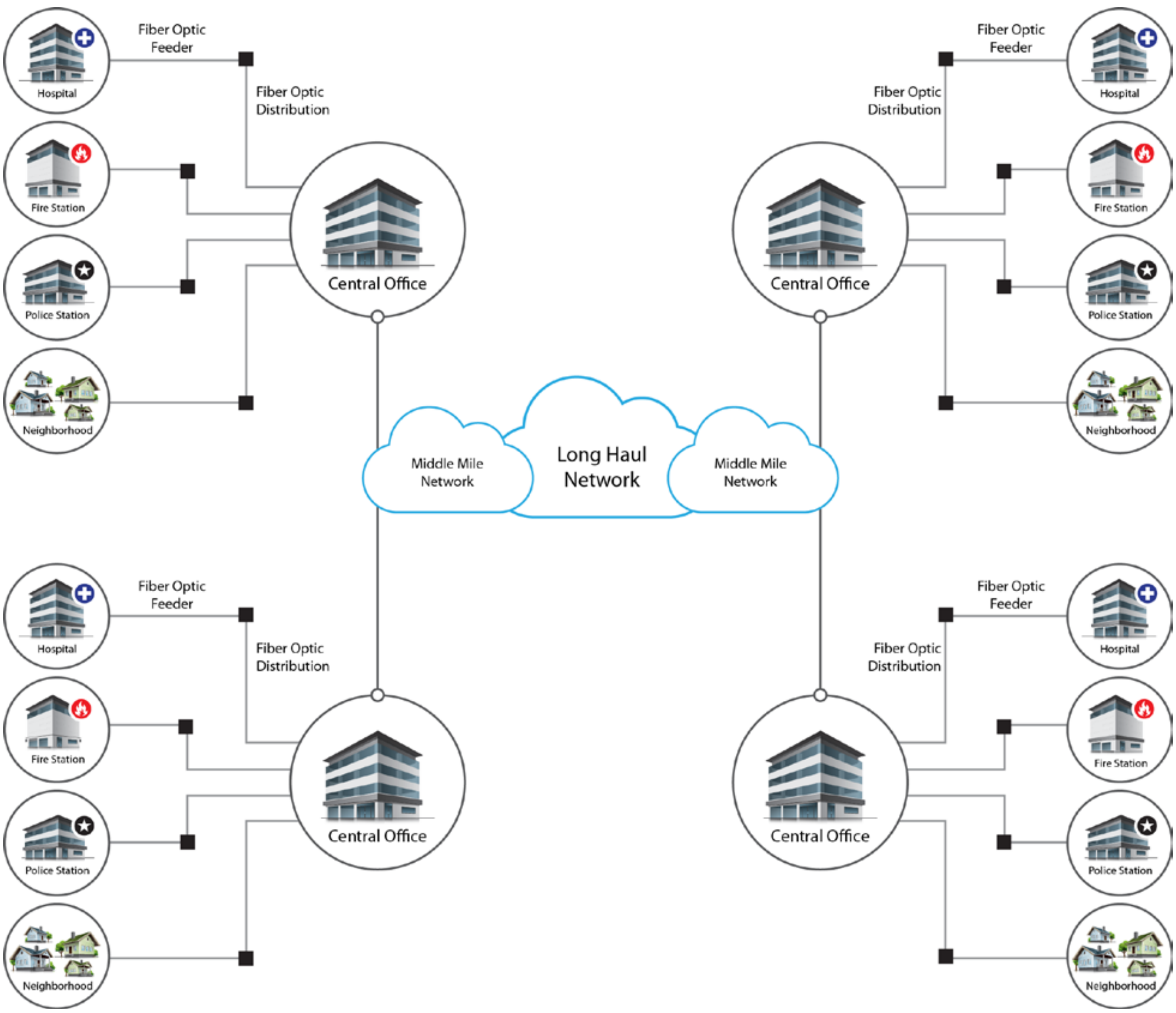


Figure 7.1.1-11: FCC Tower Structure Locations in Maryland

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 7.1.1-12. 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 7.1.1-12: Typical Fiber Optic Network in Maryland

Last Mile Fiber Assets

In Maryland, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Maryland, there are 32 fiber providers that offer service in the state, as listed in Table 7.1.1-10. Figure 7.1.1-13, Figure 7.1.1-14, and Figure 7.1.1-15 show coverage for Verizon, Comcast and Megapath Corporation, and other providers, respectively.

Table 7.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Verizon Maryland Inc.	57.11%
Comcast	42.20%
Other[a]	23.44%
MegaPath Corporation	22.42%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Atlantic Broadband, Antietam Cable Television, Inc., MetroCast Communications, Armstrong Cable Services, Cavalier Telephone Mid-Atlantic, LLC, Level 3 Communications, LLC, Anne Arundel Broadband, Bay Country Communications Inc., Easton Utilities Commission, Mediacom Delaware LLC, Comcast Cable Communications, LLC., Broadview Networks Holdings, Inc., Shentel, QCOL, RCN and RCN Business Solutions, PAETEC Communications, Inc., Charter Communications Inc., XO Communications, LLC, New Edge Network, Inc., FiberLight LLC, TW Telecom of Maryland LLC, ProCom, One Communications, Allied Telecom Group, LLC, Zayo Group, LLC, Atlantech Online, Inc., Cogent Communications Group, Tata Communications (America) Inc., Sidera Networks, Hotwire Communications, Ltd.

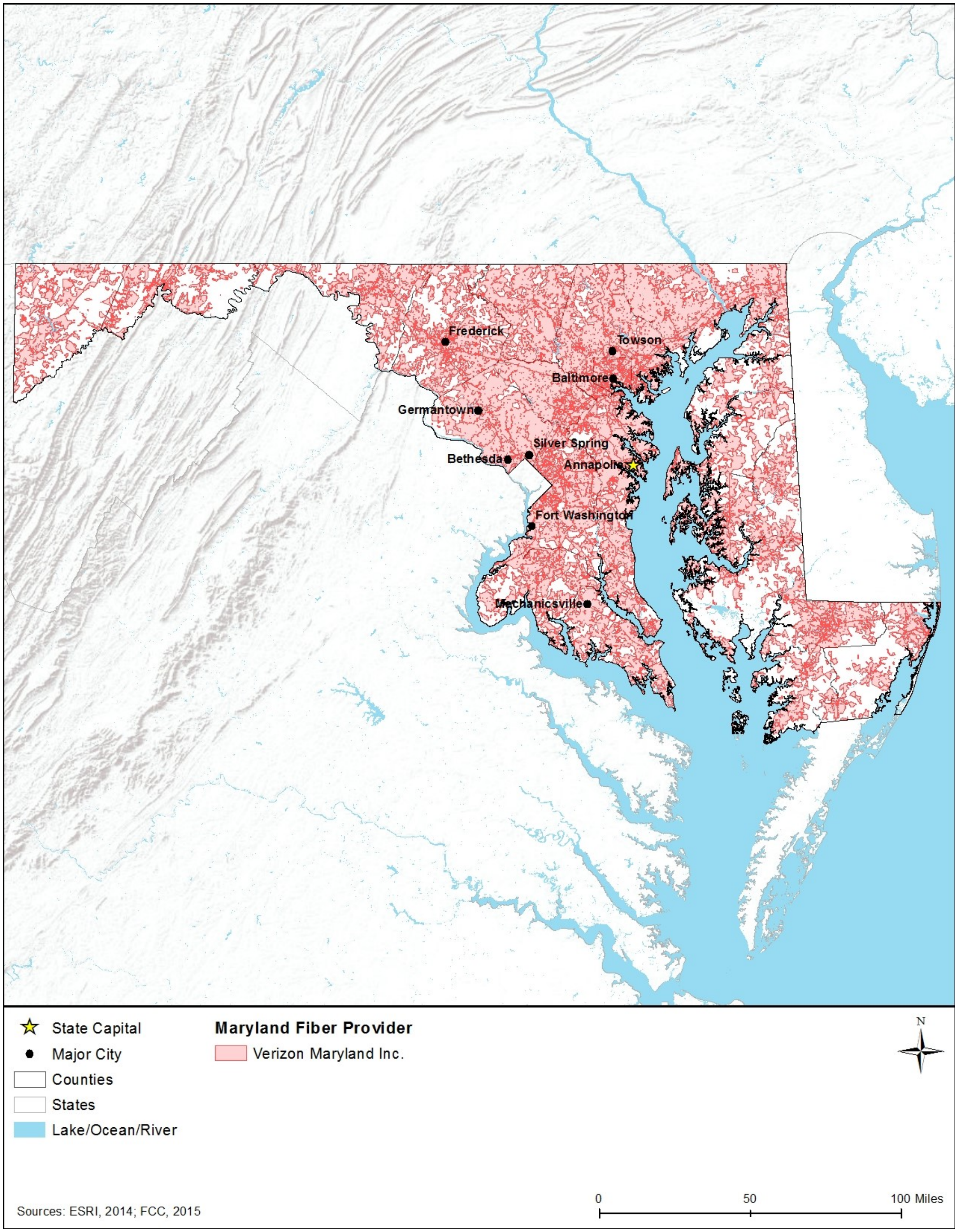


Figure 7.1.1-13: Verizon Fiber Availability in Maryland

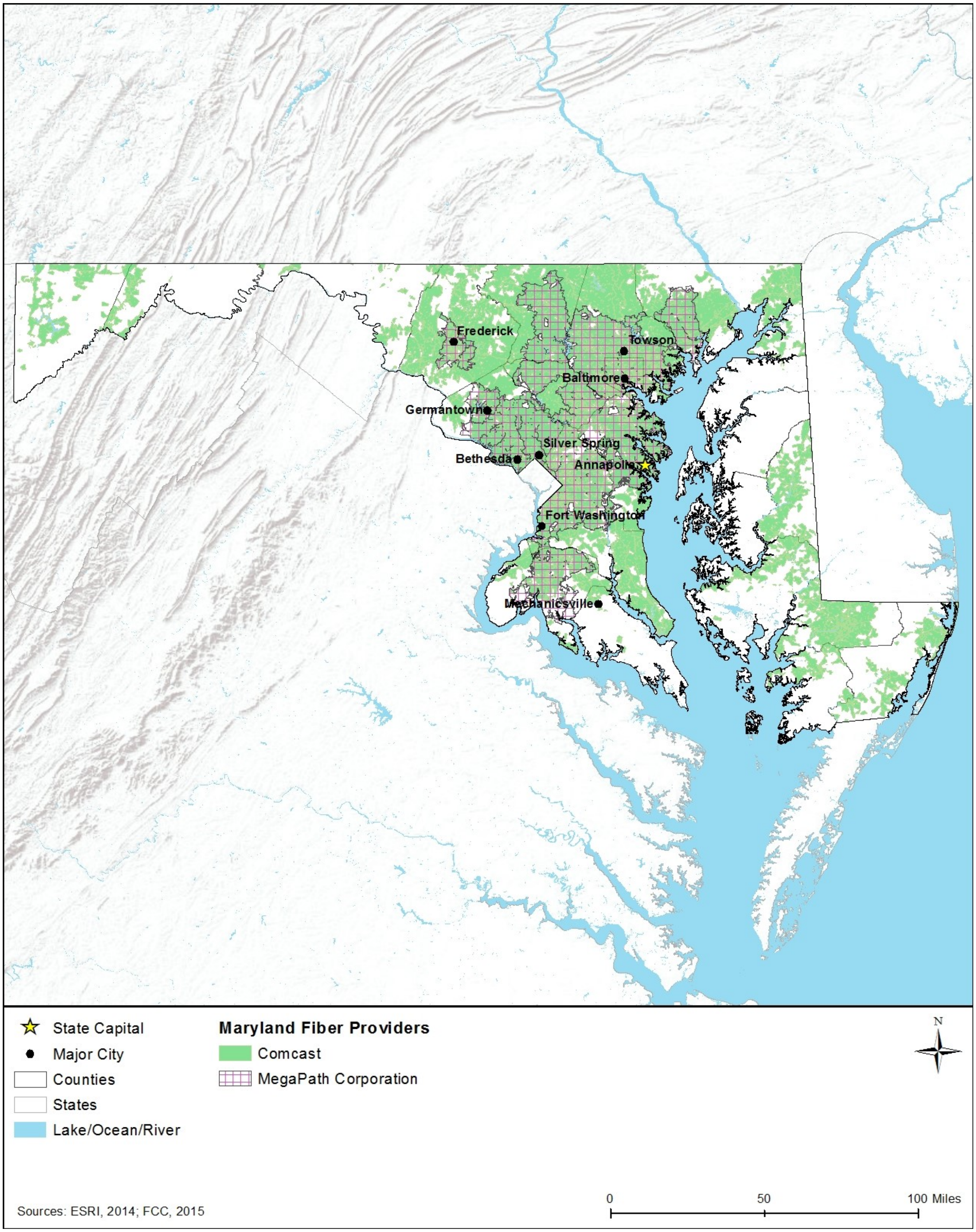


Figure 7.1.1-14: Comcast and Megapath Corporation Fiber Availability in Maryland

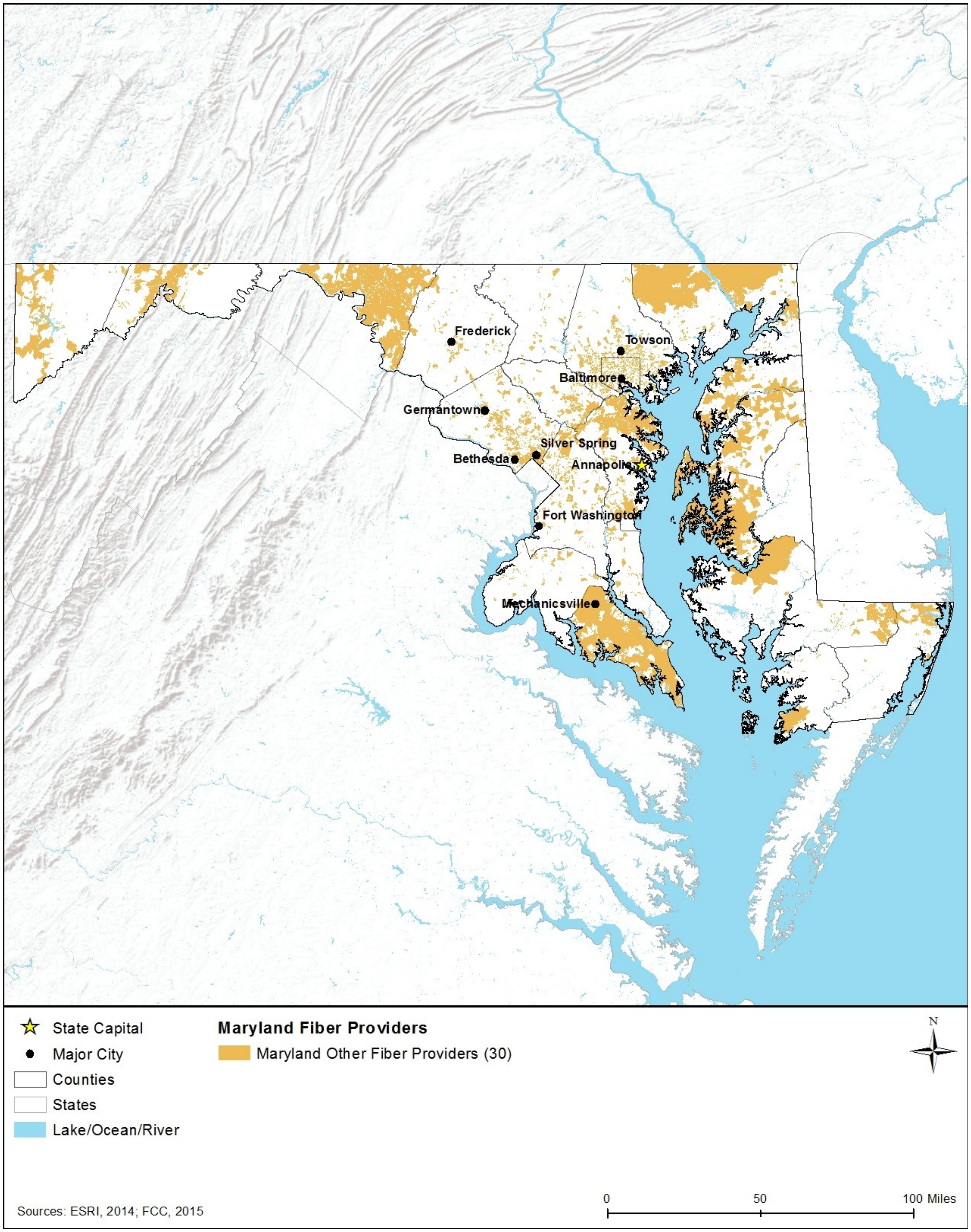


Figure 7.1.1-15: Other Provider Fiber Availability in Maryland

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).

7.1.1.6. 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 solid waste. Section 7.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Utilities in the state of Maryland are regulated by the Maryland Public Service Commission. This body certifies electricity supplier, as well as performing analytics on pricing structures, policy for low income customers, and rates of return (PSC, 2015a). There are six distribution companies that operate in Maryland, each with their own service area. In total, there are 859 companies that supply electricity to residential customers. Similarly, there are 1550 companies that supply commercial customers. There is some overlap between the two groups, as many companies supply electricity to a variety of customers. For instance, Better Cost Energy LLC serves residential, commercial, and industrial customers (PSC, 2015b). In 2014, almost 38% of Maryland’s electricity was produced by the only nuclear power plant in the state (Calver Cliffs). A further 7% came from renewable sources, such as hydroelectric power plants (EIA, 2016). In 2015, Maryland’s two largest electricity sources were nuclear power and coal. Nuclear power produced 37,985 thousand megawatt hours of electricity and coal produced 85,201 thousand-megawatt hours (EIA, 2016). Maryland’s Renewable Energy Portfolio Standard Program “requires electricity suppliers to meet a prescribed minimum portion of their retail electricity sales with various renewable energy sources” (PSC, 2015c). Electricity suppliers that do not meet this requirement have to pay a fine (PSC, 2015c).

Water

Most of Maryland’s water systems are operated by individual municipalities. In these cases, the infrastructure and rates are not regulated by the Maryland Public Service Commission. In total, there are only twenty-two water utilities whose rates, management, and infrastructure are regulated by the Commission. The utilities regulated by the Commission serve about 11,000 residential customers across eight counties (PSC, 2015d). In contrast to this, there are 3.653 public water systems in the state. Approximately 60 percent of the population is served by the community water systems of Baltimore and Washington, D.C. Although ground water is a more common source across systems, approximately 80 percent of Maryland’s population is served by water systems that rely on surface water. This is worth noting because these systems only constitute approximately 10 percent of the community systems in the state. In 2006, Maryland completed assessments of the quality of all drinking water sources, including rivers, streams, aquifers and reservoirs, though aquifer ground water is the most common source across the numerous community water systems. The results of these assessments are available through public libraries (MDE, 2015b). The 1996 Safe Drinking Water Act (SDWA) Amendments require annual drinking water quality reports from all community water systems. These annual reports, known as Consumer Confidence Reports (CCRs), contain information on the source of drinking water, risk of contamination, levels of contaminants, and other related information. Many systems publish their CCRs online, but a copy can always be obtained by contacting the system directly (MDE, 2015c).

Wastewater

Maryland's wastewater treatment plants are regulated by way of permits, which are issued by the state and federal governments. The Maryland Department of Environment (MDE) is the state body that issues these permits. Treatment plants that discharge into surface waters receive combined permits from the federal government and the state. Plants that discharge into groundwater must receive a permit from the state. Maryland's wastewater treatment plants are broken into three categories: Municipal, Industrial, and On-Site. Each category is overseen by a Division of the MDE (MDE, 2015d). In some cases, an industrial facility will discharge its waste to a municipal wastewater collection system. In these cases, a pretreatment permit would be required (MDE, 2015e). In fact, MDE offers a number of specialized permits, depending on the type of wastewater and location of discharge. As an example, a "Discharges from the Application of Pesticides" is available, as is a permit for "Seafood Processing Facilities" (MDE, 2015f). In total, the MDE Wastewater Permits Program has 3,287 active permits, spread across these different types of facilities (MDE, 2015g).

Solid Waste Management

The handling and disposal of Maryland's, "domestic, commercial, and non-hazardous industrial solid waste" is overseen by the MDE Solid Waste Program (MDE, 2015h). The MDE regulates Solid Waste Acceptance (SWA) facilities as a means of disposing of waste properly. These Solid Waste Acceptance facilities include municipal landfills and incinerators, processing and transfer stations, waste to energy facilities, medical waste processing facilities and a number of other facility types (MDE, 2015h). A total of 83 permits have been issued to SWAs, including 25 permitted landfills and seventeen processing facilities and transfer stations (MDE, 2015i). Under the Maryland Recycling Act, all state government organizations, Maryland counties, and the city of Baltimore are required to recycle a portion of their solid waste. Maryland counties and the city of Baltimore are required to recycle 15 percent of their waste if their population is under 150,000 people, and 20 percent, if the population is over 150,000. These rates increase to 20 percent and 35 percent respectively on December 31, 2015. By July 1, 2014, state government organizations must have implemented a plan to recycle 30 percent of their solid waste (MDE, 2015j). Additionally, Maryland has 23 electronic waste recycling facilities, most of which are only available to the residents of the municipality in which the facility is located

(MDE, 2015k). As of 2014, the state also ran 13 composting facilities, many of which compost yard trimmings. Four of these facilities accept food scraps as well (MDE, 2015l).

7.1.2. Soils

7.1.2.1. 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 do.
- 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.

7.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of 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 Section 1.8. A list of applicable state laws and regulations is included in Table 7.1.2-1 below.

Table 7.1.2-1: Applicable Maryland Soil Statutes and Regulations

State Law/Regulation	Regulatory Agency	Applicability
COMAR Title 26.17.01: Erosion and Sediment Control	MDE	Provides requirements for erosion and sediment control ordinances, plan approval requirement exemptions, training and certification program requirements, plan submittal, review, and approval criteria, and inspection and enforcement procedures.

7.1.2.3. Environmental Setting

Maryland is composed of three Land Resource Regions (LRR),[10] as defined by the Natural Resources Conservation Service (NRCS) (NRCS, 2006):

- Atlantic and Gulf Coast Lowland Forest and Crop Region,
- East and Central Farming and Forest Region, and
- Northern Atlantic Slope Diversified Farming Region.

Within and among Maryland's three LRRs are eight Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Maryland's MLRAs are presented in Figure 7.1.2-1 and Table 7.1.2-2, respectively.

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).

[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)
[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)

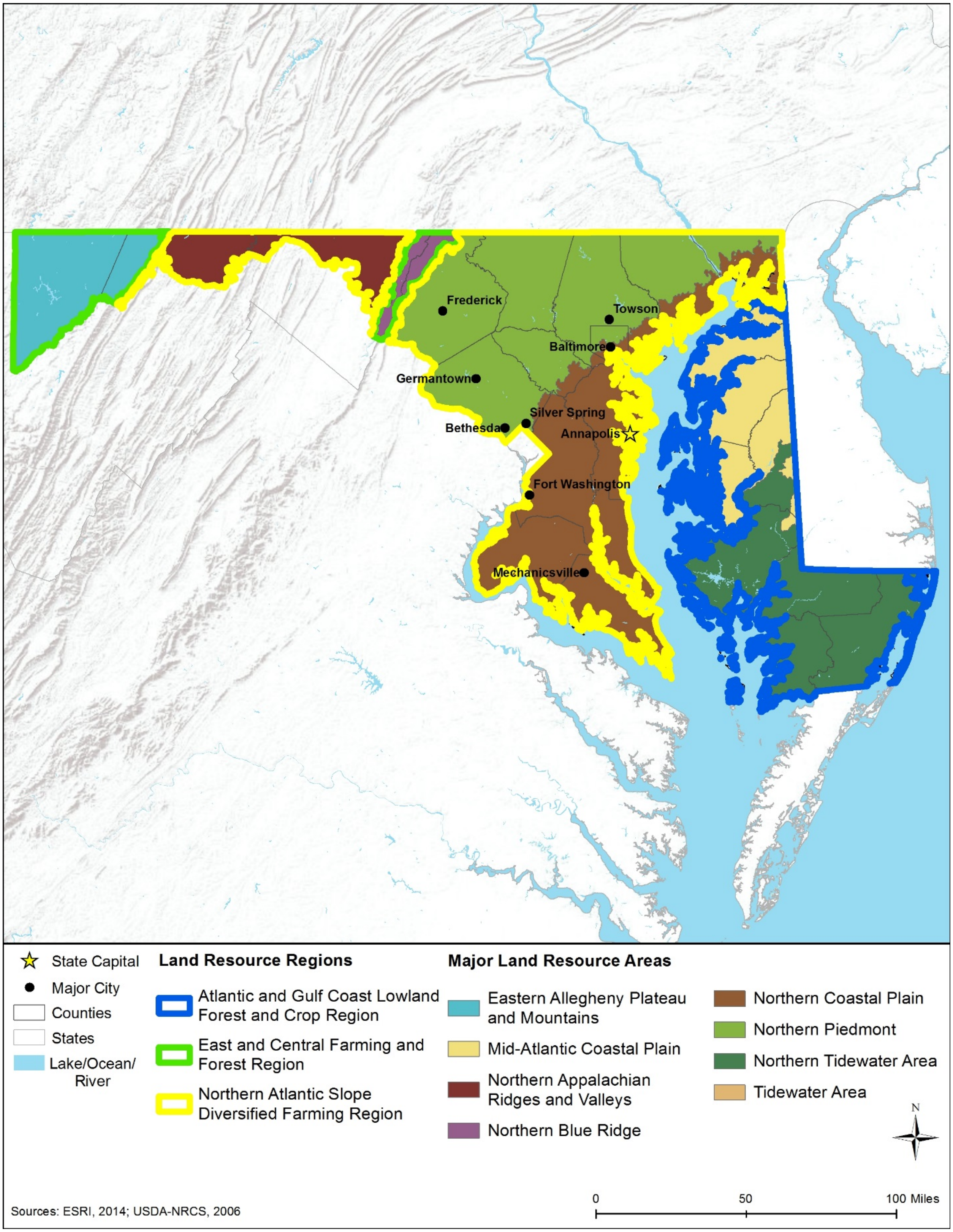


Figure 7.1.2-1: Locations of Major Land Resource Areas in Maryland

Table 7.1.2-2: Characteristics of Major Land Resource Areas in Maryland

MLRA Name	Region of State	Soil Characteristics
Eastern Allegheny Plateau and Mountains	Western Maryland	Ultisols[15] and Inceptisols[16] are dominant soils orders in this MLRA. They are moderately deep to very deep, excessively drained to somewhat poorly drained, and sandy or loamy.
Mid-Atlantic Coastal Plain	Eastern Maryland	Ultisols are the dominant soil order in this MLRA, and soils in this area are generally very deep, dominantly well drained to poorly drained, and loamy or sandy in the mineral horizons.
Northern Appalachian Ridges and Valleys	Western Maryland	Inceptisols, Ultisols, and Alfisols[17] are the dominant soil orders. They are shallow to very deep, generally excessively drained to moderately well drained, and also loamy or clayey.
Northern Blue Ridge	Central Maryland	Inceptisols, Ultisols, and Alfisols are the dominant soil orders. They are moderately deep to very deep and are also loamy-skeletal and sandy-skeletal to clayey.
Northern Coastal Plain	South Central Maryland	Ultisols are the dominant soil order in this MLRA, and soils in this area are very deep, excessively drained to very poorly drained, and loamy or sandy.
Northern Piedmont	Northern Maryland	Dominant soil orders are Alfisols, Inceptisols, and Ultisols. The soils in this area are moderately deep to very deep, moderately well-drained to somewhat excessively drained, and loamy or loamy-skeletal.
Northern Tidewater Area	Southeastern Maryland	Ultisols are the dominant soil order in this MLRA. The soils are very deep, very poorly drained to excessively drained, and loamy or sandy in the mineral horizons.
Tidewater Area	Southeastern Maryland bordering Northeastern Virginia	Alfisols and Entisols[18] are dominant soil orders in this MLRA. The soils are wet with very low infiltration rates and mixed mineralology.

Source: (NRCS, 2006)

7.1.2.4. 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; there are twelve soil orders in the world and they are characterized by both observed and inferred[19] 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

[15] 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, 2015c)

[16] 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, 2015c)

[17] 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, 2015c)

[18] 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, 2015c)

[19] “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, 2015d)

physical and chemical properties (NRCS, 2015b). The State Soil Geographic (STATSGO2)[20] soil database identifies nine different soil suborders in Maryland (NRCS, 2015e). Figure 7.1.2-2 depicts the distribution of the soil suborders, and Table 7.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

7.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D)[21] that are based on a soil's runoff potential. Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 7.1.2-3 provides a summary of the runoff potential for each soil suborder in Maryland.

> **Group A. Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[22] 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). Psamments, Udepts, and Udults fall into this category in Maryland.
>
> **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. Aquults, Fluvents, Udalfs, Udepts, and Udults fall into this category in Maryland.
>
> **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. Aquults, Udalfs, Udepts, and Udults fall into this category in Maryland.
>
> **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). Aquents, Aquepts, Aquolls, Aquults, Udalfs, Udepts, and Udults fall into this category in Maryland.

[20] 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.

[21] 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.

[22] 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)

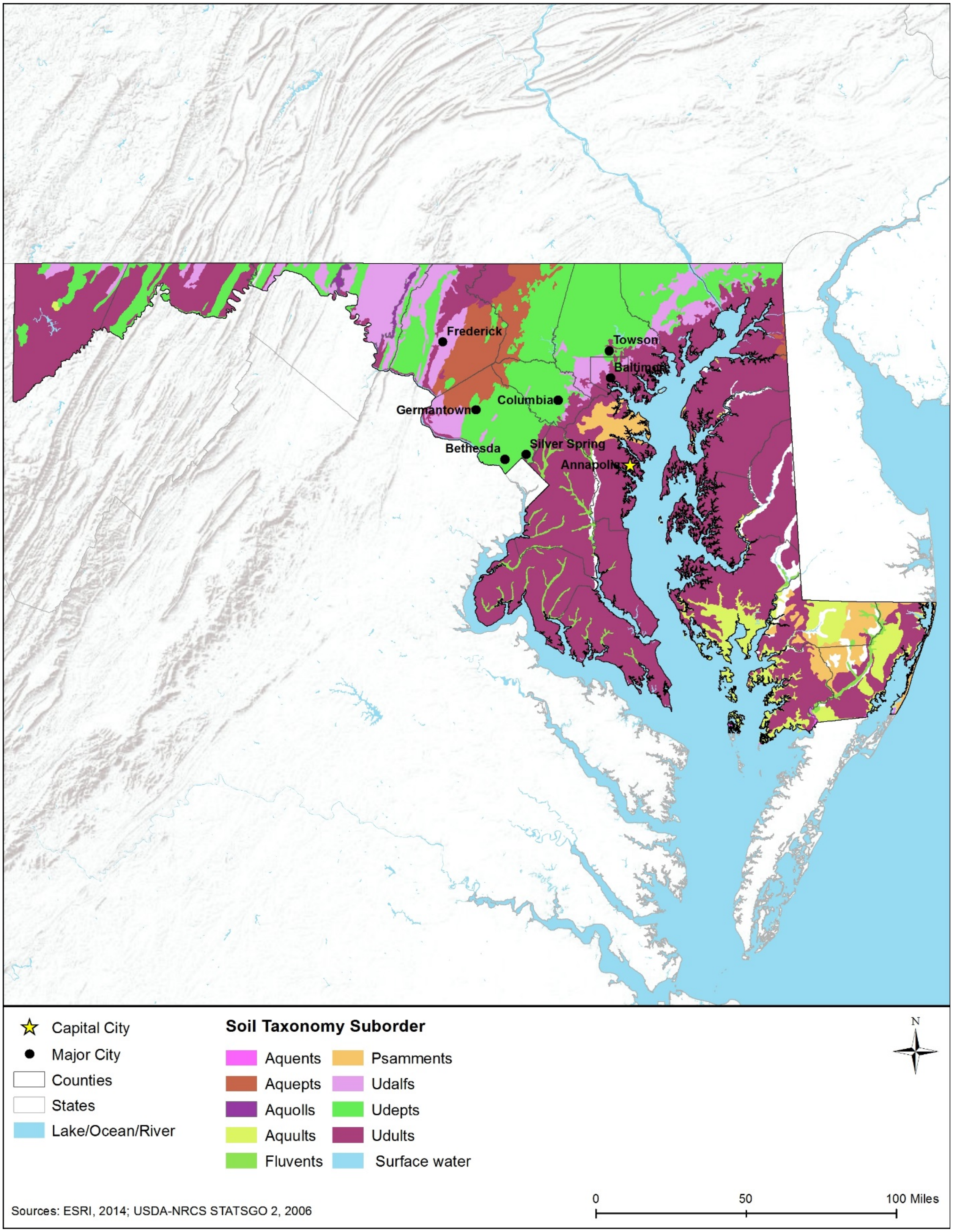


Figure 7.1.2-2: Maryland Soil Taxonomy Suborders

Table 7.1.2-3: Major Characteristics of Soil Suborders Found in Maryland, as depicted in Figure 7.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[23]	Hydrologic Group	Runoff Potential	Permeability[24]	Erosion Potential	Compaction and Rutting Potential
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Silty clay loam	0-1	Very poorly drained	Yes	D	High	Very Low	High	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, ground water 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.	Silt loam, Stratified sand to loamy sand	0-3	Very poorly drained to poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Silty clay loam	0-3	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Ultisols	Aquults	Aquults are found in wet areas where ground water 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.	Clay, fine sandy loam, sandy loam, silty clay loam,	0-8	Very poorly drained to somewhat poorly drained	Yes, No	B, C, D	Medium to High	Moderate to Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Loamy sand	0-2	Well drained	No	B	Medium	Moderate	Medium	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.	Fine sand, loamy sand	0-40	Excessively drained	No	A	Low	High	Low	Low
Alfisols	Udalfs	Udalfs have a udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Channery clay, channery silty clay loam, clay, clay loam, loam, silt loam, silty clay, unweathered bedrock, very gravelly silt loam, weathered bedrock	0-50	Moderately well drained to well drained	No	B, C, D	Medium to High	Moderate to Very Low	Medium to High, depending on slope	Low
Inceptisols	Udepts	Udepts have a 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 sandy loam, channery silt loam, fine sandy loam, silt loam, unweathered bedrock, very channery loam, very fine sandy loam	0-70	Somewhat excessively drained to moderately well drained	No	A, B, C, D	Low, Medium, High	Very Low, Low, Moderate, High	Low to High, depending on slope	Low

[23] 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, 2015f).
[24] Based on Runoff Potential, described in Section 7.1.2.5

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[23]	Hydrologic Group	Runoff Potential	Permeability[24]	Erosion Potential	Compaction and Rutting Potential
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have a 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 clay loam, channery loam, channery sandy clay loam, clay, cobbly fine sandy loam, extremely channery silt loam, fine sandy loam, gravelly sandy loam, loam, sandy clay loam, sandy loam, silt loam, stratified sand to gravelly sandy loam, very channery sandy clay loam, very channery silt loam, very cobbly clay loam, very flaggy loam, very gravelly loamy sand	0-70	Moderately well drained to well drained	No	A, B, C, D	Low, Medium, High	Very Low, Low, Moderate, High	Low to High, depending on slope	Low

Source: (NRCS, 2015e) (NRCS, 1999)

7.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015g). 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 7.1.2-3 provides a summary of the erosion potential for each soil suborder in Maryland. Soils with the highest erosion potential in Maryland include those in the Aquents, Aquepts, Aquolls, Aquults, Fluvents, Udalfs, Udepts, and Udults suborders, which are found throughout most of the state (Figure 7.1.2-2).

7.1.2.7. 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 10 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 7.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Maryland. Soils with the highest potential for compaction and rutting in Maryland include those in the Aquents, Aquepts, Aquolls, and Aquults suborders, which are found in north-central and southeastern areas of the state (Figure 7.1.2-2).

7.1.3. Geology

7.1.3.1. 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 ground-water availability. Several of these elements are discussed in other sections of this Programmatic Environmental Impact Statement (PEIS), including Water Resources (Section 7.1.4), Human Health and Safety (Section 7.1.15), and Climate Change (Section 7.1.14).

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

- Section 7.1.3.3, Major Physiographic Regions and Provinces[25, 26]
- Section 7.1.3.4, Surface Geology
- Section 7.1.3.5, Bedrock Geology[27]
- Section 7.1.3.6, Paleontological Resources[28]
- Section 7.1.3.7, Fossil Fuel and Mineral Resources
- Section 7.1.3.8, Potential Geologic Hazards[29]

7.1.3.2. 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 Geology, such as the National Historic Preservation Act and the Clean Water Act, are detailed in Section 1.8. A list of applicable state laws and regulations is included in Table 7.1.3-1 below.

Table 7.1.3-1: Relevant Maryland Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maryland Code § 5-1405, Disturbing paleontological sites[30]	MDNR	No one can excavate, remove, destroy, injure, deface, or in any manner disturb any paleontological site or any part thereof, including saltpeter workings, fossils, bones, or any other paleontological features which may be found in any cave, without obtaining a permit from the Secretary of the MDNR.
Building Codes[31]	County and Municipal Governments	Guidelines for seismic design in construction

7.1.3.3. 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-

[25] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology. (Fenneman, 1916)
[26] Physiographic provinces: Subsets within physiographic regions. (Fenneman, 1916)
[27] Bedrock: Solid rock beneath the soil and superficial rock. (USGS, 2015l)
[28] Paleontology: "Study of life in past geologic time based on fossil plants and animals." (USGS, 2015f)
[29] 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)
[30] (General Assembly of Maryland, 2015)
[31] Example: (Montgomery County Department of Permitting Services, 2015)

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

Maryland has two major physiographic regions: Atlantic Plain and Appalachian Highlands (USGS, 2003b). Maryland's physiographic regions and provinces are discussed in detail below and depicted in Figure 7.1.3-1.

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.

Within Maryland, the Atlantic Plain (which includes the Coastal Plain Province) comprises the eastern portion of the state. The western edge of the Coastal Plain abuts the Piedmont Province (discussed in Section 7.1.3.4) at the Fall Zone; the Fall Zone is a narrow zone that marks the boundary between the older, resistant, metamorphic rocks of the Piedmont Province and younger, mostly unconsolidated sediments of the Coastal Plain. The Maryland Coastal Plain is underlain by sediments that increase in thickness from zero at the Fall Zone to more than 8,000 feet at the edge of the Atlantic Ocean. The sediments of the Coastal Plain Province "dip eastward at a low angle, generally less than one degree, and range in age from Triassic (255 to 199 MYA) to Quaternary (2.6 MYA to present). The younger formations crop out successively to the southeast across Southern Maryland and the Eastern Shore." (MGS, 2015a)

Maryland's Eastern Shore is characterized by flat topography and elevations rising from sea level to about 100 feet above sea level (ASL). Maryland's Western Shore (i.e., west of the Chesapeake Bay) ranges from sea level at the Chesapeake Bay to 200 feet ASL. Marshes and tidal flats are pervasive in close proximity to the Chesapeake Bay. (Clearwater, Turgeon, Noble, & LaBranche, 2000)

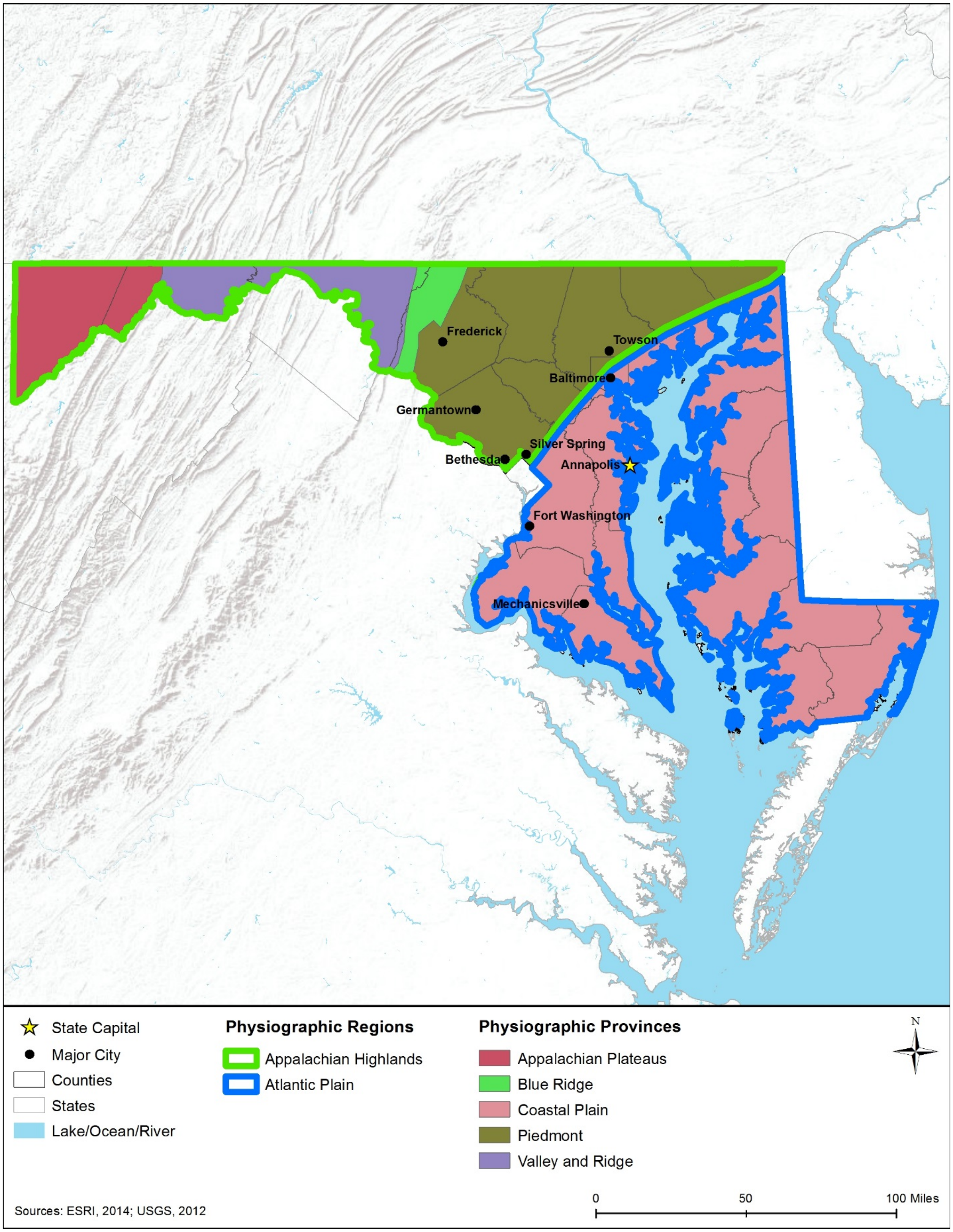


Figure 7.1.3-1: Physiographic Regions and Provinces of Maryland

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[32] 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,[33] the Appalachian Highlands have eroded considerably, and most peaks are now under 5,000 feet above sea level (ASL). The current Appalachian Highlands Region is characterized by prime and unique farmlands and is rich in mineral resources. (USGS, 2003b)

As reported above, the Appalachian Highlands Region within Maryland is composed of several physiographic provinces, most notably the Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau (USGS, 2003b).

Piedmont Province – The Piedmont includes 29 percent of Maryland. The Piedmont Province encompasses the area between the Fall Line and Catoctin Mountain. The Piedmont's topography ranges from about 100 feet ASL to more than 1,200 feet ASL at Sugarloaf Mountain (MDNR, 2005a).

The eastern Piedmont Province is underlain by both metamorphic[34] (including schist,[35] gneiss,[36] quartzite,[37] phyllite,[38] and marble[39]) and igneous rocks[40] (including granite[41]). Areas made up of stronger rocks are prominent in topographic highs, whereas weaker rocks are found in valleys and lowlands. The western portion of the Piedmont is dominated by the Frederick Valley, which is underlain by limestone[42] and dolostone,[43] and the Triassic Upland, which includes stronger, layered sedimentary rocks including sandstone, siltstone, and red shale. The Triassic Upland averages 500 feet ASL and includes Sugarloaf Mountain. (Clearwater, Turgeon, Noble, & LaBranche, 2000)

Blue Ridge Province – Immediately west of the Piedmont Province lies the Blue Ridge Province. The Blue Ridge Province includes a large geologic fold that is underlain by Cambrian (542 to 488 MYA) quartzites; Catoctin Mountain and South Mountain are two prominent ridges in the

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32 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)
33 The Rocky Mountains exceed 14,000 feet above sea level (National Commission on Terrorist Attacks upon the United States, 2004).
34 Metamorphic Rock: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids." (USGS, 2015c)
35 Schist: "Metamorphic rock usually derived from fine-grained sedimentary rock such as shale. Individual minerals in schist have grown during metamorphism so that they are easily visible to the naked eye." (USGS, 2015c)
36 Gneiss: "A coarse-grained, foliated metamorphic rock that commonly has alternating bands of light and dark-colored minerals." (USGS, 2015c)
37 Quartzite: "Hard, somewhat glassy-looking rock made up almost entirely of quartz. Metamorphosed quartz sandstone and chert are quartzites." (USGS, 2015c)
38 Phyllite: "A very fine-grained, foliated metamorphic rock, generally derived from shale or fine-grained sandstone." (USGS, 2015c)
39 Marble: "A metamorphic rock of made of calcium carbonate. Marble forms from limestone by metamorphic recrystallization." (USGS, 2015c)
40 Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)." (USGS, 2015c)
41 Granite: "A coarse-grained intrusive igneous rock with at least 65% silica." (USGS, 2015c)
42 Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation." (USGS, 2015c)
43 Dolostone: "A magnesium-rich carbonate sedimentary rock." (USGS, 2015c)

Blue Ridge Province. The Middletown Valley lies between the ridges and is underlain by Precambrian (4.6 billion years ago to 542 MYA) gneiss and metamorphosed volcanic rock. (MGS, 2008)

Ridge and Valley Province – The Ridge and Valley Province contains deformed (i.e., folded and faulted) Cambrian to Mississippian (359 MYA to 323 MYA) age sedimentary rocks. The province's mountain ridges trend northeast-southwest, while the province's valley is underlain by softer limestone of Cambrian and Ordovician (488 MYA to 444 MYA) age. (MGS, 2008)

Appalachian Plateau Province – The Appalachian Plateaus Province includes western Allegany County and all of Garrett County. The bedrock of the Appalachian Plateau consists folded sedimentary rocks including shale, siltstone, and sandstone. (MGS, 2015a)

7.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[44] 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,[45] subsidence,[46] and erosion. (Thompson, 2015)

Most of the surficial materials in Maryland are marine deposits that are on the Coastal Plain. Most surface deposits include sands and gravels from the Quaternary Period (2.6 MYA to present), during periods when sea level was higher than current levels. Modern day streams and rivers continue to add surface deposits to the landscape on a periodic basis. There is no evidence of recent glacier deposits in Maryland (MGS, 1967). Figure 7.1.3-2 displays the surface geology for Maryland.

[44] 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)

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

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

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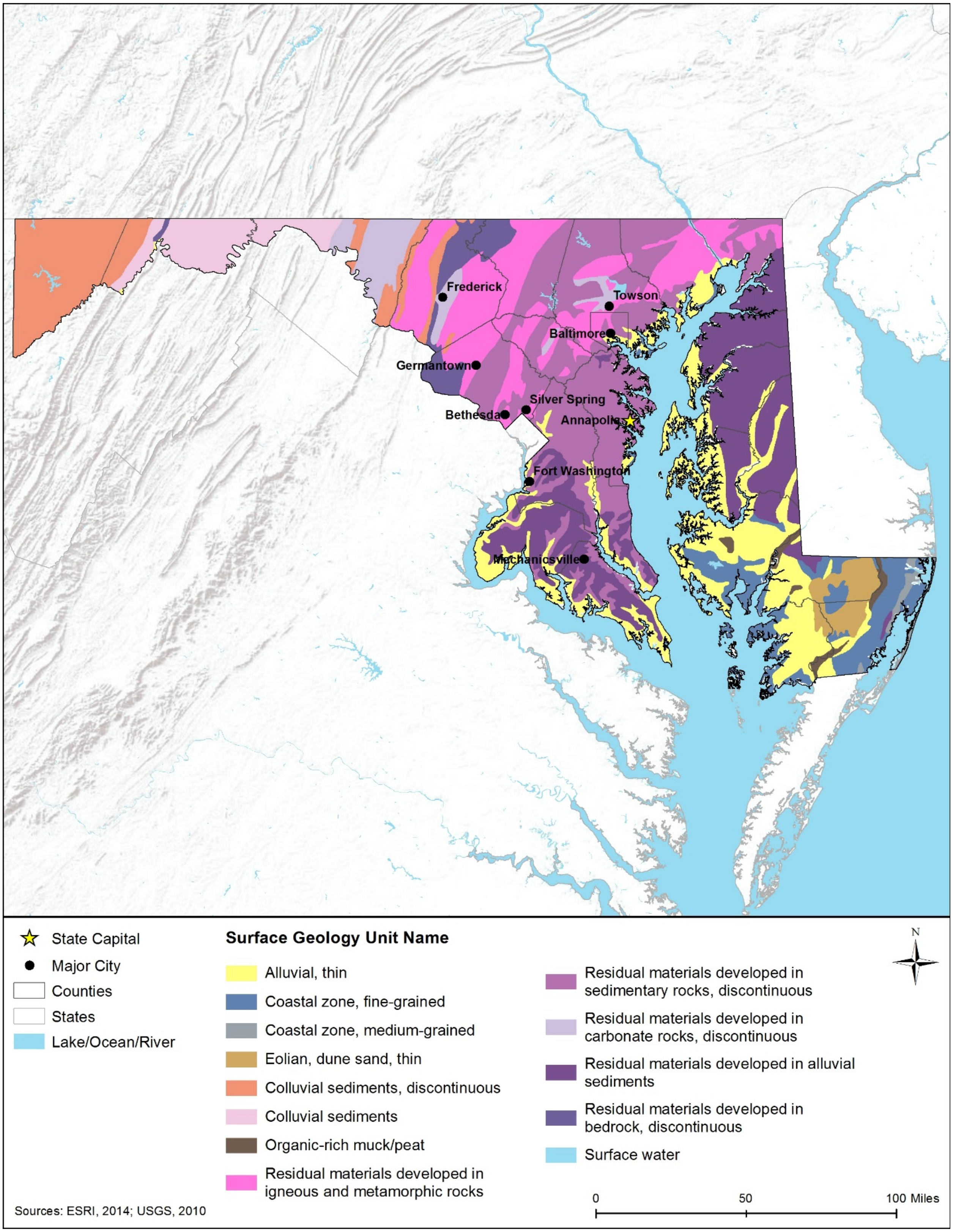


Figure 7.1.3-2: Generalized Surface Geology for Maryland

7.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015b) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[47] rock composition, and regional tectonism. 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).

The bedrock geology of Maryland varies significantly by physiographic designation. A brief overview of the bedrock geology of each physiographic province is included below.

- Maryland's Coastal Plain is underlain by a wedge of sediments that thickens to the east; starting at zero at the Fall Line, sediment thickness exceeds 8,000 feet at the coastline. Sediments dip slightly to the southeast at an angle of less than one degree; younger formations are encountered at the surface, moving further to the southeast across Southern Maryland and the Eastern Shore. (MGS, 1967)
- "The Piedmont Province is composed of hard igneous and metamorphic rocks”; the eastern Piedmont's bedrock is dominated by metamorphosed sedimentary rocks and igneous rocks, while the western Piedmont's bedrock includes metamorphosed volcanic rocks. The Frederick Valley lies on top of Cambrian and Ordovician limestone and dolomite. Bedrock of Triassic red shale, siltstone, and sandstone underlie the western Piedmont's plains. (MGS, 1967)
- The Blue Ridge, Valley and Ridge, and Appalachian Plateau Provinces are underlain primarily by folded and faulted sedimentary rocks. Prominent topographic features, including Catoctin Mountain and South Mountain in the Blue Ridge, Powell Mountain in the Valley and Ridge, and Dans Mountain in the Appalachian Plateau, in each province are typically underlain by erosion resistant sedimentary rocks (e.g., quartzite, sandstone, and shale). The intervening valleys lie on top of relatively soft rocks such as limestone and dolomite. (MGS, 1967)
- Despite no active tectonic plate[48] boundaries in Maryland, there are existing vulnerabilities in certain areas where fault lines occur (see Section 7.1.3.8, Geologic Hazards). Figure 7.1.3-3 displays the general bedrock geology for Maryland.

[47] 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)
[48] Tectonic Plate: a massive, irregularly shaped slab of solid rock, generally composed of both continental and oceanic lithosphere. Plate size can vary greatly, from a few hundred to thousands of kilometers across. (USGS, 1999a)

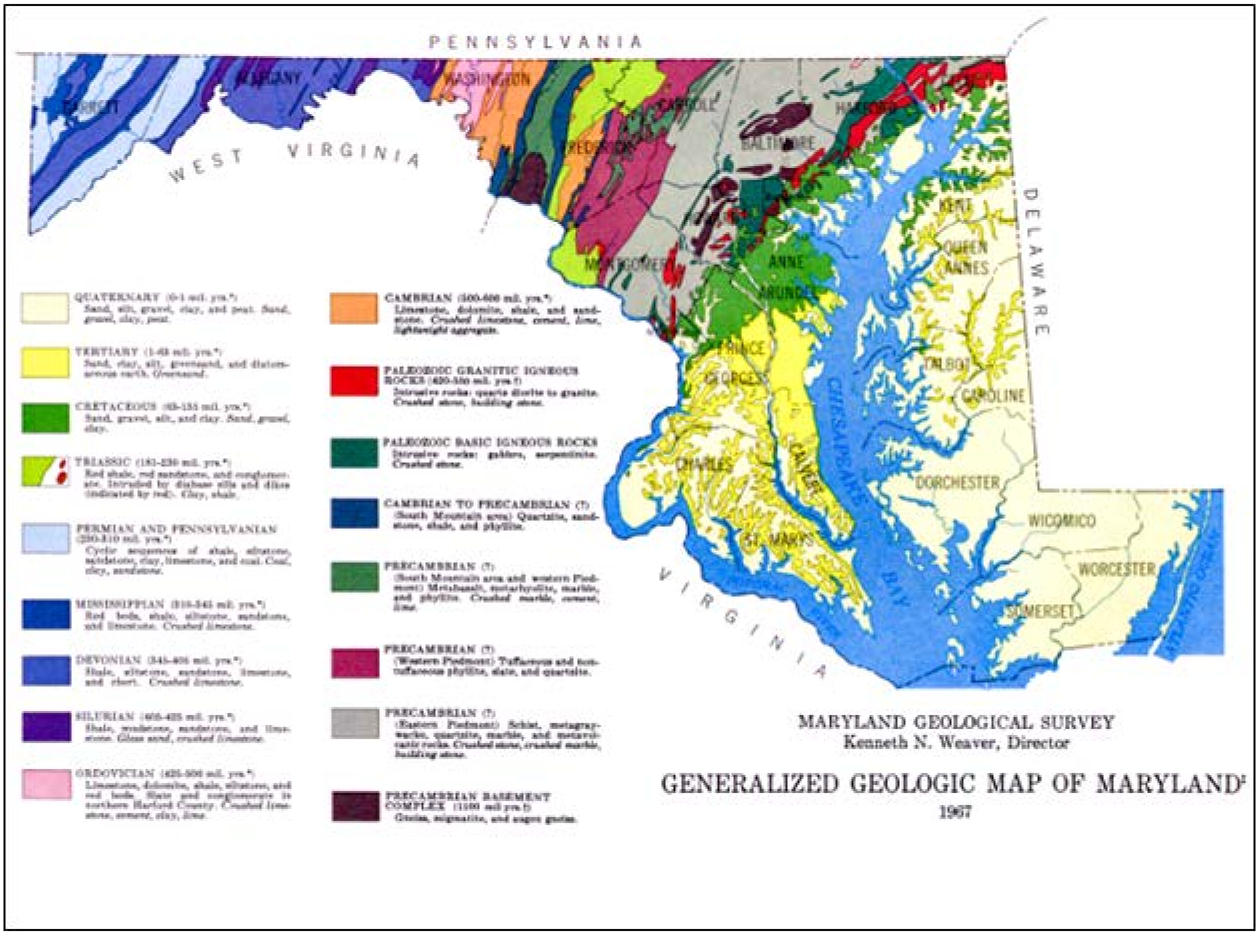
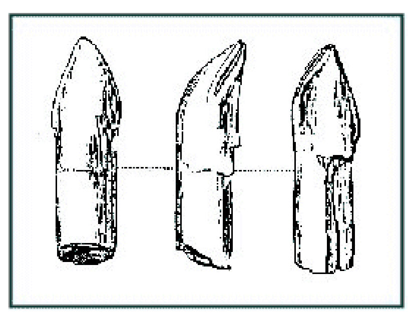


Figure 7.1.3-3: Generalized Bedrock Geology for Maryland

Source: (MGS, 1967)

7.1.3.6. Paleontological Resources

Throughout the Paleozoic Era (542 to 251 MYA), sea level in Maryland experienced repeated cycles of rising and falling resulting in periods of shallow sea deposition interspersed with mountain building events and erosion. These cycles led to the alternating deposition of non-marine and marine sediments and corresponding non-marine (terrestrial) and marine fossils. Mesozoic Era (251 to 66 MYA) plant fossils and dinosaur footprints have been recorded in Maryland. Between the Late Triassic Period (229 to 200 MYA) to the Late Cretaceous Period (100 to 66 MYA), at least twelve species of dinosaurs roamed the state. Dinosaur fossils are found in central Maryland, mostly in the Arundel Clay, Severn and Mt. Laurel Formations, and the Gettysburg Shale (MGS, 2015b). The official state dinosaur of Maryland is the *Astrodon johnstoni* (Paleontology Portal, 2015).



Maryland State Dinosaur Astrodon johnstoni teeth

Source: (MGS, 2015c)

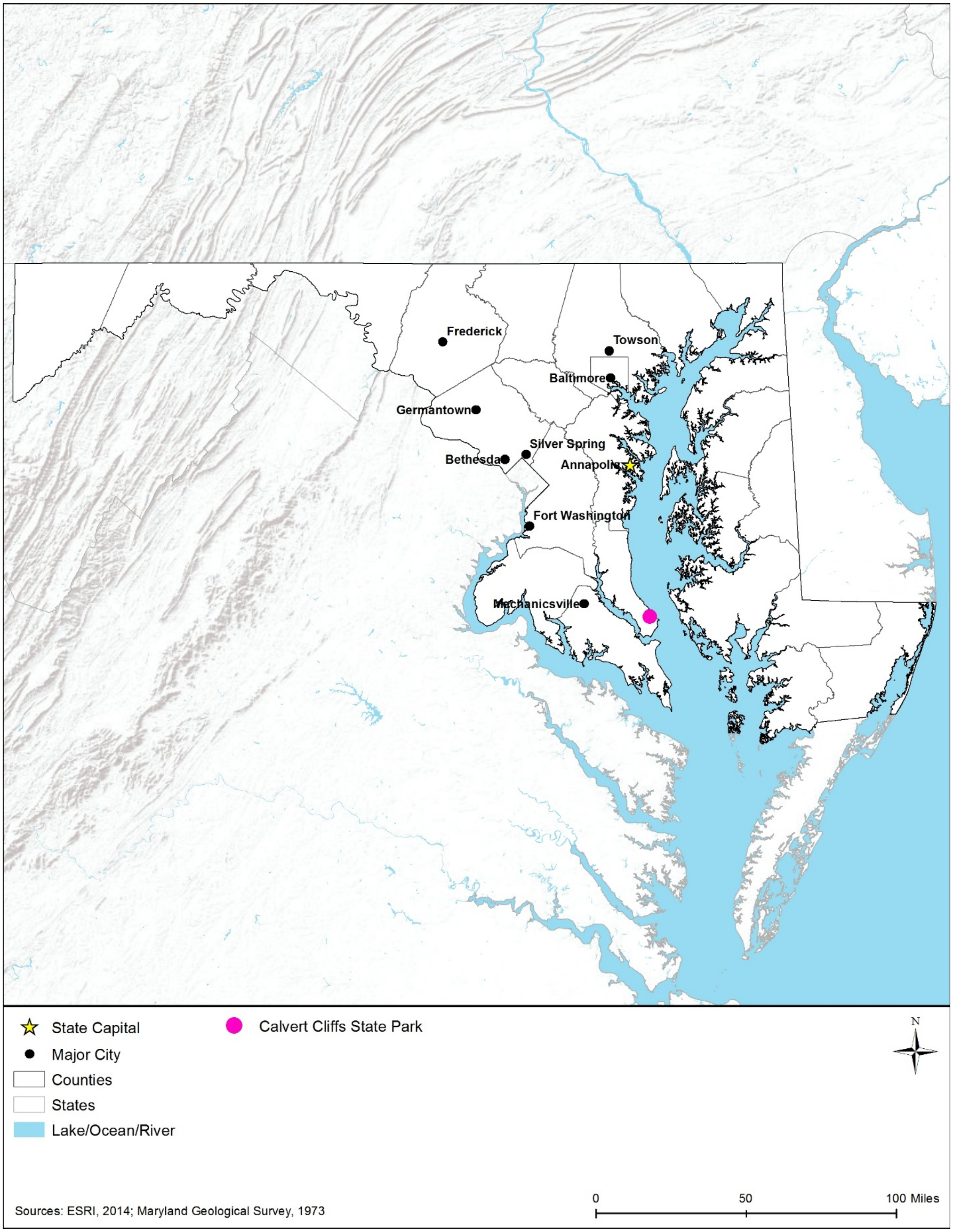


Figure 7.1.3-4: Calvert Cliffs

Cenozoic Era (66 MYA to present) marine fossils, including oysters, snails, and clams, are common in the Chesapeake Bay region (Paleontology Portal, 2015). Miocene Epoch (23 to 5 MYA) deposits with fossilized shark, fish, reptile, and mammal teeth are commonly found at Calvert Cliffs (Figure 7.1.3-4) (MGS, 2015b); Calvert Cliffs, which also has revealed fossils from diatoms, mollusks, and nearly every other animal phylum, contains the most complete section of Miocene Epoch deposits and fossils in the eastern United States. One type of mollusk, *Ecphora quadricostata*, was found in the St. Mary's formation, and is the first fossil described from North America and published in England in 1685 (MGS, 1973). Of the marine vertebrates found at Calvert Cliffs, whales are the most abundant, along with porpoises, dolphins, and sea cows (MGS, 1973).

7.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

Maryland does not produce or refine petroleum and relies on out-of-state imports for its petroleum products. In 2013, Maryland produced 32M cubic feet of natural gas; all of Maryland's natural gas production is from small, older wells in the state's westernmost counties: Garrett County and Allegany County. Portions of both counties are on top of the Marcellus Shale Formation, a unit known to contain natural gas (Figure 7.1.3-5). Most of the state's natural gas consumption is derived from pipelines rooted out of the Gulf of Mexico. (EIA, 2014)

Minerals

As of 2015, Maryland's nonfuel mineral production was estimated at \$306M, ranking 35th in the nation by total value (USGS, 2016b). Maryland's leading nonfuel mineral commodities were portland cement,[49] crushed stone, construction sand and gravel,[50] masonry cement,[51] and dimension stone;[52] all nonfuel mineral commodities mined in Maryland were industrial minerals (USGS, 2015e).

[49] Portland cement: Manufactured cement made from clay, limestone, and water than hardens when fired in a kiln. (USGS, 2005)
[50] Construction sand and gravel: Also known as construction aggregate or natural aggregate, construction sand and gravel is a basic raw material consisting of crushed stone (limestone, granite, etc.), sand, and gravel that is used by the construction industry. (USGS, 2015h)
[51] Masonry cement: Similar to portland cement, masonry cement is manufactured cement made from clay, limestone, and other additives to impart plasticity for use as a binder in mortar. (USGS, 2005)
[52] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape." (USGS, 2016a)

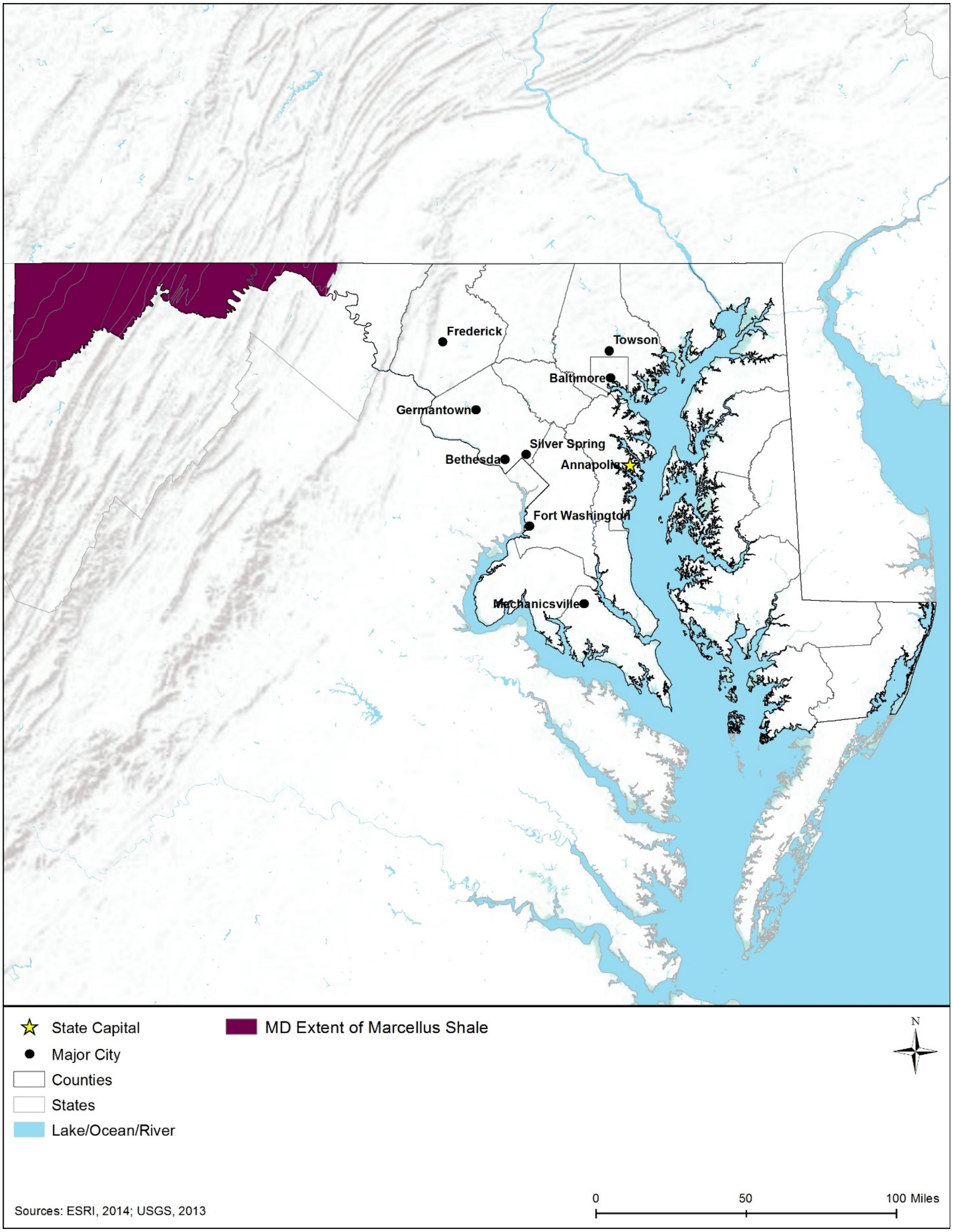


Figure 7.1.3-5: Marcellus Shale Formation in Maryland

7.1.3.8. Geologic Hazards

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

Earthquakes

Between 1758 and 2003, 61 earthquakes were felt within Maryland's borders (MGS, 2015d). 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).

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 tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth." (Oregon Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2006). 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). “The mid-Atlantic and central Appalachian region, including Maryland, is characterized by a moderate amount of low-level earthquake activity, but their cause or causes are largely a matter of speculation.” Maryland has numerous non-active faults (MGS, 2015d).

Figure 7.1.3-6 depicts the seismic risk throughout Maryland. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration) 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 exceedances of 10% g. (USGS, 2010)

Areas of greatest seismicity in Maryland are concentrated in the extreme northeastern portion of the state. Earthquakes felt in Maryland are more likely to originate in areas such as southwestern and central Virginia, and parts of the Atlantic seaboard northward of Wilmington, DE. The most recent earthquake felt in Maryland occurred on August 23, 2011, a magnitude 5.8 earthquake originating near Mineral, VA. (MGS, 2015d)

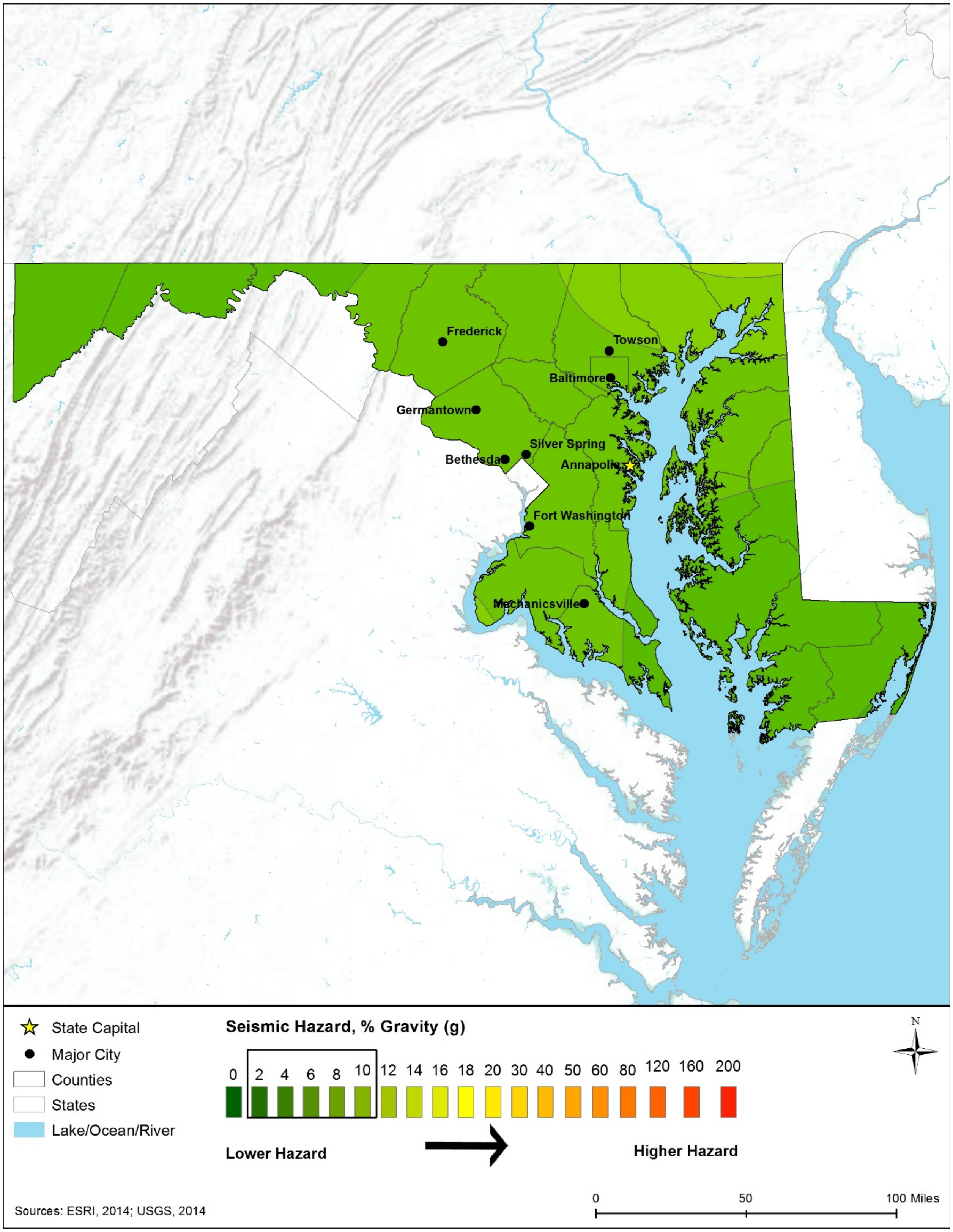


Figure 7.1.3-6: Maryland 2014 Seismic Hazard Map

Landslides

Landslide susceptibility in Maryland varies by physiographic province. "Landslide susceptibility by physiographic province from highest to lowest is as follows: Coastal Plain, Appalachian Plateau, Ridge and Valley, Blue Ridge, and Piedmont" (Pomeroy, 1988). "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, 2003a). 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, 2003a)

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, 2003a)

In Maryland's Atlantic Plain province, the Marlboro Clay formation is highly susceptible to landslides, particularly when it becomes saturated. The Marlboro Clay surfaces near Palmers Corner in Prince Georges County and trends southwest for 20 miles to Rison in Charles County (MGS, 2015e). Landslides typically occur "in soils and weathered material overlying most of the bedrock units" in the Appalachian Plateau Province, particularly the Conemaugh Formation (Pomeroy, 1988). Landslides associated with the failure of mining spoils have also been documented in this province (Pomeroy, 1988).

Figure 7.1.3-7 displays the landslide incidence and susceptibility for Maryland.

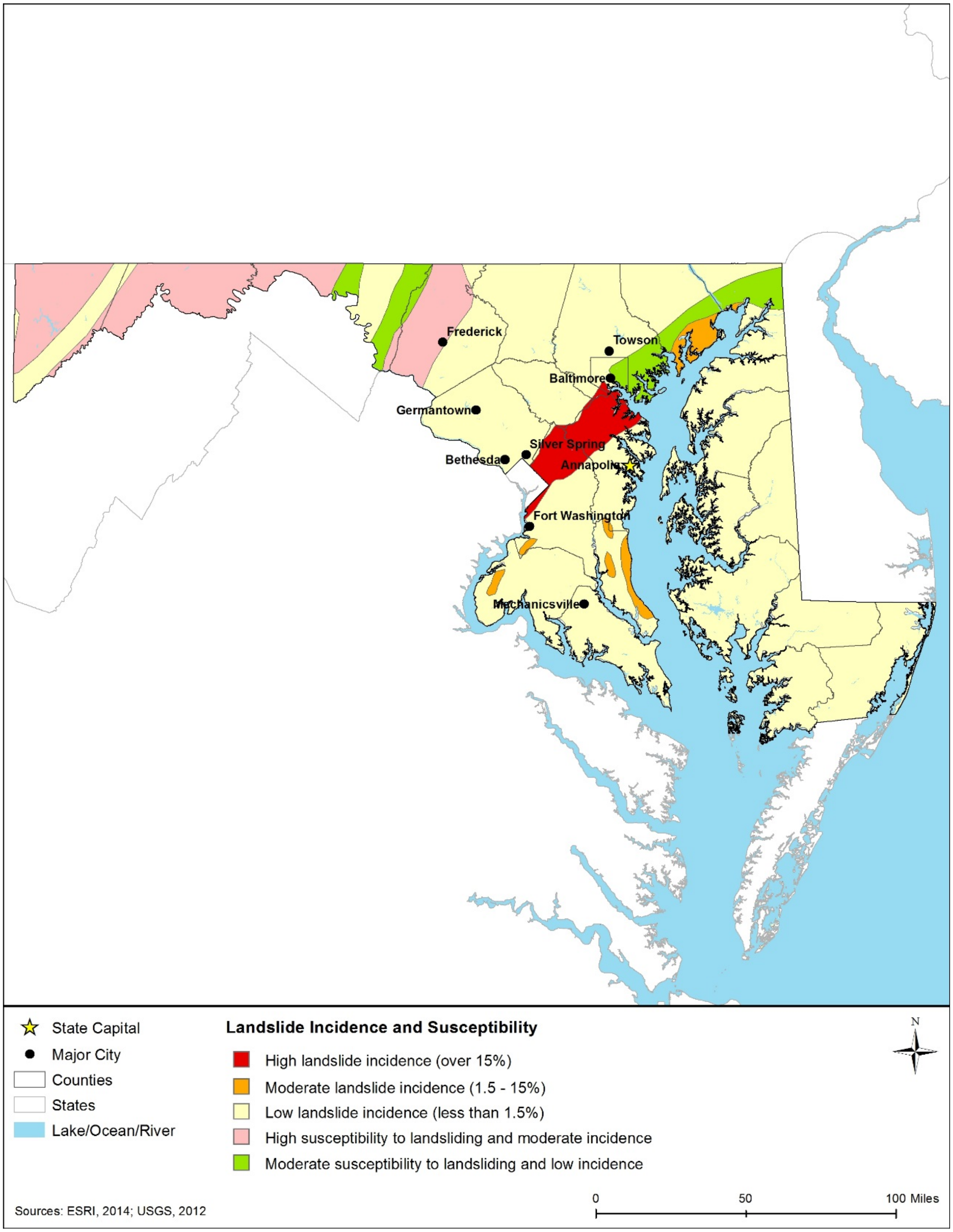


Figure 7.1.3-7: Maryland Landslide Incidence and Susceptibility Hazard Map[53]

[53] Susceptibility hazards not indicated in Figure 7.1.3-7 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, 2014b)

Subsidence

In Maryland, a significant cause of land subsidence is the collapse of karst. Karst topography is largely shaped by the dissolving action of water on soluble, carbonate bedrock (usually limestone, dolomite, or marble) (MGS, 2015f). 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 compression are seen in the lowering of the land surface elevation, which is permanent (USGS, 2000).

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)

Within Maryland, karst is most prevalent in the following counties: Washington, Carroll, Frederick, and Baltimore, with less extensive areas in Allegany County; this generally corresponds to areas within the Piedmont and Ridge and Valley Provinces. Frederick County contains 35 square miles of karst topography, including about 125 sinkholes. Washington County may have two to three times more karst area (MGS, 2015f). Figure 7.1.3-8 displays the areas in Maryland underlain by carbonate rocks that are susceptible to development of karst topography.

Land subsidence has been observed in eastern portions of Maryland due to several other factors. In eastern Maryland, land subsidence is attributed to sediment compression following the end of the Ice Age. "The southern Chesapeake Bay region is in the glacial forebulge area[54] and was forced upward" when the Laurentide ice sheet extended as far south as northern New Jersey, roughly 18,000 years ago (USGS, 2013d). As the ice melted and retreated northward and its weight was removed from the land surface, glacial forebulge areas (including eastern Maryland), which previously had been forced upward, began to subside. Throughout the Chesapeake Bay region, land subsidence in response to glacial retreat is roughly 1 mm per year (USGS, 2013d). Additional land subsidence on the Maryland Eastern Shore (about 0.5 mm per year) may be attributable to excessive groundwater withdrawal (Leatherman, Chalfont, Pendleton, McCandless, & Funderburk, 1995).

[54] Glacial forebulge: Upward movement of the outer crust of the earth (the lithosphere) caused by ice sheets. (Fjeldskaar, 1994)

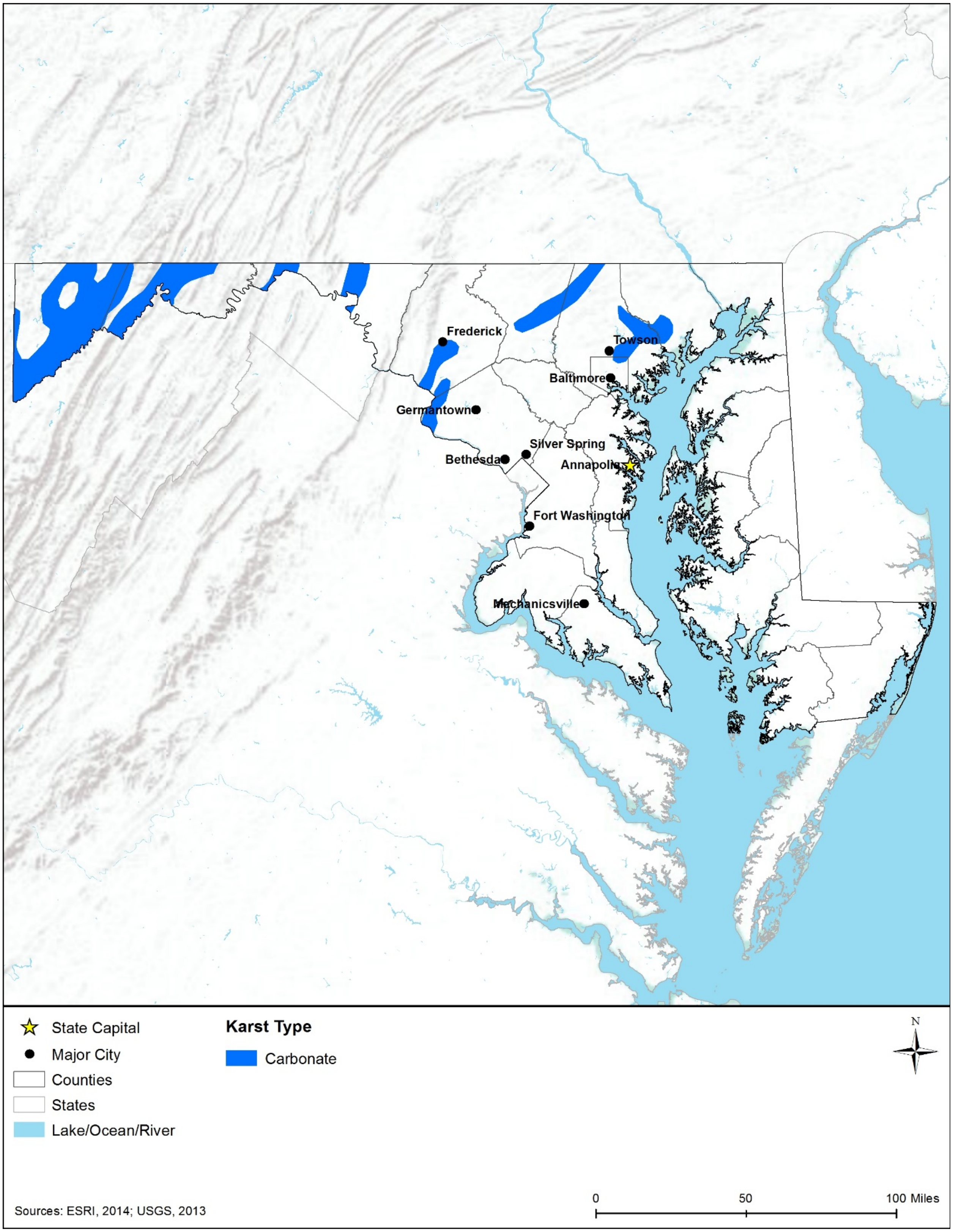


Figure 7.1.3-8: Maryland Karst Topography

7.1.4. Water Resources

7.1.4.1. 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 7.1.5). 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.

7.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 7.1.4-1 summarizes the major Maryland laws and permitting requirements relevant to the state's water resources.

Table 7.1.4-1 Relevant Maryland Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
COMAR Section 9-322: Maryland Waste Water Permit Program (WWPP)	MDE	Any point source facility that discharges wastewater to surface waters.
COMAR Section 5-906: Construction on Nontidal Waters and Floodplains	MDE	Required for projects in a waterway or 100-year floodplain that involve dams and reservoirs, bridges and culverts, excavation, filling, or construction channelization, stream alteration, temporary construction, or similar projects.
Clean Water Act (CWA) Section 404 permit, Maryland State Programmatic General Permit	U.S. Army Corps of Engineers (USACE), Baltimore District	Pile driving, sediment-disturbing activities and dredging prohibited for certain parts of the year for low salinity waters in the upper Chesapeake Bay, and Chester, Choptank, Nanticoke, Wicomico East, Pocomoke, Potomac, Wicomico, and Patuxent Rivers.

Sources: (MDE, 2015a)

7.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[55] and coastal waters. Maryland has over 100 lakes and reservoirs (Maryland State Archives, 2015a). The state has more than 19,000 miles of rivers and streams, about 2,500 square miles of estuaries and bays, and more than 7,700 miles of estuarine and ocean coastline. Surface waters in Maryland

[55] Estuarine: related to an estuary, or a "partially enclosed body of water where fresh water from rivers and streams mixes with salt water from the ocean. It is an area of transition from land to sea." (USEPA, 2015a)

supply water for drinking, agriculture, industrial use, hydroelectric power generation, flood control, recreation, and habitat for wildlife.

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains all the streams and rainfall to a common outlet (e.g., reservoir, bay). Maryland's waters (lakes, rivers, and streams) are divided into 12 major watersheds, or drainage basins (Figure 7.1.4-1). Maryland Appendix A, Table A-1: Characteristics of Maryland's Watersheds, provides detailed information on Maryland's major watersheds. Visit http://mddnr.chesapeakebay.net/wsprofiles/surf/prof/prof.html for additional maps and more information on Maryland's watersheds.

The Coastal Bays Watershed lies along Maryland's small stretch of Atlantic coastline and drains to the Atlantic Ocean and the state's inland bays. The Lower Eastern Shore, Choptank River, and Upper Eastern Shore Watersheds are located on the eastern shore of the Chesapeake Bay. The Upper Western Shore Watershed contains the mouth of the Susquehanna River where it drains to the Chesapeake Bay. The Upper, Middle, and Lower Potomac River Watersheds contain the Potomac River, which flows by the nation's capital in Washington, D.C., before draining into the Chesapeake Bay (MDNR, 2015b). The Youghiogheny Watershed is the only watershed in the state that ultimately drains to the Gulf of Mexico via the Mississippi River, and not the Chesapeake Bay (MDNR, 2000).

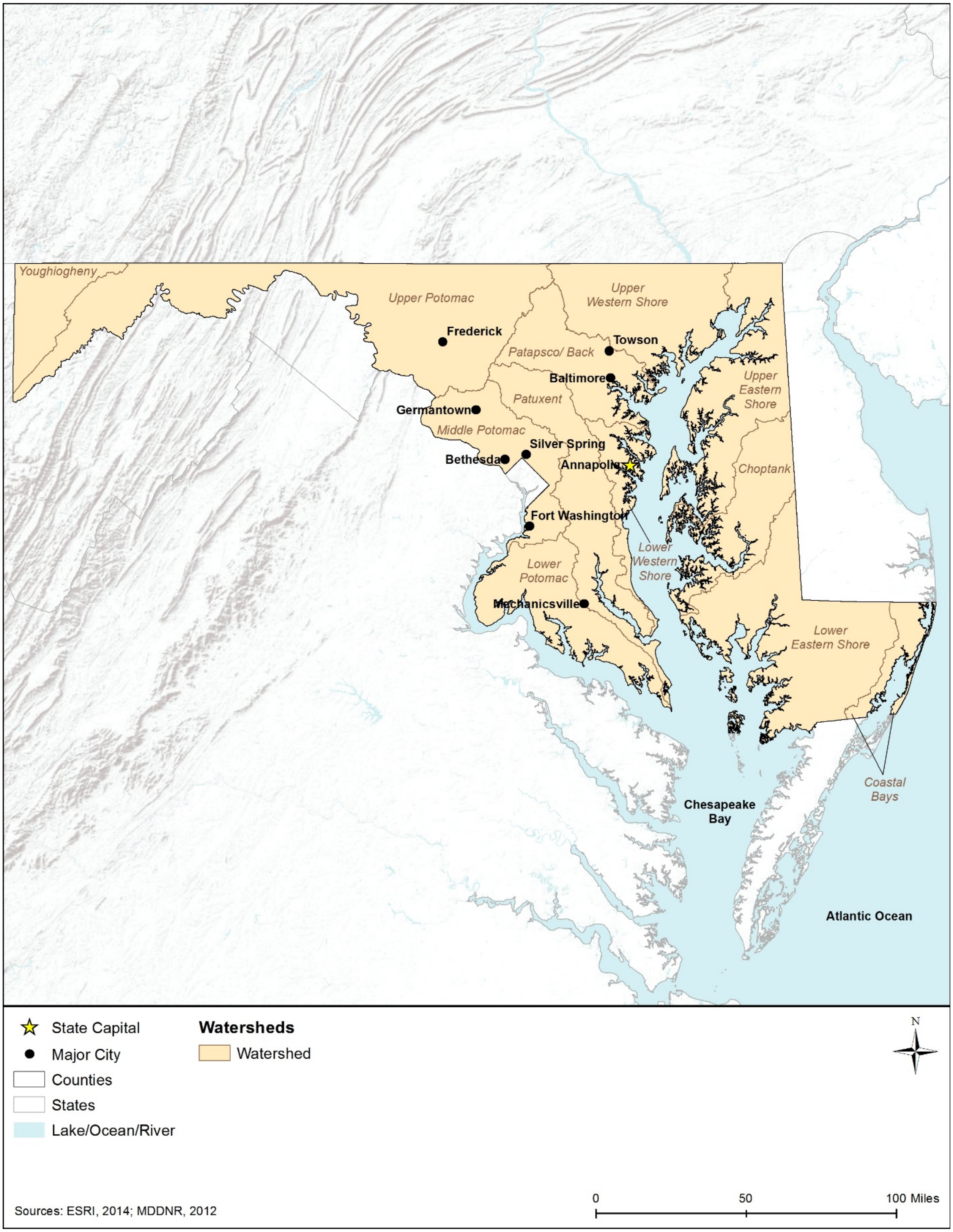


Figure 7.1.4-1: Major Maryland Watersheds, defined by MDNR

Freshwater

As shown in Figure 7.1.4-2, there are nine major rivers in Maryland: Pocomoke, Nanticoke, Choptank, Chester, Susquehanna, Patuxent, Potomac, Monocacy, and Youghiogheny. The Susquehanna River provides about half of the Chesapeake Bay's freshwater and, at 444 miles, is the longest river that passes through Maryland, although only a small portion of the river lies within Maryland (Maryland State Archives, 2016). The Potomac River, at about 340 miles in length, is the second longest river that passes through Maryland, and forms much of the state's western border with Virginia and West Virginia (Maryland State Archives, 2016). The Patuxent River at 115 miles in length is the longest river entirely within Maryland and flows into the Chesapeake Bay on the bay's western shore, while the Pocomoke, Nanticoke, Choptank, and Chester River all lie on the bay's eastern shore.

Maryland has no natural lakes; all were created by damming river channels. Deep Creek Lake, at nearly 4,000 acres in size, is the state's largest lake, and is used for recreation and power generation. The Prettyboy Reservoir, Liberty Reservoir, and Loch Raven Reservoir supply the City of Baltimore with water, and the Rocky Gorge Reservoir supplies the Washington, D.C. area with water (MGS, 2015g).

Estuarine and Coastal Waters

Estuaries (including bays and tidal rivers) are bodies of water that provide transition zones between fresh river water and saline ocean water. Barrier islands, sand bars, and other landmasses protect estuaries, including those in Maryland, from ocean waves and storms. Maryland's estuarine environments support a variety of habitats, including tidal wetlands, mudflats, rocky shores, oyster reefs, freshwater wetlands, sandy beaches, and eelgrass beds, and are a critical part of the life cycle of many different plant and animal species (USEPA, 2015b)

Maryland has two distinct coastal water environments: the Chesapeake Bay, and the Atlantic coast and associated inland bays, which are located on the eastern border of the state. The Chesapeake Bay is described as a drowned river valley[56] because it was formed when ocean waters flooded what was once the Susquehanna River channel (Chesapeake Bay Program, 2016a). The state's Atlantic coastline features barrier islands that form sandy beaches on their eastern borders and inland bays on their western borders. Maryland has about 6,950 miles of Chesapeake Bay coastline and 770 miles of coastline along the Atlantic Ocean. The MDNR works with the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (USEPA) and local municipalities to implement programs to manage the state's coastal resources (MDNR, 2015b). For more information on Maryland coastal resources, visit the MDNR Chesapeake and Coastal Service website at http://dnr2.maryland.gov/ccs/Pages/default.aspx.

[56] Drowned river valleys or drowned river mouths are estuarine environments that were formed when rising sea levels after the last ice age flooded river valleys and river mouths, converting freshwater river channels into estuarine bays. (NOAA, 2008).

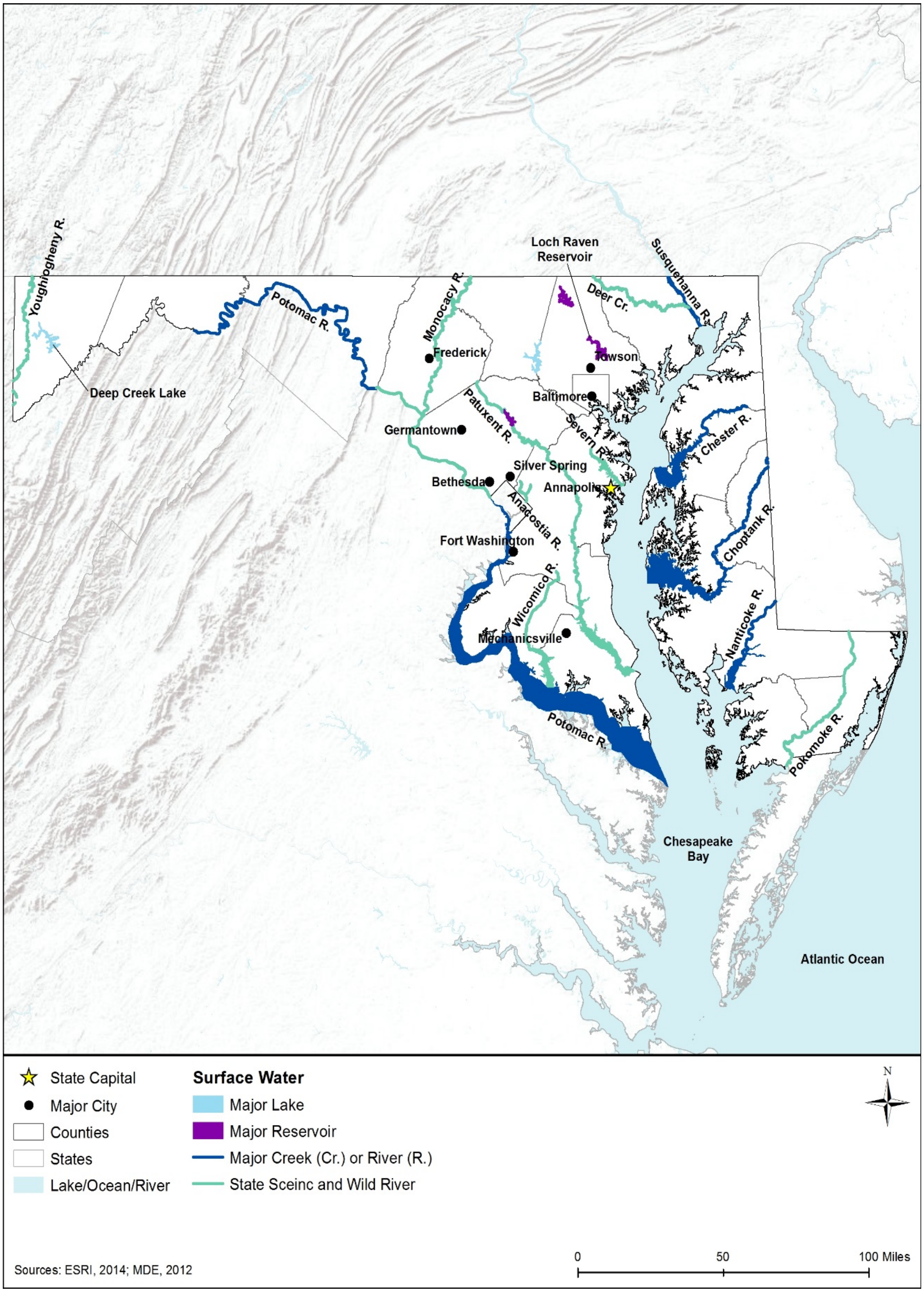


Figure 7.1.4-2: Maryland's Surface Waterbodies

Maryland has two major estuaries (Figure 7.1.4-4).

Figure 7.1.4-3: The Chesapeake Bay

Source: (NASA, 1996)

- The Chesapeake Bay Estuary lies roughly in the center of Maryland, stretching 200 miles from the mouth of the Susquehanna River to the bay's outlet to the Atlantic Ocean (see Figure 7.1.4-3) (Chesapeake Bay Program, 2016b). The Chesapeake Bay and its tidal tributaries have a "combined surface area of 4,480 square miles," making it the largest estuary in the United States (Chesapeake Bay Program, 2016b). The Chesapeake Bay's watershed of about 64,000 square miles encompasses "parts of six states – Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia – and the entire District of Columbia" (Chesapeake Bay Program, 2016b). The Chesapeake Bay was the first estuary in the United States to receive special protection under federal law when the Chesapeake Bay Program was established in 1983 (Chesapeake Bay Program, 2016c). The Bay has a variety of water quality problems including excess nitrogen and phosphorous which results in depleted dissolved oxygen levels, harming aquatic life (MDNR, 2015c). Despite federal and state efforts over the past 25 years, the Bay's water quality has failed to sufficiently improve, and as a result, the USEPA established a Total Maximum Daily Load (TMDL) for the bay in 2010 (USEPA, 2016a). The TMDL establishes limits for the total amounts of nitrogen, phosphorous, and sediment that can enter the bay, and is being implemented by the six states within the Bay watershed and the District of Columbia (USEPA, 2016a). For more information on the Chesapeake Bay, visit USEPA's Chesapeake Bay Program Office website at http://www.epa.gov/aboutepa/about-chesapeake-bay-program-office. The Chesapeake Bay is also an USEPA-designated Large Aquatic Ecosystem (USEPA, 2012a). The bay ecosystem is home to about 350 species of fish, more than 170 species of shellfish, about 30 species of waterfowl, and about 80,000 acres of aquatic grasses that provide habitat for blue crabs (Chesapeake Bay Program, 2016b).
- The **Chesapeake Bay National Estuarine Research Reserve (NERR)** is located within the Chesapeake Bay Estuary. The Chesapeake Bay NERR, administered by NOAA, is part of a network of 28 NERRs across the country whose mission is to "improve coastal resource management by increasing scientific understanding of estuarine systems and making estuarine research relevant, meaningful, and accessible to managers and stakeholders" (MDNR, 2016a). The Chesapeake Bay NERR consists of seven components, three in

Maryland and four in Virginia. The Maryland components, Otter Point Creek, Jug Bay, and Monie Bay, protect more than 6,200 acres (NERRA, 2016). See Section 7.1.5.4 for additional information on the Chesapeake Bay NERR.

- The **Maryland Coastal Bays Estuaries** are Sineppuxent Bay, Newport Bay, Isle of Wight Bay, St. Martin River, Assawoman Bay, and Chincoteague Bay (Figure 7.1.4-4). These six inland bays lie between barrier islands, and the Maryland mainland. The bays provides habitat for 2 species of seagrass (eelgrass and widgeon grass), blue crabs, over 140 species of fish, and 350 bird species (Maryland Coastal Bays Program, 2009). The Maryland Coastal Bays were designated an Estuary of National Significance by the USEPA in 1995, and the Comprehensive Conservation and Management Plan (CCMP) was released in 1999. The CCMP sets forth goals for water quality, fish and wildlife, recreation and navigation, and community and economic development. For more information on the Maryland Coastal Bays Estuary and CCMP, visit http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.

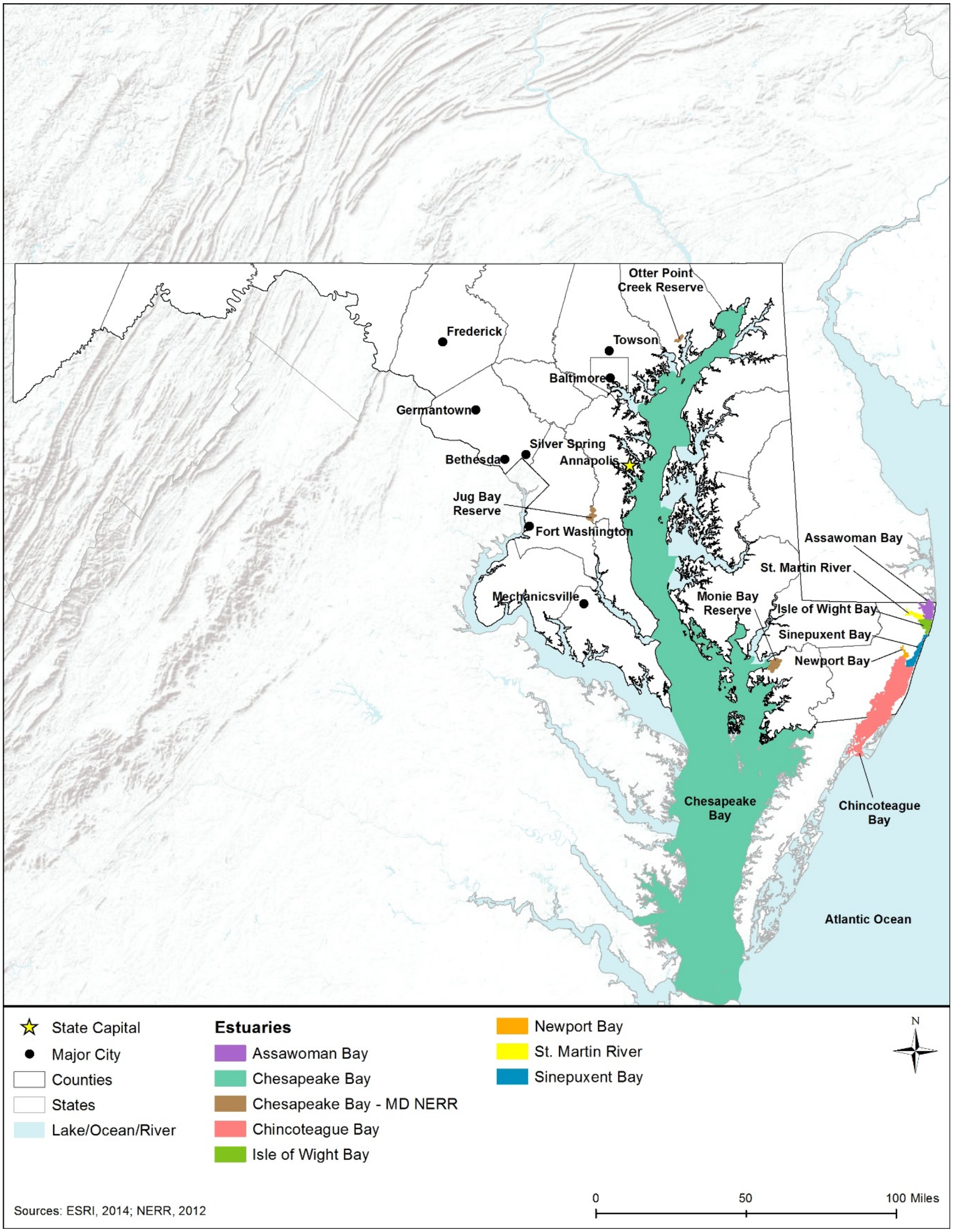


Figure 7.1.4-4: Maryland's Estuaries

7.1.4.4. *Sensitive or Protected Waterbodies*

Wild and Scenic Rivers

Maryland has no federally designated National Wild and Scenic Rivers, but the state has designated nine river segments as Scenic and Wild under state law. Maryland's Scenic and Wild rivers are recognized for their "outstanding scenic, geological, ecological, historic, recreational, agricultural, fish, wildlife, and other similar resources values." The purpose of this policy is to preserve, enhance, and wisely use these waterways. For more information on Maryland's Scenic and Wild Rivers, visit http://dnr.maryland.gov/land/stewardship/scenicrivers.asp. The following river segments are Maryland Scenic and Wild Rivers (Figure 7.1.4-2): (MDNR, 2015d)

- The **Youghiogheny River** flows north through Garret County in western Maryland before crossing into Pennsylvania. The river flows through scenic, agricultural land before entering a steep, forested river valley, and then a series of rapids and waterfalls that drops 280 feet in one 4-mile section. (MDNR, 2015d)
- The **Potomac River** is designated a state Wild and Scenic River from the point where it flows into Knoxville, Maryland to the point where the river flows into Washington, D.C. (MDNR, 2015d). This river segment includes Great Falls, a scenic series of rapids and waterfalls created when the river flows through the narrow, rocky Mather Gorge (MDOT, 2015b).
- The **Monocacy River** originates in Pennsylvania and flows through Maryland before draining into the Potomac River. It flows primarily through flat, agricultural land within Maryland and is the largest Maryland tributary to the Potomac. (MDNR, 2015d)
- **Deer Creek** is a small, fast-flowing creek that originates in Pennsylvania and flows into Maryland before draining into the Susquehanna River. (MDNR, 2015d)
- The **Severn River** is entirely within Maryland and begins as a headwater stream before widening into a tidal, estuarine river that flows into the Chesapeake Bay. While the river's headwaters wind through hardwood forests, its estuarine reaches are bordered by the urban area of Annapolis, Maryland. (MDNR, 2015d)
- The **Patuxent River** is the longest river entirely within Maryland and flows into the Chesapeake Bay on its western shoreline. (MDNR, 2015d)
- The **Anacostia River**'s headwaters are in Maryland and flow into Washington, D.C. before draining into the Potomac River. (MDNR, 2015d)
- The **Wicomico River** flows for about 16 miles in the southeastern portion of the state before draining into the Potomac River, which then drains into the Chesapeake Bay. The river's waters are partially saline[57] and tidally influenced because of their proximity and connection to the Chesapeake Bay. (MDNR, 2015d)
- The **Pocomoke River** is on the peninsula between the Chesapeake Bay and the Atlantic Ocean where it flows south and west through sparsely populated agricultural land before flowing into Pocomoke Sound, and ultimately the Chesapeake Bay. (MDNR, 2015d)

[57] Saline water is water that contains a concentration of sodium chloride (salt) that is greater than about 1,000 parts per million. (USGS, 2015i)

7.1.4.5. 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,[58] the causes of impairment, and probable sources. Table 7.1.4-2 summarizes the water quality of Maryland's assessed major waterbodies by category, percent impaired, designated use,[59] cause, and probable sources. Figure 7.1.4-5 shows the Section 303(d) waters in Maryland as of 2012.

As shown in Table 7.1.4-2, various sources affect Maryland's waterbodies, causing impairments. For example, the Pocomoke River is impaired by turbidity, Assawoman Bay has low dissolved oxygen due to excess phosphorous, and Liberty Reservoir is contaminated with mercury in fish tissue from atmospheric deposition[60] (USEPA, 2016b). Nearly all of Maryland's estuaries and bays are impaired (USEPA, 2016b). Designated uses of the impaired estuaries and bays include aquatic life, fishing, primary contact recreation, and shellfish (USEPA, 2016b). Elevated levels of mercury, PCBs, and pesticides in fish tissue have resulted in fish consumption advisories for many species in the state (MDE, 2016).

As part of the Chesapeake Bay TMDL (see Estuarine and Coastal Waters) Maryland and the other Chesapeake Bay watershed states (VA, DE, PA, NY, WV, and DC), in coordination with the USEPA, are developing Watershed Implementation Plans (WIPs) with a goal of restoring the impaired waters of the bay. Maryland's WIP is particularly important for the state since the majority of its waters are within the Chesapeake Bay watershed. Maryland finalized its Phase I WIP in 2010 and its Phase II WIP in 2012, which establish interim and final reduction targets for pollution entering the Chesapeake Bay from Maryland. Interim reduction targets of 60 percent of the final targets are to be reached by 2017 and final targets are to be reached by 2025. Progress is measured from a 2010 baseline. Maryland plans to reduce nitrogen pollution by 22.4 percent, phosphorous by 21 percent, and sediment by 16.1 percent by 2020. Among the largest sources of nitrogen and phosphorous are crops, septic systems, and municipal wastewater. Crops and stormwater from construction and developed areas are among the largest contributors of sediment (Chesapeake Bay Program, 2016d).

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[58] 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.

[59] 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.

[60] 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.

Table 7.1.4-2: Section 303(d) Impaired Waters of Maryland, 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	100%	75%	Aquatic life and wildlife fishing, public water supply, and primary contact recreation	Turbidity[c], total phosphorous, pathogens[d], habitat alterations	Agriculture, urban runoff/storm sewers, livestock grazing or feeding, sanitary sewer overflows
Lakes, Reservoirs, and Ponds	25%	89%	Aquatic life and wildlife, fishing, and primary contact recreation	Mercury in fish tissue, total phosphorous, sedimentation, PCBs in fish tissue	Atmospheric deposition of toxics, agriculture, contaminated sediments, urban runoff/storm sewers
Estuaries and Bays	100%	92%	Aquatic life and wildlife, fishing, open water fish and shellfish, deep-channel refuge, migratory fish spawning and nursery	Nutrients (total nitrogen and phosphorous), PCBs in fish tissue, turbidity, pathogens, pesticides	Agriculture, contaminated sediments, municipal sewage discharge, manure runoff, wastes from pets
Maryland coastal shoreline	4%	18%	Primary contact recreation	Pathogens	Wildlife other than waterfowl

[a] Some waters may be considered for more than one water type
[b] Maryland has not assessed all waterbodies within the state.
[c]Turbidity: the cloudiness or lack of clarity of water.
[d] Pathogen: a bacterium, virus, or other microorganism that can cause disease.
Source: (USEPA, 2016b)

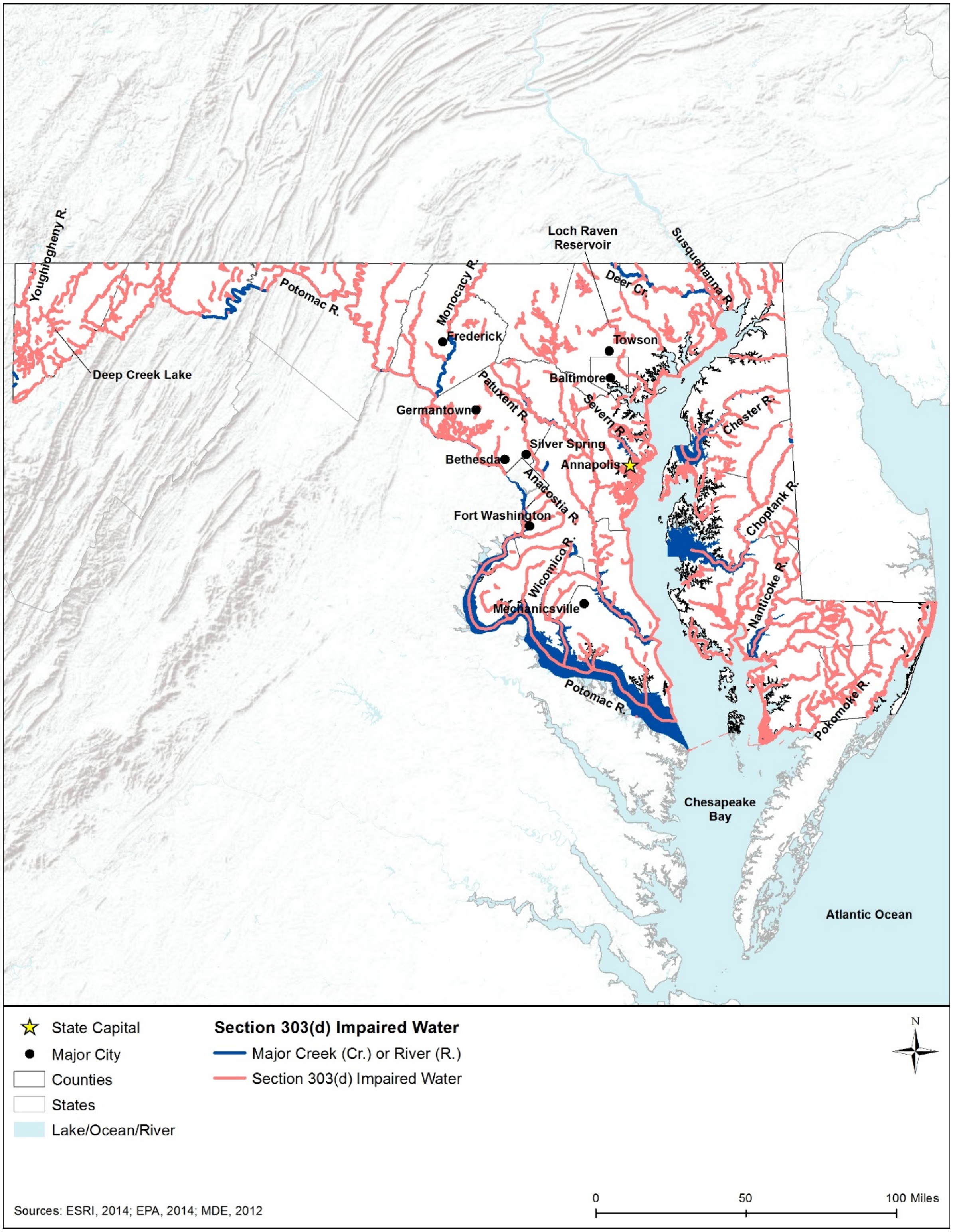

Figure 7.1.4-5: Section 303(d) Impaired Waters of Maryland, 2012

7.1.4.6. 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, 2006). 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, 2013).

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 provides shade, 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. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping. (FEMA, 2014a)

There are two primary types of floodplains in Maryland.

- **Riverine and lake floodplains** occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous parts of the states, such as the Blue Ridge and Appalachian Mountains, 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. In contrast, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014a)
- **Coastal floodplains** in Maryland border the Atlantic Ocean coastline of Assateague Island and Fenwick Island, the inland bays, and the Chesapeake Bay shoreline, especially near the Bay's outlet to the Atlantic Ocean. Coastal flooding can occur when strong wind and storms, usually nor'easters and hurricanes, increase water levels on the adjacent shorelines (FEMA, 2013). In addition, a storm surge event that takes place during high tide can cause floodwaters to exceed normal tide levels, resulting from strong winds preventing tidal waters from receding in conjunction with additional water pushed toward the shore.

Flooding is the leading cause for disaster declaration by the President in the U.S. and results in significant damage throughout the state annually (NOAA, 2015a). There are several causes of flooding in Maryland, often resulting in loss of life, injury, and damage to property including agriculture. These include severe rain events, snowmelt, hurricanes, over-development/impervious[61] surfaces, and deforestation[62] (NOAA, 2015a).

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Based on historical flooding, flood disaster declarations, and population vulnerability to floods, flood risk is most severe in the counties of Frederick, Montgomery, Ann Arundel, and Baltimore. Maryland has almost 8,000 miles of tidally-influenced shoreline, and greater than 12 percent of the state's landmass is within a floodplain. The state suffered more than 1,150 flood events from 1993 to 2010 causing about 15 fatalities, and over $121.5M in property damage.

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 140 communities in Maryland through the National Flood Insurance Program (NFIP) (FEMA, 2014b). 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, 2015). 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 by providing discounts on flood insurance premiums. As of May 2014, Maryland had 13 communities participating in the CRS (FEMA, 2014c).[63]

7.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water 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, 1999b). 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.

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[61] Impervious: a hardened surface or area that does not allow water to pass through. For example, roads, rooftops, driveways, sidewalks, pools, patios, and parking lots are all impervious surfaces. (USEPA, 2015c)

[62] Deforestation: the removal of a forest, woodland, or stand of trees without adequate replanting or natural regeneration. (USEPA, 2015d)

[63] A list of the 13 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014. (http://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).

Maryland's principal aquifers consist of carbonate-rock[64]crystalline rock[65], sandstone[66], and unconsolidated sedimentary deposits.[67] More than 1 million residents get their drinking water from Maryland's groundwater resources (MDE, 2012). Generally, the water quality of Maryland's aquifers is suitable for drinking and daily water needs. Threats to groundwater quality include leaking landfills and underground storage tanks, improper disposal of wastes on bare ground, livestock waste, fertilizers and pesticides and saltwater intrusion (saltwater moving into freshwater aquifers) (MDE, 2012).

Table 7.1.4-3 provides details on aquifer characteristics in the state; Figure 7.1.4-6 shows Maryland's principal and sole source aquifers.

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer 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, 2015e). Maryland has two designated SSAs within the state, as shown in Figure 7.1.4-6. The Piedmont and Poolesville SSAs lie adjacent to each other on the state's western border with Virginia. 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, 2015e).

[64] 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).

[65] Crystalline-rock aquifers are composed of igneous and metamorphic rock, and spaces between the crystals are extremely small. This type of aquifer generally yields little water, and is only permeable when the rock is fractured. (USGS, 2010)

[66] Sandstone aquifers are composed of sedimentary rock made of sand. Because the pores between rock particles are very small, most water is carried in fractures in the rock. (USGS, 2015j)

[67] Unconsolidated sedimentary deposits: "loosely bound sediments such as sand, gravel, and silt, which tend to accumulate in low areas or valleys." (USGS, 2015k)

Table 7.1.4-3: Description of Maryland's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Northern Atlantic Coastal Plain aquifer system Semi-consolidated to unconsolidated sedimentary deposits. The system include the surficial, Chesapeake, Castle-Hayne-Aquia, Severn-Magothy, and Potomac aquifers.	Underlies the entire southeastern portion of the state including all of the Delmarva Peninsula and the Chesapeake Bay. Also occurs in two narrow bands in the western part of the state.	Deeper parts of the aquifer to the southeast contain slightly saline or saline water. Dissolved solids in the western portion are calcium and magnesium bicarbonate; sodium bicarbonate in the central part of the aquifer; and sodium chloride in the eastern part of the aquifer.
Piedmont and Blue Ridge crystalline-rock aquifers Crystalline metamorphic and igneous rocks including coarse-grain gneisses and schists, phyllite and metamorphosed volcanic rocks.	Occurs in the central part of the state in a band running from the southwest to the northeast.	Water quality is generally sufficient for drinking and other uses. Dissolved solids average about 120 milligrams per liter (mg/L). The water is soft[68] and slightly acidic.
Piedmont and Blue Ridge carbonate-rock aquifers Limestone, marble, and dolomite of Paleozoic and Precambrian age.	Found in patches in the central part of the state.	Water quality is generally sufficient for drinking and other uses. Dissolved solids concentrations average 330 mg/L. The water is very hard[69] and slightly basic.
Early Mesozoic basin aquifers Igneous rocks including diabase dikes and sills and basalt flows.	Found in patches in the central part of the state.	Water quality is generally sufficient for drinking and other uses. Dissolved solid concentrations average 230 mg/L. The water is hard and slightly basic. Iron concentrations can be as high as 5.3 mg/L in some locations, which may require treatment before use.
Pennsylvanian Aquifers Sandstone, grey and black shale and claystone, limestone, and coal.	Occurs in bands running from the southwest to the northeast in the western part of the state.	Water quality is generally sufficient for drinking and other uses. Concentrations of dissolved solids average about 230 mg/L. The water is soft and slightly basic.
Mississippian Aquifers Shale, siltstone, sandstone, and some conglomerate and limestone.	Occurs in bands running from the southwest to the northeast in the western part of the state.	Water quality is generally sufficient for drinking and other uses.
Valley and Ridge aquifers Carbonate rocks, shale, and sandstone, and some coal-bearing beds.	Occurs in bands running from the southwest to the northeast in the western portion of the state.	Water quality is generally sufficient for drinking and other uses. Dissolved solid concentrations average about 150 mg/L. Water contains calcium bicarbonate. Water is moderately hard and slightly basic.
Valley and Ridge carbonate-rock aquifers Composed mostly of limestone.	Occurs in patches in the western part of the state.	Water quality is generally sufficient for drinking and other uses. Water contains calcium and magnesium carbonate and dissolved solid concentrations average about 330 mg/L. The water is very hard and slightly basic.

Source: (USGS 1995a) (USGS 1995b) (USGS 1995c) (USGS 1995d)

[68] Soft water is water that is free from dissolved salts of such metals as calcium, iron, or magnesium.
[69] Hard water is water that contains salts of calcium, magnesium, and/or iron.

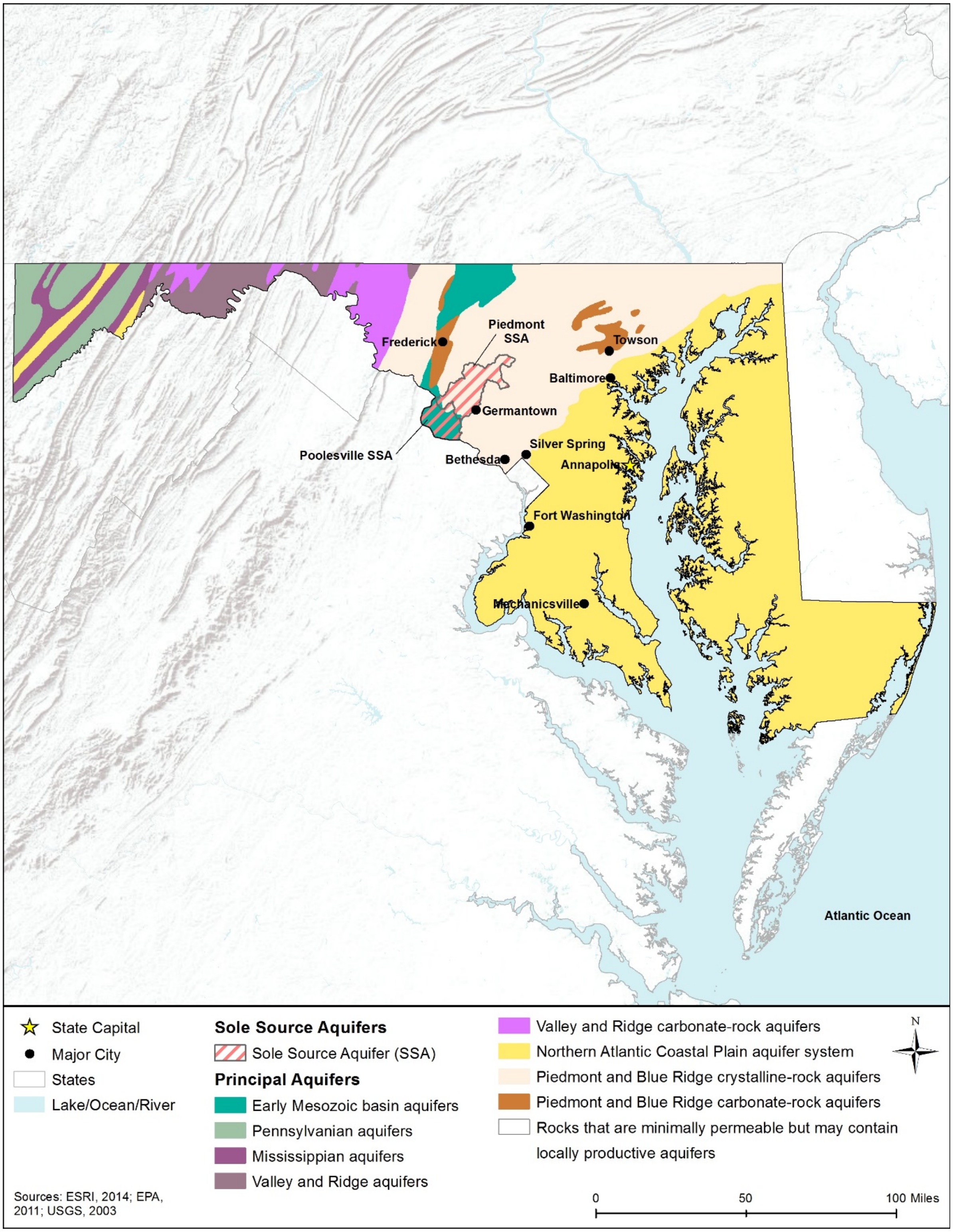


Figure 7.1.4-6: Principal and Sole Source Aquifers of Maryland

7.1.5. Wetlands

7.1.5.1. 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[70] and similar areas" (GPO, 1993).

The 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.

7.1.5.2. Specific Regulatory Considerations

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 7.1.5-1 summarizes the major Maryland state laws and permitting requirements relevant to the state's wetlands.

Table 7.1.5-1: Relevant Maryland Wetland Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
COMAR Title 27: Chesapeake and Atlantic Coastal Bays Critical Area Act	MDNR	Regulates activities situated within 1,000 ft of tidal waters in the Chesapeake Bay; activities are allowed in nontidal wetlands only if water-dependent or provide a substantial economic benefit, and are necessary and unavoidable.
COMAR Title 26: Nontidal Wetlands Protection Act	MDE	Regulates activities in nontidal wetlands and within a 25 ft buffer, including dredging and filling of soils, altering existing drainage or flood retention functionality, disturbing water level or water table, altering topography by grading or removing material, and removing or destroying vegetation. Requires a 100 ft buffer for "nontidal wetlands of Special State Concern" that have been designated as having exceptional educational or ecological value of significance.
COMAR Title 16: Tidal Wetlands Act	MDE	Permit required before filling, dredging, or altering a tidal wetland.
Water Quality Certification	MDE	In accordance with CWA Section 401, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from MDE indicating that the proposed activity will not violate water quality standards.

[70] Bog: "Characterized by spongy peat deposits, acidic waters, and a floor covered by a thick carpet of sphagnum moss. Bogs receive all or most of their water from precipitation rather than from runoff, groundwater or streams. As a result, bogs are low in the nutrients needed for plant growth, a condition that is enhanced by acid forming peat mosses." (USEPA, 2013a)

7.1.5.3. 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 in (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 7.1.5-2). 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 (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)

In Maryland, the two main types of wetlands are palustrine (freshwater) wetlands found on river and lake floodplains across the state, and estuarine/marine (tidal) wetlands around the Chesapeake Bay and along the Atlantic coast. Table 7.1.5-2 uses 2014 NWI data to characterize and map Maryland wetlands 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. As shown in Figure 7.1.5-1, both palustrine and estuarine/marine wetlands are more dominant in the eastern portion of the state. The map codes and colorings in Table 7.1.5-2 correspond to the wetland types in the figures.

Table 7.1.5-2: Maryland Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	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.	Throughout the state	389,241
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.		
Palustrine emergent wetlands	PEM	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, [71] and sloughs.	Throughout the state	34,478
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	17,395
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[72], and other miscellaneous wetlands are included in this group.	Throughout the state	1,495
Riverine wetland	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	1,824
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	1,440
Estuarine and Marine intertidal wetland	E2/M2	These intertidal[1] 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.	Around the Chesapeake Bay and Atlantic coastline	216,874

[a] Wetlands descriptions are based on information from Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data has 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, 2015b)

[71] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (Edinger, et al., 2014)
[72] Saline seep is an area where saline groundwater discharges at the soil surface. These wetland types are characterized by saline soils and salt tolerant plants. (City of Lincoln, 2015)

[1] Intertidal wetlands are wetlands found along a shoreline that are exposed to air at low tide and submerged by water at high tid.e
Source: (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015c) (FGDC, 2013)

Palustrine Wetlands

The most common wetlands in Maryland are palustrine wetlands, totaling just over 57 percent of all wetlands in the state. Over these, nearly 89 percent are nontidal (not affected by tide) wetlands (Clearwater, Turgeon, Noble, & LaBranche, 2000). Wetlands found on the east side of Chesapeake Bay (Eastern Shore) are typically flat and low, with only slight variations in vegetation compared to surrounding upland vegetation, as well as minor topographical differences. Soils are mostly clay on the Lower Eastern Shore and poorly drained, while soils on the Upper Eastern Shore are well drained, and have steeper gradients. A specific wetland type found in Caroline, Kent, and Queen Anne's counties, called a "Delmarva Bay" is separated from surface water drainage, with sandy soil and an elliptical shape. Plant species are found in these wetlands, including Bald cypress (*Taxodium distichum*) and Atlantic white cedar (*Chamaecyparis thyoides*). On the west side of the Chesapeake (Western shore), wetlands are usually found near streams, with more variable topography and differentiating vegetation. The typical water source for these wetlands is a localized high water table (Clearwater, Turgeon, Noble, & LaBranche, 2000).

Approximately 45 to 65 percent of Maryland's original wetlands have been lost, mostly for agricultural land conversion. Although there are still abundant wetlands found in the state, it is expected that demands from commercial, resort, and residential real estate will continue to threaten wetlands. Wetlands in Maryland are also threatened by water pollution from point sources, such as municipal wastewater treatment and industrial facilities, as well as nonpoint sources such as agricultural and urban runoff (Clearwater, Turgeon, Noble, & LaBranche, 2000).

Estuarine and Marine Wetlands

Marine wetlands in Maryland are found along the coast of the Atlantic Ocean, are most commonly found on Assateague Island. These wetlands have very little vegetation (Bleil, Clearwater and Nichols 2015).

Estuarine wetlands are found in coastal areas where saline water from the ocean mixes with freshwater, and are influenced by the tides. Wetlands permanently flooded with tidal water are called "subtidal" and can provide essential habitat for wildfowl. Wetlands that alternate from flooded to nonflooded are called "intertidal" are common along the mainland shoreline of Maryland, as well as around the lower Eastern Shore of the Chesapeake Bay (Bleil, Clearwater and Nichols 2015). Approximately 82 percent of estuarine wetlands in Maryland are emergent,[73] while nearly 11 percent are nonvegetated (Clearwater, Turgeon, Noble, & LaBranche, 2000).

Sea level rise has contributed to conversion of tidal wetlands to open water, as well as nontidal wetlands to tidal marsh. Approximately 16,000 acres of estuarine forested wetlands (nearly 7

[73] Emergent wetlands: “Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens… dominated by perennial plants” (USFWS, 2015d)

percent of the total estuarine wetlands acreage in the state) have also been flooded by salt water from the ocean (Clearwater, Turgeon, Noble, & LaBranche, 2000).

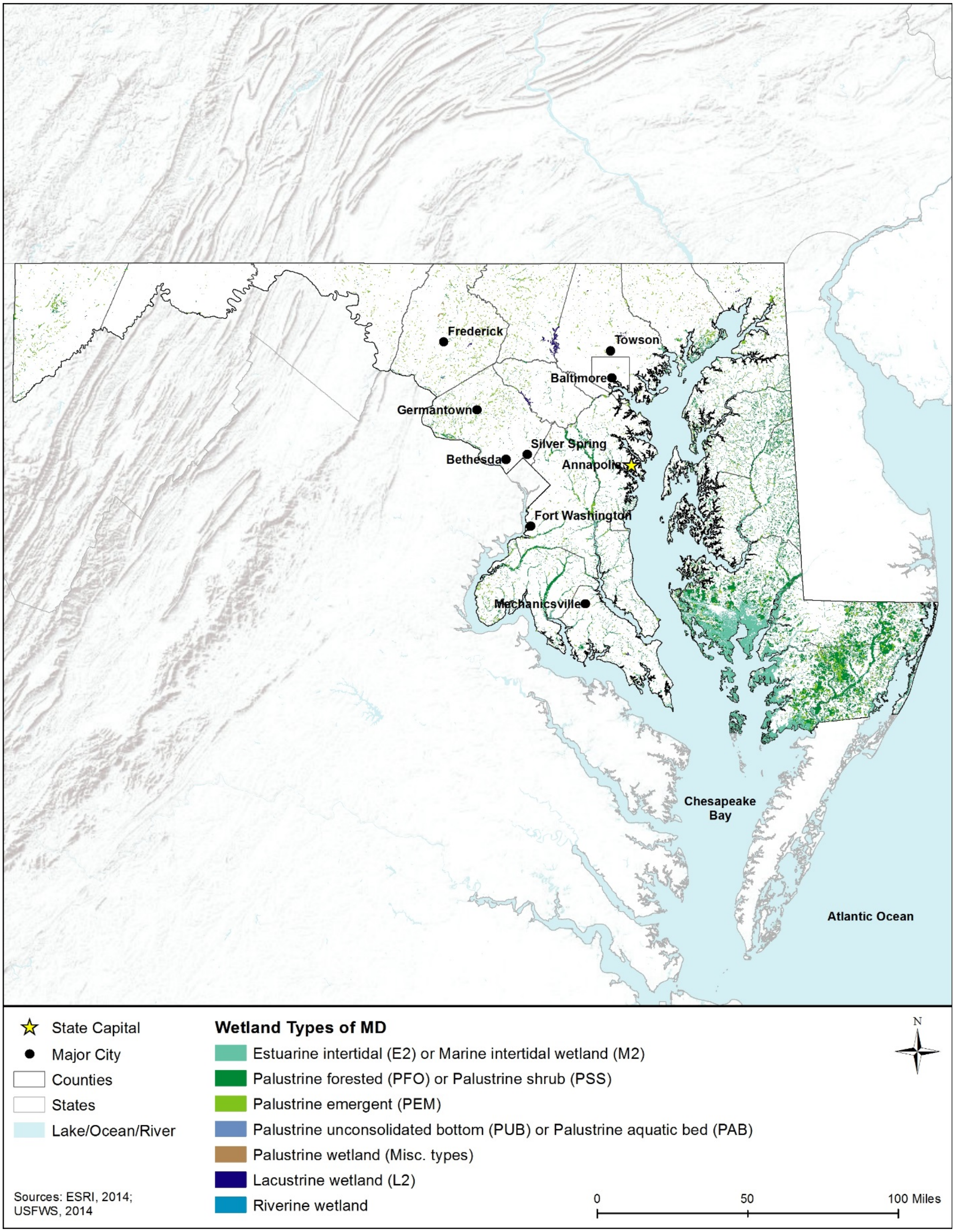


Figure 7.1.5-1: Wetlands by Type, in Maryland, 2014

Riverine and Lacustrine Wetlands

As identified in Table 7.1.5-2, less than one percent of Maryland's wetlands are riverine or lacustrine, and therefore are not discussed in significant detail (USFWS, 2014b).

7.1.5.4. Wetlands of Special Concern or Value

Nontidal Wetlands of Special State Concern

Under Maryland's Nontidal Wetlands Protection Act, nontidal wetlands of Special State Concern (WSSC) are designated for extra protection, including a 100 foot buffer from development. These wetlands typically have rare, threatened, or endangered species, or unique habitat, and include bogs, Delmarva bays (discussed above), and coniferous swamp forest (uncommon in Maryland and as a whole, mostly found in Garrett County). These sites are identified by USFWS NWI mapping, as well as field inspections. The highest acreage of WSSC are found near Fishing Bay, the Nanticoke River, and the Lower Pocomoke River; there are 365 wetland sites total across the state. (Clearwater, Turgeon, Noble, & LaBranche, 2000)

Bogs

Bogs can be found in western Maryland and in the coastal plain. These coastal plain bogs are rare and threatened in the state. Most of Maryland's original coastal plain bogs have been destroyed by agriculture and development that drained and filled them, forest clearing, and fire suppression. The few remaining bogs found in the state provide habitat for many rare or endangered species in Maryland. Anne Arundel County contains the highest number of bogs in the state (MDNR, 2015ae).

The two types of coastal bogs found in Maryland include sphagnum bogs and cedar bogs. Sphagnum moss (*Sphagnum* sp.), low shrubs, and herbaceous plants characterize sphagnum bogs. Typical plants found in these bogs include cranberry (*Vaccinum macrocarpon)*, rose pogonia orchid (*Pogonia ophioglossoides*), northeastern marshfern (*Thelypteris palustris*), Virginia chainfern (*Woodwardia virginica*), bog fern (*Thelypteris simulata*), and pitcher plants (*Sarracenia purpurea*). Pin oak (*Quercus ellipsoidalis*), willow oak (*Quercus phellos*), sweet gum (*Liquidambar styracifus*), and sour gum/tupelo (*Nyssa sylvatica*) typically surround these coastal bog, along with dense shrubs such as swamp azalea (*Rhododendron viscosum*), buttonbush (*Cephalanthus ocidentalis*), swamp magnolia (*Magnolia virginiana*), and clethra (*Clethra* sp.). Cedar bogs are dominated by Atlantic white cedar (*Chamaecyparis thyoides*), along with plants such as sphagnum moss, swamp magnolia, sour gum, blackberry (*Rubus* sp.), highbush blueberry (*Vaccinum corymbosum*), swamp leucothoe (*Leucothoe* sp.), and royal fern (*Osmunda regalis*) (MDNR, 2015ae).

Chesapeake Bay NERR

Chesapeake Bay, the largest estuary in the country, has a variety of diverse estuarine habitats. The Chesapeake Bay NERR is comprised of three sites (nearly 6,300 acres total) in Maryland: Monie Bay (salt marsh), Otter Point Creek (tidal freshwater marsh), and Jug Bay (tidal riverine system) (NERRA, 2016) (See Figure 7.1.5-2). Monie Bay contains saltwater marshes, along with shallow open water and tidal creeks, and upland pine forests; all of which provide habitat for many species. Otter Point Creek contains one of the last tidal freshwater marshes in upper Chesapeake Bay that is relatively undisturbed and in a natural condition. This site contains shallow open water, upland hardwood forests, and forested wetlands, with many bay grasses, waterfowl, and mammal species found there. Jug Bay contains shallow, tidal freshwater marsh, along with fringe marsh and streams, and adjacent upland. It has been designated an Audubon Important Bird Area, with over 100 native bird species sighted (Friends of Jug Bay, 2014).

Figure 7.1.5-2: Jug Bay, Chesapeake Bay NERR

Source: (NOAA, 2015b)

Other important wetland sites in Maryland include:

- Wildlife Management Areas in Maryland total nearly 120,000 acres, some of which include wetlands (MDNR, 2015e). To learn more about state Wildlife Management Areas, see http://dnr2.maryland.gov/Wildlife/Pages/publiclands/home.aspx.
- National Natural Landmarks range in size from 9 acres to over 3,100 acres, and are owned by MDNR, The Nature Conservancy, and other conservation organizations and individuals. See www.nature.nps.gov/nnl/state.cfm?State=MD to learn more about Maryland's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including Maryland Agricultural Land Preservation Foundation (MALPF), Maryland Environmental Trust, Maryland Rural Legacy Program, Eastern Shore Land Conservancy, NRCS, and other natural resource conservation groups such as state land trusts. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements, NRCS holds more than 10,000 acres in conservation easements in Maryland (National Conservation Easement Database, 2015).

For more information on Maryland's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 7.1.7, Land Use, Recreation, and Airspace, and Section 7.1.8, Visual Resources.

7.1.6. Biological Resources

7.1.6.1. Definition of the Resource

This section describes the biological resources of Maryland. Biological resources include terrestrial[74] vegetation, wildlife, fisheries and aquatic habitats[75], and threatened[76] and endangered[77] species, and communities and 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 glaciation, and its location along the Atlantic coast, Maryland supports a wide diversity of biological resources ranging from marine[78] settings along Chesapeake Bay in the eastern portion of the state, to coniferous[79] forests in the Appalachian areas of western Maryland. Each of these topics is discussed in more detail below.

7.1.6.2. Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in Maryland are summarized in Appendix C. Table 7.1.6-1 summarizes the major federal and state laws relevant to Maryland's biological resources.

Table 7.1.6-1: Relevant Maryland Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
COMAR Title 08: Department of Natural Resources, Subtitle 03, Wildlife	MDNR	Protection and restoration of wildlife and wildlife areas.
COMAR Title 10: Nongame and Endangered Species Conservation Act; Title 08, Department of Natural Resources, Section 08.03.08, Threatened and Endangered Species	MDNR, Wildlife and Heritage Service (WHS)	Allows and governs the official state listing of Threatened and Endangered Species and species in need of conservation.
COMAR Title 4: The Endangered Species of Fish Conservation Act; Title 8, Section 08.02.12, Endangered and Threatened Fish Species	MDNR	Provides the official list of game and commercial fish species designated as threatened or endangered.
COMAR, Title 26: Department of Environment	MDE	Protection and restoration of the state's air, water, and land resources.

[74] Terrestrial: "Pertaining to the land." (USEPA, 2015f)
[75] Habitat: "The place where a population lives, including its living and non-living surroundings." (USEPA, 2015g)
[76] Threatened: "A species that is likely to become endangered if not protected." (USEPA, 2015h)
[77] Endangered: "Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (man-caused) or other natural changes in their environment. Requirements for declaring a species endangered are contained in the Endangered Species Act." (USEPA, 2015i)
[78] Marine: "Any marine environment, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment." (USEPA, 2015j)
[79] Coniferous: "Cone-bearing trees, mostly evergreens, that have needle-shaped or scale-like leaves. They produce wood known commercially as softwood." (USEPA, 2015k)

State Law/Regulation	Regulatory Agency	Applicability
COMAR Title 9: Maryland Weed Control Law, Subtitle 4, Weed Control	Maryland Department of Agriculture	Requires counties to provide technical assistance to landowners for initiating noxious weed control programs.

Source: (MDNR, 2015f) (State of Maryland, 2015a)

7.1.6.3. Terrestrial Vegetation

The distribution of flora[80] within the state is a function of the characteristic geology[81], soils, climate,[82] and water of a given geographic area and correlate to distinct areas identified as ecoregions.[83] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems of regional extent. 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, 2015) (World Wildlife Fund, 2015). Ecoregion boundaries often coincide with physiographic[84] regions of a state.

In Maryland, the five main physiographic provinces include the Appalachian Plateaus, Ridge and Valley, Blue Ridge, Piedmont, and Atlantic Coastal Plain (MGS, 2015a). 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 provides an overview of the terrestrial vegetation resources for Maryland at USEPA Level III (Woods, Omernik, & Brown, 1999) (Woods, Omernik, & Brown, 2015).

As shown in Figure 7.1.6-1, the USEPA divides Maryland into six Level III ecoregions. These six ecoregions support a variety of different plant communities, all predicated on their general location within the state. Communities range from mixed forest communities in the Appalachian Forest region in western Maryland, to coastal marsh and dune communities in the Southeast Plains region within the southeastern portion of the state. Table 7.1.6-2 provides a summary of the general abiotic characteristics, vegetative communities, and the typical vegetation found within each of the six Maryland ecoregions.

[80] Vegetation within an area.
[81] “Geology is the study of the planet earth- the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin.” (USEPA, 2015l)
[82] Climate: “The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more.” (USEPA, 2015m)
[83] Ecoregion: “A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables.” (Ecology Dictionary, 2008)
[84] Physiographic: “The natural, physical form of the landscape.” (USEPA, 2015n)

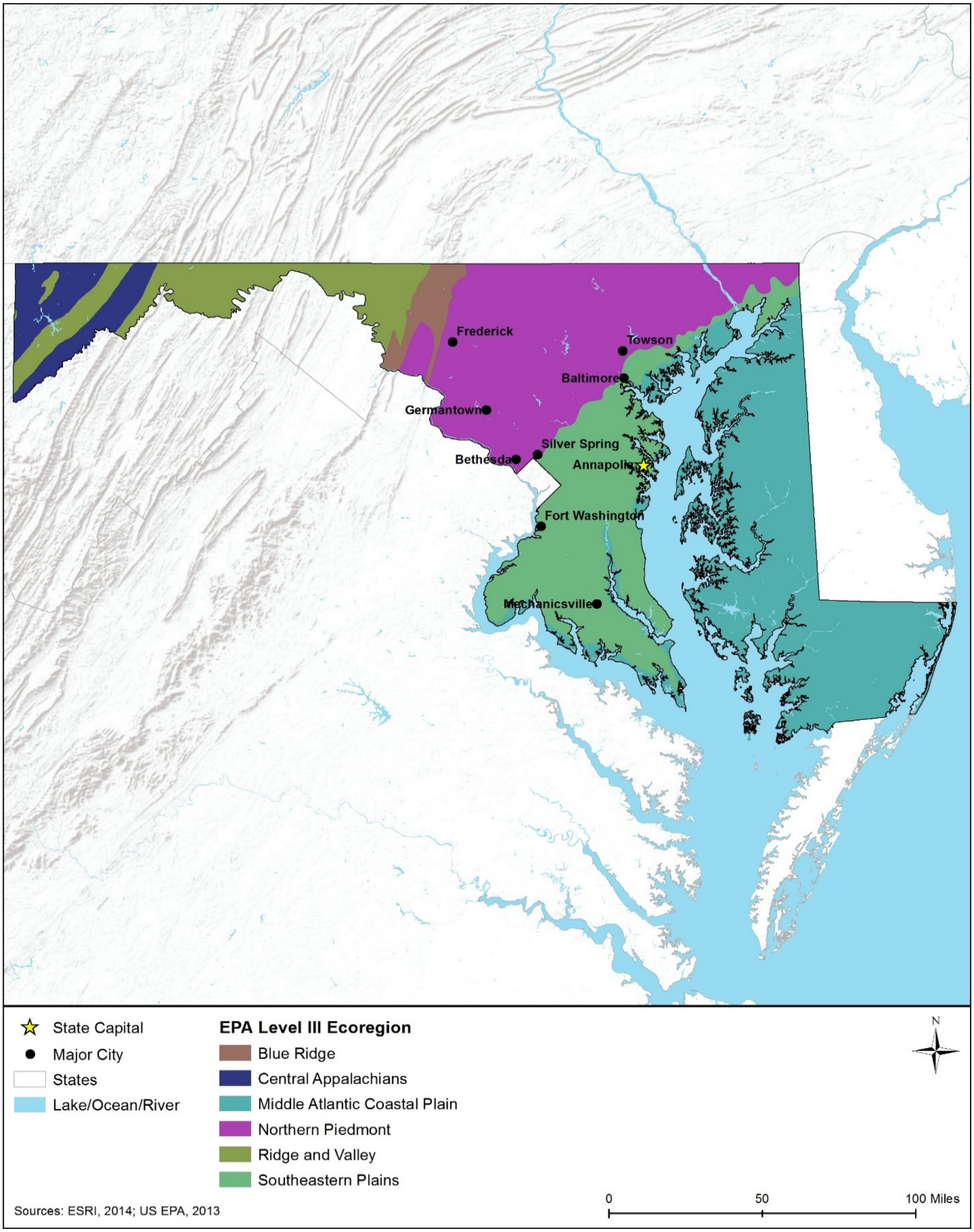


Figure 7.1.6-1: USEPA Level III Ecoregions of Maryland

Table 7.1.6-2: USEPA Level III Ecoregions of Maryland

Ecoregion Number	Description		Abiotic Characterization	General Vegetative Communities	Typical Vegetation
	Appalachian Mountains, including Western Maryland				
69	Central Appalachians		Composed primarily of a high, dissected, rugged plateau with mostly forested land cover	Mixed Mesophytic[85] Forest and Appalachian Oak forest	White oak (*Quercus alba*) Red oak (Quercus rubra) Black spruce (*Picea mariana*) Tamarack (Larix laricina) Sphagnum moss
67	Ridge and Valley		Alternating forested ridges and agricultural valleys that are elongated and folded and faulted.	Appalachian Oak Forest and Oak-Hickory-Pine forest	Hickory (*Carya* sp.) Longleaf pine (*Pinus palustria*) Shortleaf pine (*Pinus echinata*) Loblolly pine (*Pinus taeda*) White Oak Post Oak (Quercus stellata) Hemlock (Tsuga canadenis) Beech (Fagus sylvatica)
	Piedmont Plateau, including Blue Ridge, Central Maryland				
66	Blue Ridge		Rugged varying terrain of narrow ridges to hilly plateaus to mountainous high peaks with mostly forested slopes	Appalachian Oak Forest	White Oak Red Oak

[85] Mesophytic species are terrestrial plants that only need a moderate amount of water to survive and grow under moderate to hot and humid climates

Ecoregion Number	Description		Abiotic Characterization	General Vegetative Communities	Typical Vegetation
64	Northern Piedmont		Transitional region composed of low hills, irregular plains, and open valleys in contrast to the low mountains to the north and west and the flatter coastal plains to the east	Appalachian Oak Forest and in part Oak-Hickory-Pine Forest	Hickory Virginia pine Pitch pine (*Pinus rigida*) Chestnut oak (*Quercus prinus*) White oak Black oak (Quercus velutina)
	Coastal Maryland, including Eastern Shore, Chesapeake Bay, and Southern Maryland				
65	Southeastern Plains		Hilly upland with narrow stream divides	Oak-Hickory-Pine Forest and Appalachian Oak Forest	Hickory Longleaf pine Shortleaf pine Loblolly pine White oak Post oak Red oak
63	Middle Atlantic Coastal Plain includes Chesapeake-Pamlico lowlands and tidal marshes as well as Delmarva uplands		Chesapeake-Pamlico is characterized by low elevation flat plains and terraces, with swamps, marshes, and estuaries, transitioning to dunes, barrier islands, and beaches. Delmarva uplands are characterized by gently rolling uplands, sandy ridges and low paleodunes.	Oak Hickory Pine, Northern Cordgrass Prairie, Southern Floodplain Forest, and row crops.	Hickory Longleaf pine Shortleaf pine Loblolly pine White oak Post oak Cordgrass species (*Spartina* sp.) Row crop species

Source: (MGS, 2015a) (MDNR & USEPA, 1999) (Woods, Omernik, & Brown, 1999) (Woods, Omernik, & Brown, 2015)

Communities of Concern

Maryland contains several vegetative communities of concern that include rare natural plant communities, plant communities with greater vulnerability or sensitivity to disturbance, and communities that provide habitat for rare plant and wildlife species. The ranking system for these communities gives an indication of the relative rarity, sensitivity, uniqueness, or vulnerability of these areas to potential disturbances. This ranking system also gives an indication of the level of potential impact to a particular community[86] that could result from implementation of an action.

The Maryland Natural Heritage Program (NHP) statewide inventory includes lists of all types of natural communities known to occur, or that have historically occurred, in the state. Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Each natural community is assigned a rank based on its rarity and vulnerability. As with most state heritage programs, the MD NHP ranking system assesses rarity using two geographic scales - a global rank (G1, G2, G3, G4, G5) assigned by NatureServe, [87] and a state rank (S1, S2, S3, S4, S5) assigned by the state (MD NHP, 2004). The global rank reflects the rarity of the community throughout its range, while the state rank indicates its rarity within Maryland. This rank is typically based on the range of the community, the number of occurrences, the viability of the occurrences, and the vulnerability of the community. As new data become available, ranks are revised as necessary to reflect the most current information.

Maryland is currently in the process of updating its 2015 state ranking; however, 35 key wildlife habitat types have been identified by MDNR. Each of the key habitat types represent rare natural communities for wildlife species (MDNR, 2005b). The distribution of habitat types is influenced by the diversity of Maryland's five major east-west physiographic provinces: Lower Coastal Plain, Upper Coastal Plain, Piedmont, Ridge and Valley, and Allegheny Plateau. Table 7.1.6-3 provides a description of the key wildlife habitat types in Maryland along with their physiographic location.

[86] Community: "In ecology, an assemblage of populations of different species within a specified location in space and time. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake or the soil arthropod community in a forest." (USEPA, 2015o)
[87] NatureServe is a non-profit organization that provides high-quality scientific expertise for conservation projects with over 1,000 conservation professionals from the U.S., Canada, and Latin America. (www.natureserve.org).

Table 7.1.6-3: Key Wildlife Habitat Types in Maryland[88]

Vegetative Community Type	Region		
	Appalachian Mountains	Piedmont	Coastal Plain
Old Growth Forest	X	X	X
Early Successional Forests	X	X	X
Maritime Forests and Shrublands			X
Loblolly Pine-Oak forests			X
Mesic Deciduous Forests	X	X	X
Dry Oak-Pine Forests	X	X	X
Northern Conifer-Hardwood Forests	X	X	X
Floodplain Forests	X	X	X
Upland Depressional Swamps	X	X	X
Carolina Bays			X
Vernal Pools	X	X	X
Forested Seepage Wetlands	X	X	X
Bog and Fen Wetland Complexes		X	X
Nontidal Shrub Wetlands	X	X	X
Tidal Shub Wetlands			X
Nontidal emergent Wetlands	X	X	X
Tidal Marshes			X
Grasslands	X	X	X
Barrens and Dry Glades	X	X	
Cliffs and Rock Outcrops	X	X	X
Caves, Mines, and Springs	X	X	X
Coastal Beaches, Dunes, and Mudflats			X
Coldwater Streams	X	X	
Limestone Streams	X		
Highland Streams	X		
Piedmont Streams		X	
Coastal Plain Streams			X
Blackwater Streams			X
Highland Rivers	X		
Piedmont Rivers		X	
Coastal Plain Rivers			X
Oligohaline Estuaries (low salinity)			X
Mesohaline Estuaries (medium salinity)			X
Polyhaline Estuaries (higher salinity)			X
Ocean			X

Source: (MDNR, 2005b)

Nuisance and Invasive Plants

Nuisance and invasive plants is a broad category that includes a large number of undesirable plant species. 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 (US 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

[88] Wetland communities are also described in Section 7.1.5.

September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S., 88 of which terrestrial, 19 aquatic, and 5 parasitic (USDA, 2014).

Invasive plants are a threat to Maryland's native plant health and biodiversity, largely due to importation, breeding, and distribution for landscape and nursery industries (MDA, 2014a). The state's Invasive Plant Advisory Committee (IPAC) is responsible for advising the Secretary of Agriculture on regulating the sale of invasive plants to prevent entry or further spread into the state. The Maryland Invasive Plants Prevention and Control Law (Maryland Agriculture Code Ann. Title 9.5, 2014) stipulates that the IPAC be responsible for classification of invasive plants as Tier 1 or Tier 2, in accordance with science-based risk assessment protocol. Tier 1 listings restrict propagation, import, transfer, sale, purchase, or introduction any living part of a Tier 1 invasive plant within the state, unless exempt or with prior approval from Secretary of Agriculture. Tier 2 listings restrict retail sale without tier notification, as well as landscaping services to plant Tier 2-listed plants unless the tier list is provided to the customer. Violations to these requirements have the potential to result in both civil (up to $500 per violation) and criminal penalties.

Maryland is assessing 30 invasive plants for possible listing in the state. Two of these species (Cogongrass [*Imperata cylindrical*] and Japanese bloodgrass [*Imperata cylindrica*] occur on the Federal Noxious Weed List (MDA, 2014b). Of these species/complexes, almost all are terrestrial but a number of them also occur in wetland areas (MDA, 2014a), as follows:

- **Trees –** mimosa (*Albizia julibrissin*), Japanese angelica tree (*Aralia elata*), Empress tree (*Paulownia tomentosa*), Amur cork tree (*Phellodendron amurense*), callery pear (*Pyrus calleryana*), Chinese tallow (*Triadica sebifera*)
- **Shrubs –** Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), Burning bush (*Euonymus alatus*), border privet (*Ligustrum obtusifolium*), Chinese privet (*Ligustrum sinense*), European privet (*Ligustrum vulgare*),
- **Terrestrial Forbs, Grasses, and Vines –** chocolate vine (*Akebia quinata*), Scotch broom (*Cytisus scoparius*), Chinese yam or cinnamon vine (*Dioscorea oppositifolia*), Wintercreeper (*Euonymus fortunei*), shining geranium (*Geranium lucidum*), Japanese hop (*Humulus japonicus*), Cogongrass (*Imperata cylindrica*), Japanese bloodgrass (*Imperata cylindrica*), Amur honeysuckle (*Lonicera maackii*), Japanese honeysuckle (*Lonicera japonica*), nandina or sacred bamboo (*Nandina domestica*), Wavy leaf basketgrass *(Oplismenus hirtellus* subsp. *Undulatifolius*), golden bamboo (*Phyllostachys aurea*), lesser celandine (*Ranunculus ficaria*), Jetbead (*Rhodotypos scandens*), Chinese wisteria (*Wisteria sinensis/W. floribunda*)
- **Aquatic** - yellow flag iris (*Iris pseudacorus*), purple loosestrife (*Lythrum salicaria*) Maryland Weed Control Law (Maryland Agriculture Code Ann., Title 9, Subtitle 4) requires landowners to manage noxious weeds designated as Johnsongrass (*Sorghum halepense*), Shattercane (*Sorghum bicolor*), and thistles, including Canada (*Cirsium arvense*), bull (*Cirsium vulgare*), plumeless (*Carduus acanthoides*), and musk (*Carduus nutans*) (MDA, 2015a). The Maryland Department of Agriculture provides technical assistance to

landowners in 16 participating counties to initiate noxious weed control programs (MDA, 2015b).

7.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Maryland, divided among mammals[89], birds[90], reptiles and amphibians[91], and invertebrates[92]. Terrestrial wildlife are those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals, furbearers,[93] nongame animals, game birds, waterfowl and migratory birds as well as their habitats within Maryland. A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. 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. According to MDNR the state is home to 90 mammal species, 93 reptile and amphibian species, more than 400 bird species, and several hundred marine and freshwater fish species (MDNR, 2015g).

Mammals

Common and widespread mammalian species in Maryland include the Virginia opossum (*Didelphis virginiana*), shrews, bats, foxes, squirrels, American beaver (*Castor canadensis*), raccoon (*Procyon lotor*), black bear (*Ursus americanus*), and white-tailed deer (*Odocoileus virginianus*) (MDNR, 2015g). Most mammals are widely distributed in the state; however, there are some species, such as the Eastern cottontail (*Sylvilagus floridanus*) and Eastern fox squirrel (*Sciurus niger*) that are found primarily in the Piedmont and mountainous areas in the western portion of the state. A number of threatened and endangered mammals are located in Maryland. Section 7.1.6.6, Threatened and Endangered Species, identifies these protected species.

In Maryland, white-tailed deer, sika deer (*Cervus nippon*), and black bear are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), furbearers, and upland and migratory game birds (MDNR, 2015h). The following 14 species of furbearers may be legally hunted or trapped in the Maryland: beaver, bobcat (closed season) (*Lynx rufus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), gray fox (*Urocyon cinereoargenteus*), long tailed weasel (*Mustela frenata*), mink (*Neovision vison*), muskrat (*Ondatra zibethicus*), nutria (*Myocastor coypus*), opossum, otter (*Lutra candadensis*), raccoon, red fox, and skunk (*Mephitis mephitis*) (MDNR, 2015i).

Maryland has identified 34 mammals as Species of Greatest Conservation Need (SGCN) (‘*MD Wildlife Resources and Species of Greatest Conservation Need_Chapter3*’ *2005* p. 3) The

[89] Mammals: “Warm-blooded vertebrates that give birth to and nurse live young; have highly evolved skeletal structures; are covered with hair, either at maturity or at some stage of their embryonic development; and generally have two pairs of limbs, although some aquatic mammals have evolved without hind limbs.” (USEPA, 2015p)

[90] Birds: “Warm-blooded vertebrates possessing feathers and belonging to the class Aves.” (USEPA, 2015q)

[91] Amphibian: “A cold-blooded vertebrate that lives in water and on land. Amphibians' aquatic, gill-breathing larval stage is typically followed by a terrestrial, lung-breathing adult stage.” (USEPA, 2015r)

[92] Invertebrates: “Animals without backbones: e.g. insects, spiders, crayfish, worms, snails, mussels, clams, etc.” (USEPA, 2015s)

[93] A furbearer species is any animal whose fur is considered commercially valued or of a high quality.

SGCN list consists of at-risk species that are rare or declining; State Wildlife Grants are authorized for efforts to reduce the potential for these species to be listed as endangered. Although these species have been targeted for conservation they are not currently under legal protection. The SGCN list is updated periodically and is used by the state to focus their conservation efforts and as a basis for implementing their State Wildlife Action Plan (SWAP).

Birds

The number of native bird species documented in Maryland varies according to the timing of the data collection effort, changes in bird taxonomy[94], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., coastal areas, mountains, large rivers and lakes, plains, etc.) in Maryland support a large variety of bird species.

A number of breeding bird species can be found in Maryland, as well as an abundance of migratory birds traveling through the state during yearly migrations. Maryland recognizes and manages various types of bird species including grassland birds, shrubland birds, night birds, migratory landbirds, raptors, upland gamebirds, waterbirds, and marsh birds. Birds commonly found throughout the state include the great-horned owl (*Bubo virginianus*), American robin (*Turdus migratorius*), and cedar waxwing (*Bombycilla cedrorum*) (MDNR, 2015c). As of 2011, 436 species of resident and migratory birds have been documented in Maryland, with 222 of those species known to have nested in Maryland (MDNR, 2015c). As of 2005, 141 bird species were identified as SGCN[95] (MDNR, 2005b).

Maryland 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 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 and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a).

Forty-three Important Bird Areas (IBAs) have also been identified in Maryland. 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

[94] Taxonomy: "A formal representation of relationships between items in a hierarchical structure." (USEPA, 2015t)

[95] Note: The ten-year update to the Maryland State Wildlife Action Plan is currently being revised; a draft list of SGCN species from the 2015 revisions is available at: http://dnr2.maryland.gov/wildlife/Documents/GCN_StatusList.pdf

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[96] for native bird populations.

According to the Maryland-D.C. Audubon Society, a total of 43 IBAs have been identified in Maryland, including breeding,[97] migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as forests, scrub/shrub, grasslands, freshwater and saltwater wetlands, and coastal beach and dune (MD-DC Audubon Society, 2011) (MD-DC Audubon Society, 2015). Figure 7.1.6-2 illustrates that these IBAs are widely distributed throughout the state, although the larger concentrations are located in the southeast Chesapeake Bay Coastal Plain and northwest Appalachian Mountain regions of the state (MD-DC Audubon Society, 2015).

A number of threatened and endangered birds are located in Maryland. Section 7.1.6.6, Threatened and Endangered Species, identifies these protected species.

Reptiles and Amphibians

A total of 93 native reptile and amphibian species occur in Maryland, including 21 salamanders, 20 frogs and toads, 19 turtles, 6 lizards, and 27 snakes (MDNR, 2015j). These species occur in a wide variety of habitats from the Appalachian forests in the west to the plains in the east. Amphibians are more abundant in either the cool damp Appalachian forests in the west or in aquatic or wetland habitats throughout the state. The reptiles are more commonly found in the arid plain regions. Of the over 90 native reptile and amphibian species, 42 have been identified as SGCN (MDNR, 2005b).

State regulations are intended to protect and conserve native reptiles and amphibians while maintaining their educational and economic benefits. A Captive Reptile and Amphibian Permit/License is required from MDNR to possess, breed, sell, offer for sale, trade or barter native reptiles or amphibians.

Invertebrates

Maryland is home to a large number of invertebrate species, including a wide variety of bees, worms, butterflies, moths, beetles, dragonflies, damselflies, and spiders. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators.[98] 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.

[96] Critical habitat: "A designated area that is essential to the conservation of an endangered or threatened species that may require special management considerations or protection." (USEPA, 2015u)
[97] Breeding areas: "The area utilized by an organism during the reproductive phase of its life cycle and during the time that young are reared." (USEPA, 2015v)
[98] Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015w)

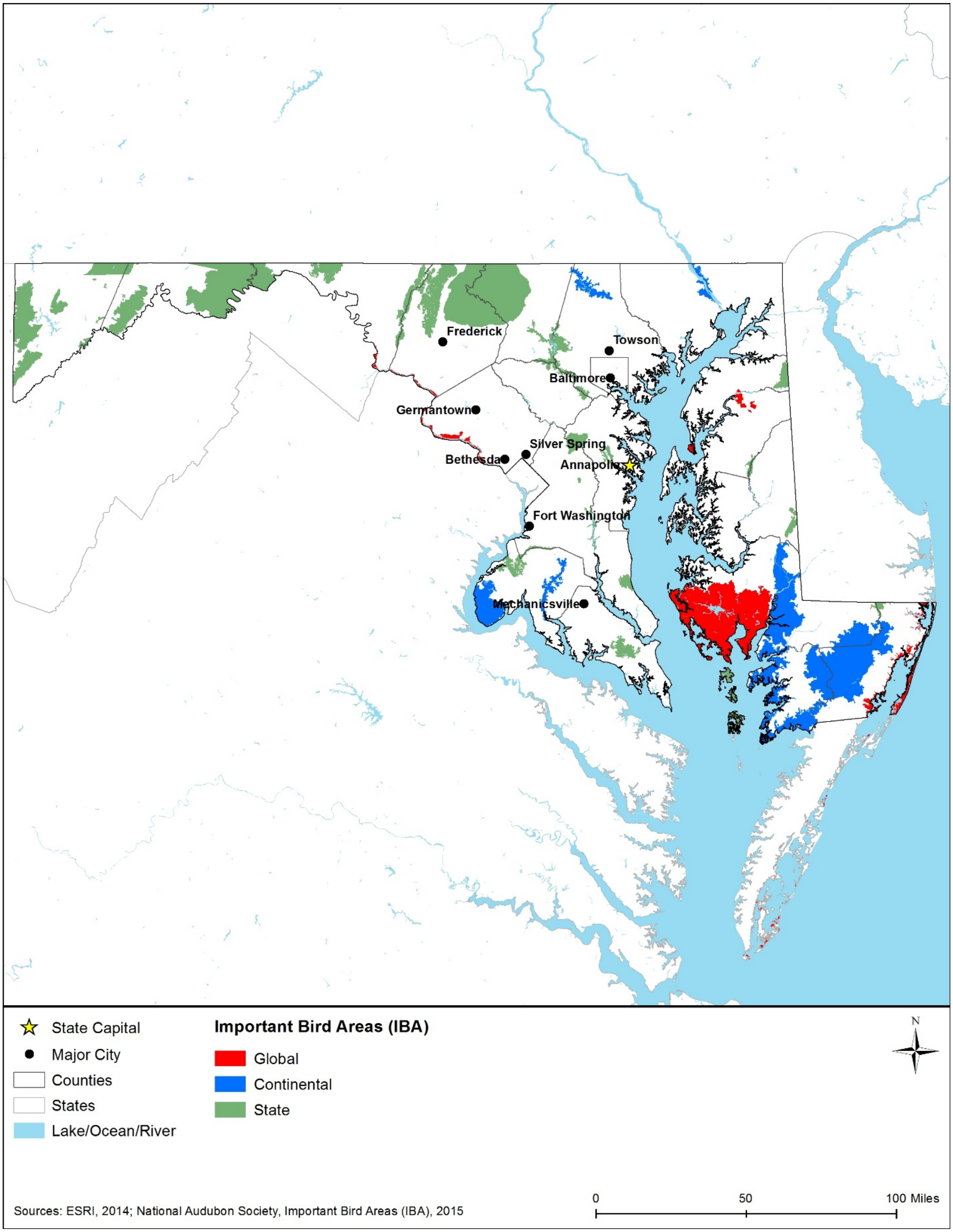


Figure 7.1.6-2: Maryland Important Bird Areas

Over 400 species of bees have been documented in Maryland. "Bees are extremely beneficial insects that are responsible for pollinating many different species of flowering plants. Bees also serve as an important food resource for some species of wildlife" (MDNR, 2015k). "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009).

Due to Maryland's marine, estuarine, freshwater, and terrestrial environments, the state's invertebrate fauna[99] is diverse. Additional data regarding the abundance and distribution of species is still needed to establish effective species management and conservation actions (MDNR, 2005b). Over 20,000 invertebrate species are in Maryland. The state lists 245 species of insects and other invertebrates as SGCN, the majority of which are unclassified and in need of further study (MDNR, 2005b).

Invasive Wildlife Species

Maryland has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select plant and animal invasive species. The Maryland Invasive Species Council maintains lists of invasive species and invasive species of concern, including those regulated under state and/or federal law. The list does not have regulatory or legal status; however, is designed to provide on-the-ground management and regulatory guidance and support for invasive species. The invasive species list includes two insects, one other invertebrate, one bird, and two virus/fungal species (MDA, 2005). Similarly, the invasive species of concern list includes 11 insects, 16 other invertebrates, 2 bird, 11 virus/fungal, and 2 mammal species (Maryland Invasive Species Council, 2005). Also included among species of concern are over 200 introduced species that have viable, wild populations in the Chesapeake Bay watershed, as recorded by the Smithsonian Environmental Research Center (MDNR, 2015l). 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.

7.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Maryland, including fish, invertebrates, marine mammals, and sea turtles. A summary of non-native and/or invasive aquatic species is also presented. Fish are divided into freshwater and saltwater species, although many of Maryland's fish are diadromous (i.e., anadromous[100] and catadromous[101]), reflecting the state's location along the Atlantic coast and the variety of aquatic habitats it provides. A distinctive feature of Maryland's landscape with regard to aquatic wildlife is the coastal habitats along the

[99] Animals within an area.

[100] Anadromous: "Referring to the life cycle 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, 2015x)

[101] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels." (USEPA, 2015y)

Chesapeake and coastal bays. This area includes open ocean, estuaries, bays, inlets, and other coastal features that provide habitat for a multitude of wildlife.

As of 2005, 40 fish SGCN have been identified (MDNR, 2005b). Essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in Maryland and is further discussed below (NOAA, 2015c). Critical habitat for threatened and endangered fish species, as defined by the Endangered Species Act of 1973 (ESA), also exists within Maryland and is discussed in Section 7.1.6.6, Threatened and Endangered Species.

Freshwater Fish

Maryland is home to more than 100 species of freshwater fish, ranging in size from small darters and minnows to large species such as blue catfish and sturgeon (MDNR, 2015m). These species are grouped into 16 families, as follows: lampreys, sturgeons, herrings, catfishes, trout, suckers, minnows, pikes, killifishes, sicklebacks, sculpins, silversides, perches, temperate basses, and sunfishes (Kazyak & Raesly, 2009). Many of these fish families include diadromous species, such as the anadromous American shad (*Alosa sapidissima*), river herring, striped bass (*Morone saxatilis*), and Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), and the catadromous American eel (*Anguilla rostrata*) (Kazyak & Raesly, 2009). A brief description of each of these families is provided below.

Three species of lamprey are known to Maryland. The native sea lamprey (*Petromyzon marinus*), is an anadromous species and is parasitic as an adult. The other two Lampetra species (least brook and threatened American brook) are not parasitic and are smaller in size (Kazyak & Raesly, 2009) (MDNR, 2015m).

The sturgeon family includes two species in Maryland: the endangered Atlantic sturgeon, which can reach over 4 meters (13 feet) in length, and the endangered shortnose sturgeon (*Acipenser brevirostrum*), with a maximum size of about 1.5 meters (under 5 feet) in length. The depression in populations of sturgeon is the result of over-collection of these species and loss of habitat (Kazyak & Raesly, 2009) (MDNR, 2015m).

River herring in Maryland include Blueback herring (*Alosa aestivalis*), Hickory shad (*Alosa mediocris*), Alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), Gizzard shad (*Dorosoma cepedianum*), and Threadfin shad (*Dorosoma petenense*) within the Clupeidae (sardine) family. River herring are relatively small anadromous fish considered an important forage base for large predators, such as striped bass and bluefish (Kazyak & Raesly, 2009) (MDNR, 2015m).

Catfish in Maryland include nine species: White catfish (*Ameiurus catus*), Yellow bullhead (*Ameiurus natalis*), Brown bullhead (*Ameiurus nebulosus*), Blue catfish (*Ictalurus furcatus*), Channel catfish (*Ictalurus punctatus*), Stonecat (*Noturus flavus*), Tadpole madtom (*Noturus gyrinus*), Margined madtom (*Noturus insignis*), and Flathead catfish (*Pylodictis olivaris*). Catfish are known for their four pairs of barbels (commonly referred to as "whiskers") and scaleless skin. Blue catfish are the largest and can weigh up to 84 pounds in Maryland, while madtoms and stonecats are much smaller in size (Kazyak & Raesly, 2009) (MDNR, 2015m).

Maryland has five species of trout: Cutthroat trout (*Oncorhynchus clarki*), Rainbow trout, (*Oncorhynchus mykiss*), Brown trout (*Salmo trutta*), Brook trout (*Salvelinus fontinalis*), and Lake trout (*Salvelinus namaycush*). Brook trout are the only trout native to Maryland waters. Trout live in a wide range of habitats and are a popular game fish (Kazyak & Raesly, 2009) (MDNR, 2015m).

Maryland's suckers include seven species: Quillback (*Carpiodes cyprinus*), Longnose sucker (*Catostomus catostomus*), White sucker (*Catostomus commersoni*), Creek chubsucker (*Erimyzon oblongus*), Northern hogsucker (*Hypentelium nigricans*), Golden redhorse (*Moxostoma erythrurum*), and Shorthead redhorse (*Moxostoma macrolepidotum*). These species of fish are generally less than 60 cm (2.0 feet) in length and have mouths located on the underside of their heads. They are most often found in rivers, although they can be found in any freshwater environment (Kazyak & Raesly, 2009) (MDNR, 2015m).

Over 30 species of minnows occur in Maryland, including the common carp and goldfish. The fish species are stomachless with toothless jaws. As with herring, minnows are not typically a popular sportfish, but are a commercially important fish and an important food source for larger fish and other wildlife (Kazyak & Raesly, 2009) (MDNR, 2015m).

Four pike species occur in Maryland, including Redfin pickerel (*Esox americanus*), Northern pike (*Esox lucius*), Muskellunge (*Esox masquinongy*), and Chain pickerel (*Esox niger*). The species are distinguished by their elongated form, pointed heads, and sharp predatory teeth. The largest northern pike recorded in Maryland measured 46 inches and weighed over 24 pounds (Kazyak & Raesly, 2009) (MDNR, 2015m).

Maryland's killifishes include Banded killifish (*Fundulus diaphanus*), Mummichog (*Fundulus heteroclitus*), Spotfin killifish (*Fundulus luciae*), Striped killifish (*Fundulus majalis*), and Rainwater killifish (*Lucania parva*). The species are found mainly in fresh or brackish waters and are generally small in size, ranging from 2.5 to 5 cm (1 to 2 inches), with the largest species growing to just under 15 cm (6 inches) (Kazyak & Raesly, 2009) (MDNR, 2015m).

The stickleback family includes three species: Fourspine stickleback (*Apeltes quadracus*), Brook stickleback (*Culaea inconstans*), and Threespine stickleback (*Gasterosteus aculeatus*). Sticklebacks are characterized by strong, isolated spines in their dorsal fins. They are generally no more than 7 cm (3 inches) in length (Kazyak & Raesly, 2009) (MDNR, 2015m).

Sculpin species in Maryland include the Mottled sculpin (*Cottus bairdii*), Blue Ridge sculpin (*Cottus caeruleomentum*), Potomac sculpin (*Cottus Girardi*), and Checkered sculpin (*Cottus*). The species are generally small in size (under 10 cm or 4 inches in length) (Kazyak & Raesly, 2009) (MDNR, 2015m).

Three silverside species found in Maryland include the Rough silverside (*Membras martinica*), Inland silverside (*Menidia beryllina*), and Atlantic silverside (*Menidia menidia*). The schooling species is common in Chesapeake Bay tributaries, usually near or below tidewater (Kazyak & Raesly, 2009) (MDNR, 2015m).

A total of 14 species of perches occur in Maryland, including large members such as Yellow perch (*Perca flavescens*) and Walleye (*Sander vitreum*), and small members such as darters.

Yellow perch occur in all state reservoirs as well as Chesapeake Bay and its major tributaries and streams, and are important sportfish in the state (Kazyak & Raesly, 2009) (MDNR, 2015m).

Temperate basses, otherwise known as “true bass” or “sea bass” in Maryland include the White perch (*Morone americana*) and Striped bass (*Morone saxatilis*) (discussed further under “Saltwater Fish”). Hybrids between the white and striped bass have also been introduced into several Maryland reservoirs, identified by a stockier body and a pattern of broken stripes along the side. Striped bass is Maryland's official state fish and an important commercial and recreational fish species (Kazyak & Raesly, 2009) (MDNR, 2015m).

The sunfish family includes 17 species, many of which are among the state’s most widely recognized and popular sporting fish. The most commonly encountered species are the bluegill, largemouth bass, and smallmouth bass. These sunfish species live in a wide variety of habitats, including rocky, cool lakes and streams, and slow-moving streams (Kazyak & Raesly, 2009) (MDNR, 2015m).

Saltwater Fish

Maryland’s nearshore marine waters are home to a large number of fish species, inhabiting the wide variety of marine habitats such as Chesapeake Bay, the Coastal Bays, and the Atlantic coastline. More than 350 fish species inhabit Chesapeake Bay and an estimated one million people travel to the bay each year for sport fishing (MDNR, 2005b).

Many saltwater fish species are well known by their recreational and commercial fishing value. The anadromous striped bass is a high-profile and important fish species for both recreational anglers and the commercial fishing industry. Striped bass use Chesapeake Bay as a primary spawning ground (MDNR, 2015m). Table 7.1.6-4 presents a list of popular saltwater sportfish in the state.

Table 7.1.6-4: Popular Saltwater Sportfish Species in Maryland

Common Name	General Habitat
American eel	Permanent freshwater streams (nonbreeding), open ocean (breeding)
Black crappie	Chesapeake Bay
Black drum	Chesapeake Bay, Coastal Bays, and estuaries
Black sea bass	Coastal Bays and open ocean
Bluefish	Chesapeake Bay, Coastal Bays and open ocean
Chain Pickerel	Chesapeake Bay
Channel catfish	Chesapeake Bay
Croaker	Chesapeake Bay, Coastal Bays, and open ocean
Hickory shad	Large rivers (breeding), Chesapeake Bay, and open ocean (nonbreeding)
Largemouth bass	Chesapeake Bay
Red drum	Chesapeake Bay, Coastal Bays, and open ocean
Scup (Porgy)	Coastal Bays and open ocean
Spanish mackerel	Chesapeake Bay, Coastal Bays, and open ocean
Spotted seatrout	Chesapeake Bay, Coastal Bays, and open ocean
Smallmouth Bass	Chesapeake Bay
Striped bass	Coastal, within a few miles of shore except during migration; large rivers (breeding)
Summer flounder (fluke)	Chesapeake Bay, Coastal Bays, and open ocean
Tautog (Blackfish)	Coastal Bays and open ocean
Walleye	Chesapeake Bay
Weakfish	Chesapeake Bay, Coastal Bays, and open ocean
White perch	Chesapeake Bay, Coastal Bays and open ocean
Winter flounder	Deeper waters (summer), shallow estuaries, rivers, and bays (winter)
Yellow perch	Chesapeake Bay

Source: (MDNR, 2015m) (MDNR, 2015n)

Essential Fish Habitat

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 illustrative representations of EFH. The online mapping tool is available at http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html, and the EFH website is available at http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm. 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 7.1.6-5 presents a summary of EFH offshore of Maryland.

Table 7.1.6-5: Essential Fish Habitat Offshore of Maryland

Common Name	Eggs	Larvae/YOY[102]	Juveniles	Adults
Albacore tuna	Not Applicable (NA)	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula	Not Designated in the immediate vicinity
Angel shark	NA	NA	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Atlantic herring	Not Designated in the immediate vicinity	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Atlantic sharpnose shark	NA	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula	Not Designated in the immediate vicinity
Bluefin tuna	Not Designated in the immediate vicinity	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	South of Chesapeake Bay
Dusky shark	NA	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Clearnose skate	NA	No larval life stage exists for this species	Eastern side of Delmarva Peninsula and Chesapeake Bay	Eastern side of Delmarva Peninsula and Chesapeake Bay
Common thresher shark	NA	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Great hammerhead shark	Mouth of Chesapeake Bay and south	Mouth of Chesapeake Bay and south	Mouth of Chesapeake Bay and south	Mouth of Chesapeake Bay and south

[102] 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, 2015z)

Common Name	Eggs	Larvae/YOY[102]	Juveniles	Adults
Little skate	Chesapeake Bay	No larval life stage exists for this species	Eastern side of Delmarva Peninsula and Chesapeake Bay	Chesapeake Bay
Monkfish	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula
Red hake	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Sandbar shark	NA	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Sand Tiger shark	NA	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
Scalloped hammerhead shark	Not Designated in the immediate vicinity	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula, mouth of Chesapeake Bay, and south	South of Chesapeake Bay
Shortfin mako shark	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)
Skipjack tuna	Not Designated in the immediate vicinity	Not Designated in the immediate vicinity	Mouth of Chesapeake Bay and south	Not Designated in the immediate vicinity
Tiger shark	NA	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay	Eastern side of Delmarva Peninsula and mouth of Chesapeake Bay
White shark	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)	Eastern side of Delmarva Peninsula (in part)
Witch flounder	Eastern side of Delmarva Peninsula (in part)	Not Designated at this location	Not Designated at this location	Not Designated at this location
Windowpane flounder	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula	Eastern side of Delmarva Peninsula and Chesapeake Bay	Eastern side of Delmarva Peninsula and Chesapeake Bay
Winter skate	NA	No larval life stage exists for this species	Eastern side of Delmarva Peninsula and Chesapeake Bay	Chesapeake Bay
Yellowtail flounder	Not Designated in the immediate vicinity	Eastern side of Delmarva Peninsula (in part)	Not Designated in the immediate vicinity	Not Designated in the immediate vicinity
Yellowfin tuna	Not Designated in the	Not Designated in the immediate vicinity	Mouth of Chesapeake Bay and south	Not Designated in the immediate vicinity

Common Name	Eggs	Larvae/YOY[102]	Juveniles	Adults
	immediate vicinity			

Shellfish and Other Invertebrates

Maryland is home to both freshwater and marine shellfish. Well-known freshwater bivalve[103] species include the eastern elliptio (*Elliptio complanata*) mussel, plain pocketbook (*Lampsilis cardium*) mussel, yellow lampmussel (*Lampsilis cariosa*), and triangle floater (*Alasmidonta undulata*) mussel. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known Maryland freshwater invertebrates that spend their lives in aquatic systems include the crayfish (*Austropotamobius pallipes*), and snails (MDNR, 2004).

Marine shellfish and other invertebrates common to Maryland waters include species such as bay scallop (*Plactopecten magellanicus*), eastern oysters (*Crassostrea virginica*), hard shell clam (*Mercenaria mercenaria*), blue crab (*Callinectes sapidus*), and horseshoe crab (*Limulus polyphemus*). Bay scallops prefer shallow coastal bays and estuaries with sandy and muddy bottoms and eelgrass beds. In Maryland, they only occur in the coastal bays behind Ocean City and Assateague Island. Eastern oysters are found throughout the Chesapeake Bay on firm bottom areas called oyster bars. Hard shell clam are found along beaches and coastal bays in sand or muddy sand. Blue crab males are often found in the upper reaches of the Chesapeake Bay while females are typically found farther downstream where salinities are higher. Horseshoe crab inhabit sandy beaches and mud flats of coastal bays and near shore waters from spring to fall, and move to offshore shoals and slews in the winter (MDNR, 2015m).

Oyster populations in Chesapeake Bay are only a small fraction of their historical abundance due to disease-related mortality, habitat degradation, reduced water quality, and harvest pressure. Maryland is implementing multiple strategies to restore a native oyster population into the Chesapeake Bay (MDNR, 2015o). The Oyster Advisory Commission provides advice on matters related to oysters in Maryland's portion of the Chesapeake and Coastal Bays, as well as strategies for rebuilding and managing the oyster population in these areas under the Chesapeake Bay Oyster Management Plan (MDNR, 2015p).

Marine Mammals

All marine mammals (i.e., whales, dolphins, porpoises, seals, and sea lions) are protected under the Marine Mammal Protection Act (MMPA). A subset of these mammals is also protected under the ESA. There are six baleen whale species that may occasionally be observed offshore of Maryland. Four species of seals—the harp seal (*Pagophilus groenlandicus*), harbor seal (*Phoca vitulina*), hooded seal (*Cystophora cristata*), and gray seal (*Halichoerus grypus*), occur in Maryland waters (MDNR, 2015q). This section briefly introduces the marine mammal species found in Maryland waters.

[103] Bivalve: "An aquatic mollusk whose compressed body is enclosed within a hinged shell." (USEPA, 2015aa)

Many whale species occur offshore of Maryland as transient individuals as they migrate northward towards feeding grounds and southward towards warmer breeding grounds. Occasionally individuals are beached or stranded along the coast or in Chesapeake Bay. Maryland's Marine Mammal & Sea Turtle Stranding Program responds to all marine mammals and sea turtles that strand alive, and The National Aquarium-Marine Animal Rescue Program responds to dead strandings. Of the species that have been stranded in Maryland waters are the 6 baleen whale species and 4 seal species discussed above, as well as 11 toothed whale species, including the most-commonly stranded bottlenose dolphin (*Tursiops truncatus*). On average, 15 marine mammals strand each year (MDNR, 2015q).

A few species of whales exhibit distinctive behaviors. In contrast to migratory patterns displayed by other whale species, minke whales breed during the summer months in the northern hemisphere; however, they spend very little time at the surface and are therefore rarely seen. Sei whales (*Balaenoptera borealis*) feed far offshore in the open ocean and are unlikely to approach nearshore areas. Humpback whales (*Megaptera novaeangliae*) are the most commonly observed whale during whale watch tours. The North Atlantic right whale (*Eubalaena glacialis*) spends the spring and summer months off the coast.

The harbor and gray seals are the more common seal species in Maryland, inhabiting coastal waters and basking on sand bars or offshore rocks. Harp seals and hooded seals normally prefer deep seas and thick ice to rest upon; gray seals prefer strong currents and bask along rocky shores of temperate waters (Burt, 1976).

Sea Turtles

Six species of sea turtles occur in U.S. waters, all of which are protected under the ESA. Five of these sea turtles occur in Maryland's waters, typically off the coast or in Chesapeake Bay (MDNR, 2015q) (MDNR, 2015r). For more information on sea turtles, refer to Section 7.1.6.6.

Invasive Aquatic Species

As previously discussed, Maryland has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals. The list of all prohibited and regulated invasive species are presented in COMAR 08.02.19.00, *Title 08 Department Of Natural Resources, Subtitle 02, Fisheries Service, Chapter 19 Nuisance and Prohibited Species*. There are 15 prohibited or regulated fish and 17 prohibited or regulated aquatic invertebrates in Maryland.

Some of the more troublesome invasive aquatic species include the Chinese mitten crab (*Eriocheir sinensis*), northern snakehead fish (*Channa argus*), blue catfish (*Arius graeffei),* flathead catfish (*Pylodictis olivaris*), Asiatic clam (*Corbicula fluminea*), zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena rostriformis*), waterflea (*Daphina* sp.), spiny waterflea (*Bythotrephes cederstroemi*), rusty crayfish (*Orconectes rusticus*), Chinese mystery snail (*Cipangopaludina chinensis*), round goby (*Neogobius melanostomus*), and virile crayfish (*Orconectes virilis*) (MDNR, 2015s).

7.1.6.6. Threatened and Endangered Species and Species of Concern

The USFWS and NMFS are responsible for administering the ESA (16 U.S.C §1531 *et seq.*) in Maryland. The USFWS has identified nine federally endangered,[104] nine federally threatened,[105] and one candidate species known or believed to occur in Maryland[106] (USFWS, 2015e) (USFWS, 2016a) (USFWS, 2014a). Of these species, one has designated critical habitat[107] (USFWS, 2015f) and one is a candidate species[108] as identified by USFWS as occurring within the state (MDNR, 2015t) (USFWS, 2015g). 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, 2014c). The federally listed and candidate species include 1 mammal, 1 fish, 4 reptiles, 2 birds, 4 invertebrates, and 6 plants (USFWS, 2015e) (USFWS, 2016a) (USFWS, 2014a). Figure 7.1.6-3 depicts the only mapped critical habitat in Maryland for the Maryland darter (*Etheostoma sellare*).

Mammals

One endangered mammal is federally listed for Maryland as summarized in Table 7.1.6-6. The northern long-eared bat (*Myotis septentrionalis*) occurs throughout. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maryland is provided below.

Table 7.1.6-6: Federally Listed Mammal Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Terrestrial Mammals				
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Trees and snags, caves and abandoned mines throughout the state

[a] T = Threatened

Source: (USFWS, 2015e)

[104] 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)).
[105] 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)).
[106] For purposes of this discussion, only listed species identified by USFWS will be discussed specifically as a threatened or endangered species in New Jersey.
[107] 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)).
[108] 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)

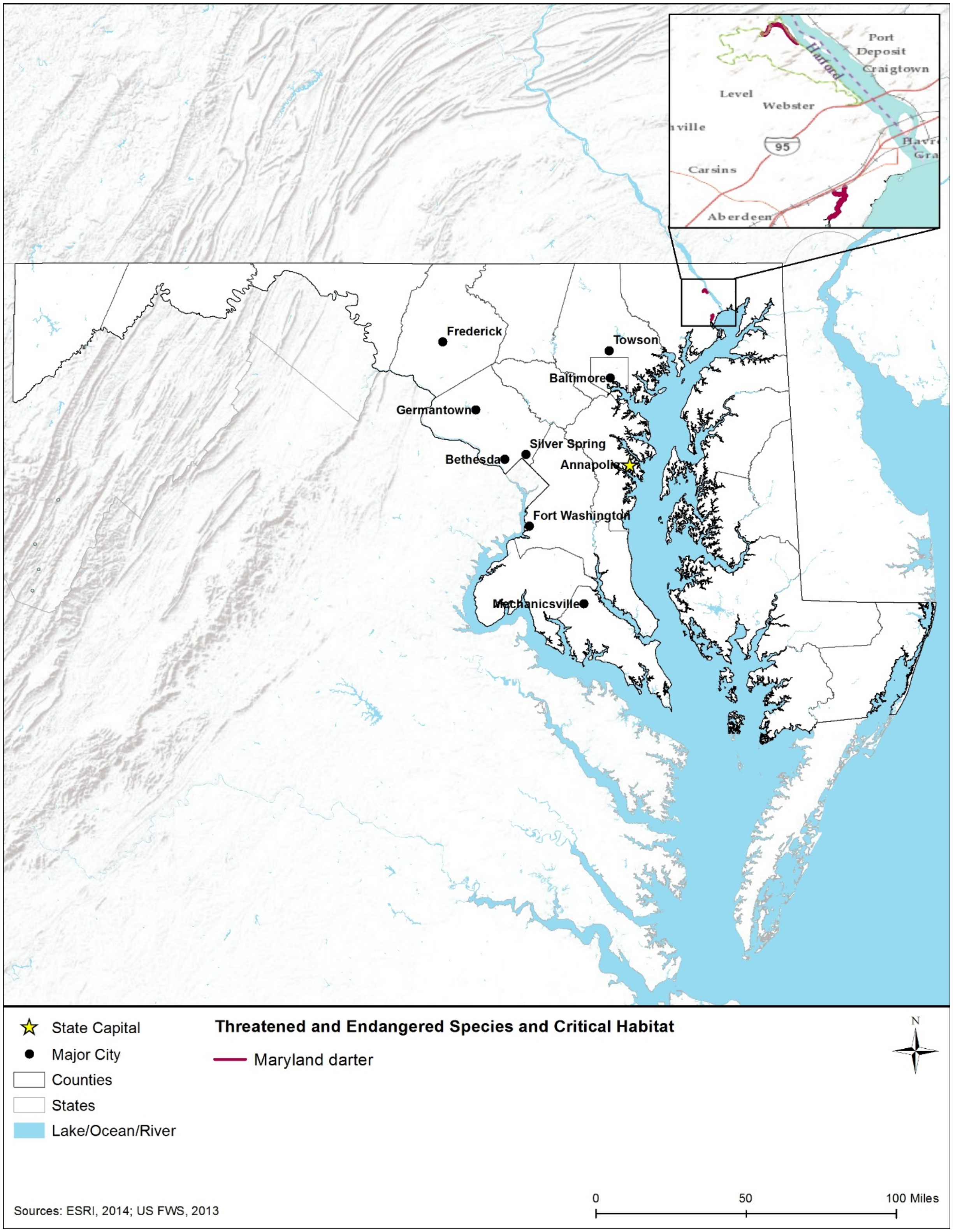


Figure 7.1.6-3: Critical Habitat for Maryland

Terrestrial Mammals

Northern Long-eared Bat. The northern long-eared bat (*Myotis septentrionalis)* is brown furred, insectivorous bat with long ears. Reaching a total length of 3 to 3.7 inches in length it is a medium size relative to other members of the genus *Myotis*. The northern long-eared bat 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 summer, their range includes 15 of the 24 counties in Maryland. They are known or believed to occur in Allegany, Anne Arundel, Baltimore, Calvert, Carroll, Cecil, Charles, Frederick, Garrett, Harford, Howard, Montgomery, Prince George's, St. Mary's, and Washington Counties (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. Although mating occurs in the fall, fertilization occurs following hibernation, from which 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).

Reptiles

Two endangered and two threatened turtles are federally listed and known to occur in Maryland, as summarized in Table 7.1.6-7. All three sea turtles are found off the coast, while the bog turtle (*Clemmys muhlenbergii*) is found primarily in northern Maryland. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maryland is provided below.

Table 7.1.6-7: Federally Listed Reptile Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Terrestial Reptiles				
Bog Turtle	*Clemmys muhlenbergii*	T	No	Wetlands, meadows, and wet areas with tussock-forming vegetation, found primarily in the northern portion of the state
Marine Reptiles				
Green Sea Turtle	*Chelonia mydas*	T	No	Coastal areas for bottom feeding, found off the eastern border of the state
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	No	Coastal areas for bottom feeding, found off the eastern border of the state
Leatherback Sea Turtle	Dermochelys coriacea	E	No	Coastal areas for bottom feeding, found off the eastern border of the state

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015e)

Bog Turtle. The threatened bog turtle is a very small turtle, averaging 3.1 to 4.5 inches in length (USFWS, 2015k). This species is the smallest member of the *Clemmys*, averaging 3.1 to 4.5 inches in length and 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). 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 59623, 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). Presently, the bog turtle is listed as threatened and state rare by MDNR, such that it is actively tracked by the Wildlife and Heritage Service (MDNR, 2016b).

The bog turtles prefer habitats that are open wetlands, sedge meadows, and boggy areas with cool, shallow, slow-moving water, deep and soft muck soils, and with tussock[109]-forming vegetation (USFWS, 2001). For hibernation the bog turtle generally retreats back to densely vegetated areas in October and tend to emerge from hibernation in late March and April (USFWS, 2001) (USFWS, 2011a). The bog turtle are omnivorous, it tends to mainly feed on insects but also consumes slugs, worms, frogs, plants, and carrion (PFBC, 2011).

Current threats to this species are habitat loss and fragmentation from development, vegetation succession, 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 to the bog turtles throughout the species' range (MDNR, 2016b).

Green Sea Turtle. The green sea turtle (*Chelonia mydas*) 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 4 feet in length. The breeding populations in Florida were listed as endangered in 1978 *(43 FR 32800 32811, July 28, 1978)* whereas all other populations were listed as threatened (NOAA, 2015d). Regionally, green sea turtles are found from Maine south to Florida, and throughout the Gulf of Mexico and the Caribbean Sea (USFWS, 2015l) (USFWS, 2015m). 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 Maryland (81 FR 20057 20090, April 6, 2016).

They are found in the shallow waters (except during migration) of shoals, bays, lagoons reefs, and inlets, often where submerged aquatic vegetation exists (NOAA, 2015d). 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, 2015d) (USFWS, 2015l). Hatching usually occurs at night, and many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015l).

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

[109] 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)

hatchlings by lighting; nest predation; marine pollution; watercraft strikes; and incidental take from channel dredging and commercial fishing operations (USFWS, 2015l) (NOAA, 2015d).

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 8498, 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, 2015n) (USFWS, 2015o). 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, 2015e).

This species 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 two to three year cycles (USFWS, 2015o).

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 (*Dermochelys coriacea*) 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, 2015p). It was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was grandfathered into the ESA of 1973 (NOAA, 2015f). The Atlantic population of the leatherback sea turtle is capable of tolerating a wide range of water temperatures and the species has been sited off the entire continental east coast of the U.S., ranging from the Gulf of Mexico, Virgin Islands and Puerto Rico, to as far north as the Gulf of Main and even Newfoundland. Locally, the numbers of leatherback sea turtles in this region are consider low and rare, but stable (NOAA, 2015f). The species is primarily found off-shore in Worcester County, and carcasses occasionally show up on shore (MDNR, 2015w).

Their diet consists of jellyfish and squid and while they may forage in coastal waters but they prefer open sea environments (NOAA, 2015f) (USFWS, 2015p). 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. Major threats to the species include harvesting of their eggs, hunting, their incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NOAA, 2015f).

Birds

Two threatened bird species are federally listed and known to occur in Maryland (Table 7.1.6-8). The piping plover (*Charadrius melodus*) is found on open, sandy beaches along the Maryland coast, while the red knot (*Calidris canutus rufa*) is found within sandy estuaries and tidal mudflats primarily during migration seasons. Information on the habitat, distribution, and threats to the survival and recovery for the species is provided below.

Table 7.1.6-8: Federally Listed Bird Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Piping Plover	*Charadrius melodus*	T	No	Open, sandy beaches along the coast, primarily in Worcester County and on Assateague Island
Red Knot	*Calidris canutus rufa*	T	No	Intertidal marines, estuaries, and bays, within the state it is most commonly found around the Chesapeake Bay tidal mudflats and sandy beaches

[a] T = Threatened

Source: (USFWS, 2015e)

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 (50 FR 50726 50734, December 11, 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, Virgin Islands (USFWS, 2015q). Piping plovers breed in three geographic regions of North America, composed of two separate subspecies (USFWS, 2015r). Those breeding within Maryland in the northeastern U.S. and Canada are of the subspecies *C. m. melodus*, whose range extends from the Atlantic to the Great Lakes (USFWS, 2015q). In Maryland, the piping plover can be found along the Atlantic coast on open, sandy beaches, primarily in Worchester County and on Assateague Island (USFWS, 2015s) (USFWS, 2016a).

This species feeds in the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrate (USFWS, 2015s). Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation,[110] flooding from coastal storms, and environmental contaminants (USFWS, 2015s) (USFWS, 2015t).

Red Knot Photo credit: USFWS

Red Knot. Federally listed as a threatened species in 2014 *(79 FR 73705 73748, December 11, 2014)*, the red knot is a large sandpiper that flies in large flocks along 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 migrate more than 9,300 miles from south to north every spring and return south

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

in autumn. Red knots are observed in at least Worcester County, Maryland, however the entire state is considered a part of its range. The species is primarily observed here during migration periods when they are moving either to or from breeding areas in the Canadian Arctic (USFWS, 2015u) (USFWS, 2015v).

The preferred habitat for the red knot is intertidal marines, estuaries, and bays. The red knot stops along the Atlantic coast during the spawning season for the horseshoe crab (*Limulus polyphemus*), feeding on horseshoe crab eggs, and mussel and clam beds, which are important food sources to the species (USFWS, 2005). Threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at their migration stopovers; and disturbance by humans, dogs, vehicles, and climate change (USFWS, 2014d) (USFWS, 2015u).

Fish

One endangered fish species is federally listed and known to occur in Maryland, as summarized in Table 7.1.6-9. The Maryland darter (*Etheostoma sellare*) has a limited range in northern creeks of the state. Information on the habitat, distribution, and threats to the survival and recovery of the species in Maryland is provided below.

Table 7.1.6-9: Federally Listed Fish Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Maryland Darter	*Etheostoma sellare*	E	Yes, 2.8 miles of Deer Creek and Gashey’s Run located in the north	The last fast-flowing areas from the hills before the flatlands of the coastal plain, characteristic of streams that flow into the Chesapeake Bay

[a] E = Endangered

Source: (USFWS, 2015f) (USFWS, 2015e)

Maryland Darter. First discovered in 1912, the Maryland darter is a small silvery freshwater fish growing to nearly three inches, with four dark saddles on its back and a small dark spot behind each eye. Due to its limited habitat range, and diminishing population, this species was first listed as endangered in 1967 (32 FR 4001, March 11, 1967), and was grandfathered into the ESA of 1973. In 1984, critical habitat was designated for this species (49 FR 34228 34232, August 29, 1984) (USFWS, 2015w), as shown in Figure 7.1.6-3. Known to occur only in a limited area in Harford County, including Swan, Gashey’s, and Deer Creeks, this species is considered endemic to Maryland (USFWS, 2011b).

Due to the rarity of the species, many specific details of the Maryland darter lifecycle are not precisely known, and are thus extrapolated by its close relation to the yellow perch and walleye, and similarity to other darters. Like other darters, key habitat features for the Maryland darter include rock crevices and similar shelters in clean, well-oxygenated, swiftly flowing parts of streams. Its primary known habitat at Deer Creek has historically had the highest population and is characterized by a steeply sloped riffle of rock, including rubble and gravel, and swiftly flowing water with moderate vegetation. As a bottom-dweller, the Maryland darter eats small insects including small snails, caddis fly larvae, mayfly larvae, and stonefly nymphs. The species has a relatively short life of approximately three years, and is assumed to spawn in late April (USFWS, 2011b).

Despite efforts to protect this species, the last confirmed siting took place in 1988. Part of the uncertainty of the continued existence of this fish is due to its limited known range, and also its nature as a bottom dweller. Primary threats to its survival include impacts to its very specialized habitat needs, including an influx of sediment, nutrients, and chemicals from growing metropolitan and agricultural areas degrading water quality (MDNR, 2015u) (USFWS, 2011b).

Invertebrates

Two endangered and two threatened invertebrate species are federally listed and known to occur in Maryland (Table 7.1.6-10). The two tiger beetles are primarily found along sandy Maryland coastlines, the endemic amphipods has been observed only within a limited selection of springs, and the dwarf wedgemussel (*Alasmidonta heterodon*) is known to occur in various rivers around the upper Chesapeake Bay. The Kenk’s Amphipod (*Stygobromus* hayi) has been identified as a candidate species in Maryland. Further information on the habitat, distribution, and threats to the survival and recovery of the species in Maryland is provided below.

Table 7.1.6-10: Federally Listed Invertebrate Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	No	Creek and river areas with a slow to moderate current and a sand, gravel, or muddy bottom, found in rivers around the upper Chesapeake Bay
Hay’s Spring Amphipod	*Stygobromus hayi*	E	No	In the shallow groundwater zone, in groundwater that percolates among sand grains and gravel towards the surface. Known only to occur in five springs in Rock Creek in Maryland and Washington, D.C.
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	T	No	Medium to medium course sand with low organics along on long, wide and dynamic beaches. Found at four sites along sandy beaches surrounding the Chesapeake Bay
Puritan Tiger Beetle	*Cicindela puritana*	T	No	Non-vegetated sandy deposits of eroding bluffs, with populations located on the eastern and western shores of the Chesapeake Bay

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015e) (USFWS, 2015g)

Dwarf Wedgemussel. The endangered dwarf wedgemussel is a small, brown or yellowish-brown freshwater mussel that is usually less than 1.5 inches in length (USFWS, 2010a). It was federally listed as endangered in 1990 (55 FR 9447 9451, March 14, 1990) throughout its range (USFWS, 2015x). In Maryland it is known to occur in three sites today, two in creeks within Queen Anne’s County and one in St. Mary’s County, though its range in Maryland also reaches the Caroline, Charles, and Kent counties (MDNR, 2016c) (USFWS, 2015x).

Dwarf wedgemussls are sedimentary filter feeders that feed off suspended particles and algae. 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, 2010a).

Hay's Spring Amphipod. The Hay's Spring amphipod (*Stygobromus hayi*) is both colorless and blind, and grows up to .4 inches. The amphipod was first listed as endangered in 1982 (47 FR 5425 5427, February 2, 1982). First collected within the National Zoological Park in 1938, the species is endemic to the region, only known to occur in five springs along Rock Creek in Maryland and Washington, D.C. (Pavek, 2002) (USFWS, 2015y).

While many details of these species lifecycle are unknown, its key habitat is identified as the shallow groundwater zone, in water that percolates among sand grains and gravel towards the surface. It remains in this region until large volumes of water flush it up and out of an exit as a spring. Current conservation measures in effect restrict activities in an area around the springs and in their recharge areas. The species is especially vulnerable provided its limited population. Threats to this species are primarily related to degradation to its specialized subterranean habitat, including groundwater pollution from toxic spills, land disturbances, sewer leaks, and excessive storm water flows (Pavek, 2002).

Northeastern Beach Tiger Beetle. The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) growing as large as .5 to .6 inches in length, was first listed as threatened in 1990 (55 FR 32088 32094, 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. It is found in Anne Arundel, Calvert, Dorchester, Somerset, and St. Mary's Counties, although the highest number of populated sites are located along sections of beaches found to the south, in Virginia's portion of the Chesapeake Bay (USFWS, 2015ai).

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. Maturity of these species requires three stages larvae transformations over one to two years, which takes place in self-made burrows of 15 to 50 cm deep along the beaches (USFWS, 2015ai).

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, 2015ai).

Puritan Tiger Beetle. The Puritan tiger beetle (*Cicindela puritana*), measuring just under 0.5 inches, was federally listed as threatened throughout its range in 1990 (55 FR 32088 32094, August 7, 1990). The species is identified by its brownish bronze body with a metallic blue underside, covered with narrow white lines on each wing cover. The Puritan tiger beetle is found in only two distinct regions, along the Chesapeake Bay in Maryland and along the Connecticut River in New England. However, the nature of the separation of these populations has lasted several thousands of years, resulting in genetic and ecological differences between populations. The Chesapeake Bay region contains two primary populations, one along the western- and one on the eastern shore, specifically in Anne Arundel, Calvert, Cecil, Dorchester, Harford, Kent, Queen Anne's, and St. Mary's Counties (USFWS, 2013c) (USFWS, 2015ab).

This species has very specific habitat requirements, laying their larvae only within non-vegetated sandy deposits of eroding bluffs, including the bluff face and base. Similar to the northeastern beach tiger beetle, maturity of these species requires at least two years of larvae transformations, taking place within their bluff burrows. Within Maryland, major threats include habitat loss and degradation, primarily from shoreline development and bluff stabilization which generally involve increased vegetation along cliffs (USFWS, 2013c).

Plants

Four endangered and two threatened federally listed plant species are known to occur in Maryland as summarized in Table 7.1.6-11. These species are found in various counties and habitats throughout Maryland. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maryland is provided below.

Table 7.1.6-11: Federally Listed Plant Species of Maryland

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Canby's Dropwort	*Oxypolis canbyi*	E	No	Open and sparse wetlands on the northern half of Delmarva peninsula
Harperella	*Ptilimnium nodosum*	E	No	Shallow ponds and rocky stream beds inland from Chesapeake Bay
Northeastern Bulrush	*Scirpus ancistrochaetus*	E	No	Wetlands and depressions in the central, northern portion of the state
Sandplain Gerardia	*Agalinis acuta*	E	No	Sandy soils of coastal grasslands northwesterly of Chesapeake Bay
Sensitive Joint-vetch	*Aeschynomene virginica*	T	No	Sediments in intertidal zones and salty rivers within counties throughout the southern half of Maryland
Swamp Pink	*Helonias bullata*	T	No	Shaded, forested wetlands circling northern Chesapeake Bay

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015e)

Canby's Dropwort. Federally listed as an endangered plant species in 1986 (51 FR 6690 6693, February 25, 1986), Canby's dropwort (*Oxypolis canbyi*) is a perennial herb which grows to heights between 2.5 and 4 feet. The plant's stems are thin and stiff, holding slender leaves and extending up to small, five-petal flower clusters with colors typically ranging from white to red (USFWS, 2015z). The species' range extends along Atlantic coastal states from Maryland to Georgia. Locally, Canby's dropwort is known or believed to occur in Caroline, Kent, and Queen

Anne's counties within Maryland, all of which are located on the northern half of Delmarva peninsula, east of Chesapeake Bay (USFWS, 2015ac) (USFWS, 2015aj).

Habitat for Canby's dropwort include open ponds, swamps, and sloughs, uninhibited by intensive canopy cover and on wet soils for a majority of the year. Wetland areas located near coastal regions with sandy or muddy upper soil layers provide adequate habitat for the species. Habitat loss, hydrologic alterations, environmental degradation from herbicides, and insect predation are all current threats to the species' survival (USFWS, 2015z).

Harperella. Harperella (*Ptilimnium nodosum*), or pond harperella, is a perennial herb that grows between half a foot and three feet tall. Its thin stalks have quill-like leaves and end in small white flowers with typically five petals each (USFWS, 2015ad). The species was listed as endangered in 1988 within the Northeast Region (53 FR 37978 37982, September 28, 1988). Harperella's range reaches down the east coast from Maryland down to Georgia and extends across to Oklahoma (USFWS, 2015ae). Within Maryland, Harperella is known or believed to exist in at least Allegany and Washington Counties, located in the central to western regions of the state, inland from Chesapeake Bay (USFWS, 2015ae) (USFWS, 2016a).

Habitat for pond harperella consists of shallow ponds in hilly terrain and along gravelly stream-banks of swift moving water. Threats to harperella consist of water changes in flow, depth, and quality, along with human factors such as damming, hydrologic alterations, and development. Habitat destroyed due to aforementioned reasons by either overwhelming water coverage or severe dehydration can detrimentally impact the species' survival, as even natural water changes can remarkably influence a subpopulation's survival (USFWS, 2015ad).

Northeastern Bulrush. The northeastern bulrush (*Scirpus ancistrochaetus*) is a plant with narrow leaves and a drooping head with chocolate-brown florets. It is a wetland plant in the sedge family (*Cyperaceae*) that is very similar to other bulrushes, but its flowers and seeds are structurally different (USFWS, 2006) (USFWS, 2010b). This species was federally listed as endangered in 1991 (56 FR 21091 21096, May 05, 1991). The northeastern bulrush is known to occur from New Hampshire south to Virginia, with the most known occurrences in Pennsylvania (USFWS, 2010b). In Maryland, the species is known to occur in Washington County, which is located inland and northwest from Chesapeake Bay, in the middle section of the state (USFWS, 2015af).

The northeastern bulrush occurs in palustrine wetlands[111] and vernal ponds with seasonally fluctuating water levels. The current threats to the northeastern bulrush include alterations to the surrounding hydrology,[112] either by drier or wetter conditions (USFWS, 2006) (USFWS, 2010b).

Sandplain Gerardia. Sandplain gerardia (*Agalinis acuta*) was federally listed as endangered in 1988 *(*53 FR 34701 34705, September 7, 1988*)*. It is a light yellowish green annual with pink blossoms. The species' range extends on coastal grasslands from Massachusetts south to Maryland. Locally, the sandplain gerardia is known or believed to occur in Baltimore and

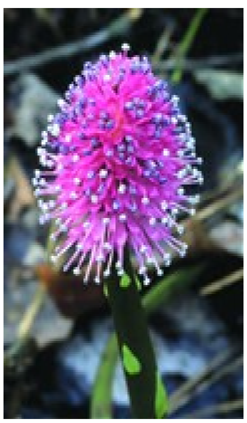
[111] Palustrine wetlands: "Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens." (USEPA, 2015ac)
[112] Hydrology: "The way water moves and is distributed via precipitation, runoff, storage and evaporation." (USEPA, 2015ad)

Carroll counties, which are located adjacent to, and northwesterly inland from, the northern region of the Chesapeake Bay (USFWS, 2015ag).

Preferred habitats are sandy soils of grasslands and roadsides, in pine/oak scrubs, and on scattered patches of bare soils. They cannot survive on their own and require a relationship with the little bluestem (*Schizachyrium scoparium*). Periodic disturbances that create open grassland habitat are necessary for sandplain gerardias success. Threats to this species include habitat loss from succession, fire suppression, land development, and invasive competitors. (MDNR, 2015v)

Sensitive Joint-vetch. The threatened sensitive joint-vetch (*Aeschynomene virginica*) is an annual plant from the legume family that can grow up to 8 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 21574, May 20, 1992). Sensitive joint-vetch are found in four states: Maryland, New Jersey, North Carolina, and Virginia. In Maryland, they have been observed in five counties sporadically located throughout the southern half of the state, Anne Arundel, Calvert, Charles, Prince George's, and Somerset, adjacent to Chesapeake Bay and the Potomac River (USFWS, 2015ah) (USFWS, 2014e).

They are found throughout the outer fringes of the intertidal zone from fresh water to salty tidal rivers and marshes on accumulated sediment. 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, 2015ah) (USFWS, 2014e).



Swamp Pink
Photo credit: USFWS

Swamp Pink. Federally listed in 1988 (53 FR 35076 35080, September 9, 1988), the threatened swamp pink (*Helonias bullata*) is an obligate wetland species[113] 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 to 3 ft tall stalks in clusters of 30 to 50 individual small pink flowers with blue anthers. Swamp pink is found on the coastal plains of three states (Delaware, New Jersey, and Maryland) and isolated spots of the southern Appalachian Mountains (USFWS, 2015aa). Within Maryland the species is found in at least eight counties, circling most of northern Chesapeake Bay and within the Baltimore region (USFWS, 2015ak).

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, 2015aa).

[113] 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." (US Army Corps of Engineers, 2012)

7.1.7. Land Use, Recreation, and Airspace

7.1.7.1. Definition of the Resources

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

Land Use, Recreation, and Airspace

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.

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, 2015d). 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. The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

7.1.7.2. Specific Regulatory Considerations

Appendix C summarizes numerous federal laws and regulations that, to one degree or another, affect land use in Maryland. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The *Models & Guidelines: Managing Maryland's Growth* is a series of documents that provide state-wide guidance to local planning agencies (MDP, 2008).

Because the nation's airspace is governed by federal laws, there are no specific Maryland state laws that would alter the existing conditions relating to airspace for this Draft PEIS. However, Chapter 05 of Subtitle 03 MAA addresses the State's code concerning obstructions to air navigation.

7.1.7.3. Land Use and Ownership

In Maryland, land use planning and policy development is under the purview of the Maryland Department of Planning (MDP). The MDP provides Maryland counties and towns with planning assistance related to land use, analysis and research, and data (maps and reports) (MDP, 2015).

For the purposes of this analysis, Maryland has been classified into three primary land use groups: forest and woodlands,[114] agricultural,[115] and developed land.[116] Land ownership within Maryland has been classified into four main categories: private, federal, state, and tribal.

[114] Forest and woodlands: Areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover. (USGS, 2012b)

[115] Agricultural: Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in developed settings for specific purposes. Herbaceous vegetation accounts for 75-100 percent of the cover. (USGS, 2012b)

[116] Developed: Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g., asphalt, concrete, buildings, etc). (USGS, 2012b)

Land Use

Forest and woodlands comprises the largest portion of land use with 45 percent of Maryland's total land area occupied by this category (Table 7.1.7-1 and Figure 7.1.7-1). Agriculture is the second largest area of land use with 35 percent of the total land area. Developed areas account for approximately 18 percent of the total land area (USGS, 2012b). The remaining percentage of land includes public land and other land covers, shown in Figure 7.1.7-1, that are not associated with specific land uses (USGS, 2012c).

Table 7.1.7-1: Maryland Land Use

Land Use	Square Miles	Percent of Land
Forest and Woodland	4,247	45%
Agricultural Land	3,296	35%
Developed Land	1,760	18%

Source: (USGS, 2012b)

Forest and Woodland

Forest and woodlands exist throughout Maryland but are more prominent in western Maryland. Private landowners collectively own approximately 74 percent of the forest and woodlands in Maryland (Lister and Push 2014). Two of the three largest state forests are located in western Maryland and together comprise a total 158 square miles. The largest state forest is in eastern Maryland and consists of 102 square miles on 240 separate parcels across eight counties (MDNR, 2015x). Section 7.1.6.3, Terrestrial Vegetation, presents additional information about terrestrial vegetation.

<u>State Forests</u>

The MDNR manages the State Forests, which account for 338 square miles of land in Maryland. The mission of the Maryland Strategic Forest Resource Plan is "To restore, manage and protect Maryland's trees, forests, and forested ecosystems to sustain our natural resources and connection people to the land" (MDNR, 2015x).

<u>Private Forest and Woodlands</u>

About 156,000 private landowners collectively own approximately 74 percent of Maryland's total forest and woodland (USFS, 2011). The average size of the private forest is 9 acres. The primary objectives for owning forest are for aesthetics, part of a residential site, and protection of nature. Individuals who have commercially harvested trees, own approximately 44 percent of private forest (USFS, 2011).

Agricultural Land

Agricultural lands exist throughout Maryland with the majority occurring in eastern Maryland. Approximately 35 percent of Maryland's total land area is classified as agricultural land (3,296 square miles). In 2012, families or individuals owned and operated nearly 83 percent of the 12,256 farms in Maryland. The average size of a farm was 166 acres (USDA, 2012). Some of the state's largest agricultural uses include poultry, dairy, corn, soybeans, wheat, hay, watermelon, apples barley, and potatoes. The MALPF is an innovative program that purchases agricultural preservation easements that restrict development on prime farmland or woodlands in perpetuity. At the end of fiscal year 2014, the program purchased easements preserving close to 300,000 acres (MALPF, 2015). For more information on field crops, irrigation, and market values by county, access the USDA Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Rankings_of_Market_Value/Maryland/

Developed Land

Developed land in Maryland tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 7.1.7-2). Although only 8 percent of Maryland is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 7.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 7.1.7-1 shows where these areas are located within the developed land use category.

Land Ownership

Land ownership within Maryland has been classified into four main categories: private, federal, state, and tribal (Figure 7.1.7-2).

Table 7.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Baltimore-Columbia-Towson, MD Metro Area	2,785,874
Washington-Arlington-Alexandria, D.C.-VA-MD-WV Metro Area (MD Portion)	2,303,870
Hagerstown-Martinsburg, MD-WV Metro Area (MD Portion)	147,430
Salisbury, MD-DE Metro Area (MD Portion)	125,203
California-Lexington Park, MD Metro Area	105,740
Total Population of Metro Areas (MD Portions)	5,468,117
Total State Population	5,976,407

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

Private Land

The majority of land in Maryland is privately owned and primarily falls within the forest and woodland, agricultural land, and developed land use categories. Private land exists in all regions of the state[117] (Figure 7.1.7-1).

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

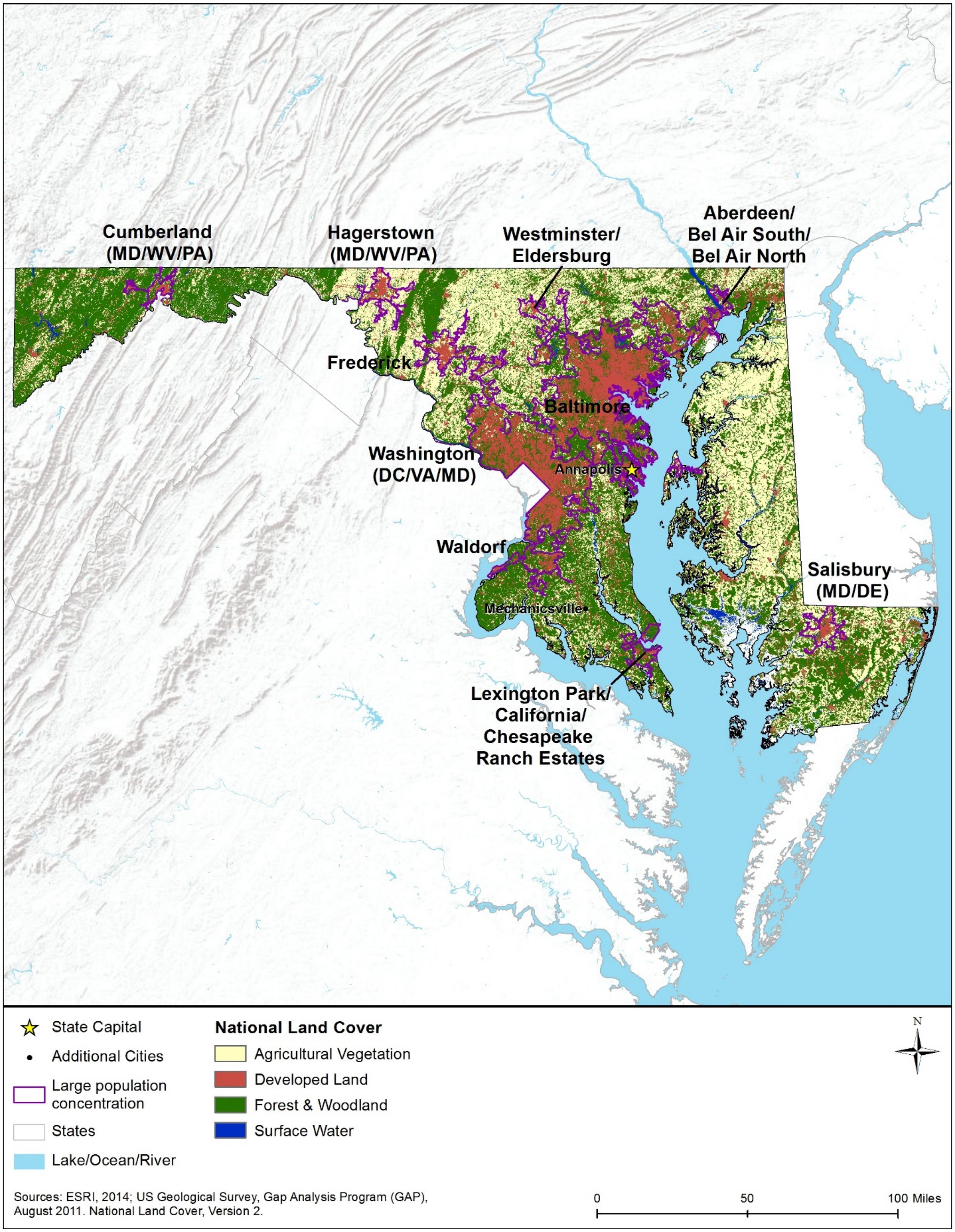


Figure 7.1.7-1: Land Use Distribution

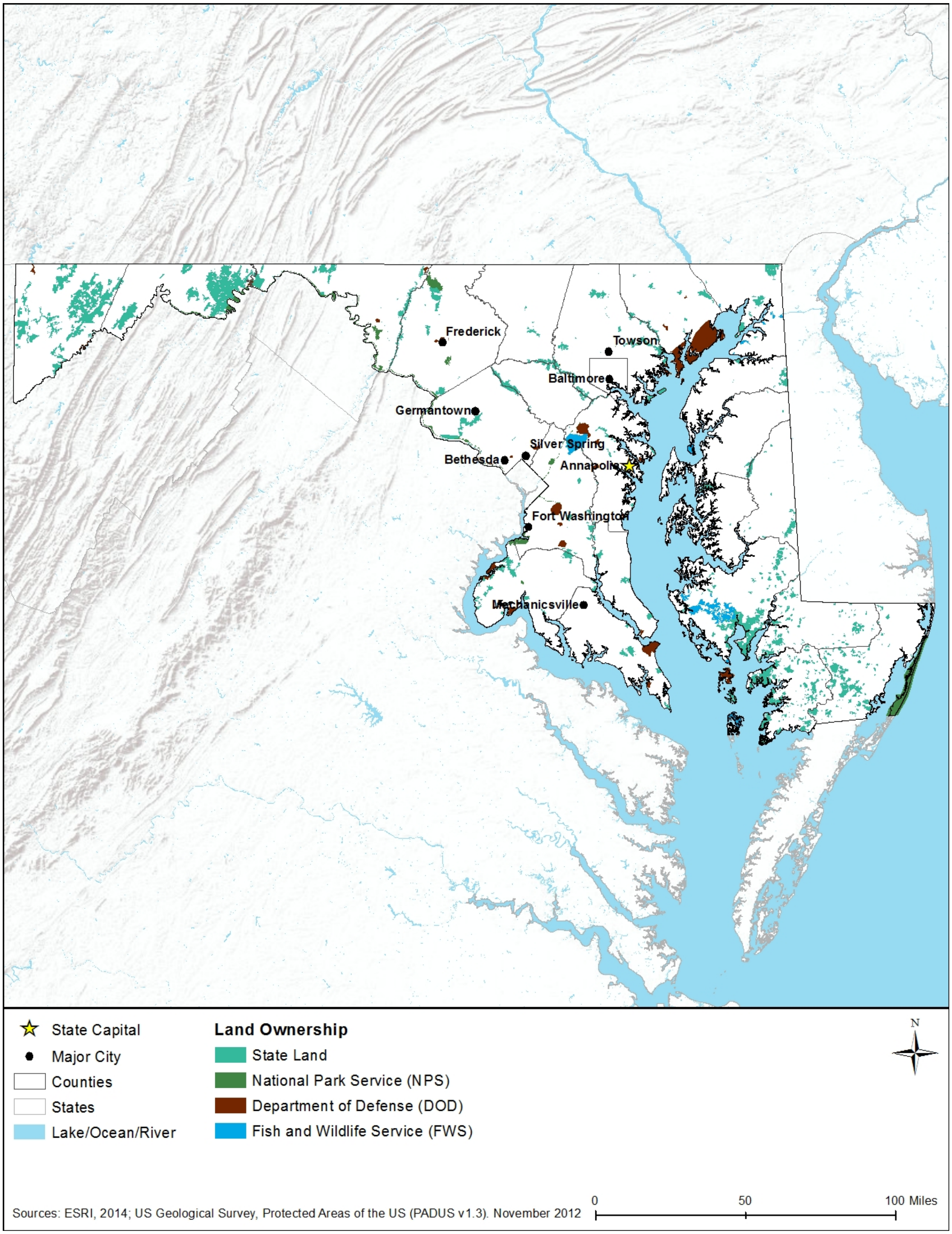


Figure 7.1.7-2: Land Ownership Distribution

Federal Land

The federal government manages 312 square miles (3.3 percent) of land in Maryland with a variety of land types and uses, including national parks, monuments, historic sites, military bases, and national forests (Figure 7.1.7-2) (Maryland.gov, 2014). Four federal agencies manage federal lands throughout the state (Table 7.1.7-3). Additional information on lands managed by federal agencies is provided in Section 7.1.5, Wetlands, and Section 371.8, Visual Resources.

Table 7.1.7-3: Federal Land in Maryland

Agency[1]	Square Miles	Type
Department of Defense	126.6	Military Bases, Military Academies, Training Centers, and Test Areas
USFWS	71	National Wildlife Refuges
National Park Service (NPS)[2]	104.8	Parks, National Heritage Areas, National Natural Landmarks, National Historic Landmarks, National Battlefields, National Trails, and a National Seashore
USDA	10	Agricultural Research Center

[1] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency.

[2] Additional trails and corridors pass through Maryland that are part of the National Park System.

Source: *(Maryland.gov, 2014)*

- The Department of Defense (DoD) owns and manages approximately 126.6 square miles used for military bases, military academies, military training centers, and test areas (DoD, 2014);
- The USFWS owns and manages approximately 71 square miles consisting of National Wildlife Refuges (NWRs) in Maryland (USFWS, 2014f);
- The National Park Service (NPS) manages 104.8 square miles including parks, landmarks, and trails (see Section 7.1.8, Visual Resources, for detailed information on these lands) (NRCS, 2015a) (National Public Safety Telecommunications Council, 2014); and
- The USDA manages over 6,500 acres (approximately 10 square miles) consisting of the Beltsville Agricultural Research Center (USDA, 2013).

State Land

The Maryland state government owns and manages approximately 752 square miles of land (Table 7.1.7-4 and Figure 7.1.7-2). This land is comprised of State Parks, State Forests, Wildlife Management Areas, Fishery Management Areas, and Marine/Communications Facilities.

Table 7.1.7-4: State Land in Maryland

Agency	Square Miles	Representative Type
MDNR	216	State Park System
MDNR	338	State Forest System
MDNR	193	Wildlife Management Areas
MDNR	2	Fish Management Areas
MDNR	3	Undesignated
MDNR	<1	Marine/communications Facilities

Source: (MDNR, 2015y)

- The MDNR manages:
  - 216 square miles of state park lands consisting of 62 state parks, 24 natural resources management areas, 7 natural environmental areas, 2 state battlefields, and 2 rail trails;
  - 338 square miles of the state forest system consisting of 9 state forests, 5 demonstration forests, 1 tree nursery, 1 Chesapeake forest lands, and 16 fire towers;
  - 193 square miles consisting of 61 wildlife management areas;
  - 2 square miles consisting of 17 fishery management areas;
  - 3 square miles consisting of 11 undesignated areas; and
  - Less than 1 square mile consisting of 10 marine/communications facilities. (MDNR, 2015y)

Tribal

There are no present-day tribal lands in Maryland.

7.1.7.4. Recreation

Maryland is relatively small in size, with a small beach coastline on the Atlantic Ocean and a coastline on the Chesapeake Bay. The state is highly varied in population density, with the Baltimore-Washington corridor densely populated. On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, and public beaches. On the state level, Maryland has an extensive variety of state forests, parks, reserves, recreation areas, monuments, and maintained multi-use trails

This section discusses recreational opportunities available at various locations throughout Maryland. For information on visual resources, see Section 7.1.8, Visual Resources, and for information on the historical significance of locations, see Section 7.1.11, Cultural Resources.

Western Region

Maryland's Western Region is known for outdoor activities and it contains the highest peak (Wild Turkey Rock) in the state. This area is used for winter recreation, and contains renowned hiking trails and many important Civil War battlefields and locations visited due to their historic significance.

The Antietam National Battlefield is nearly 2.5 square miles, and consists of the historic battlefield, visitor center and museum, and several historic buildings. The battlefield has Ranger-guided and self-guided tours, hiking; bicycling and horseback riding is permitted only in specific locations. Camping is available at the Rohrbach Group Campground. Licensed fishing and boating is allowed on Antietam Creek (NPS, 2015a).

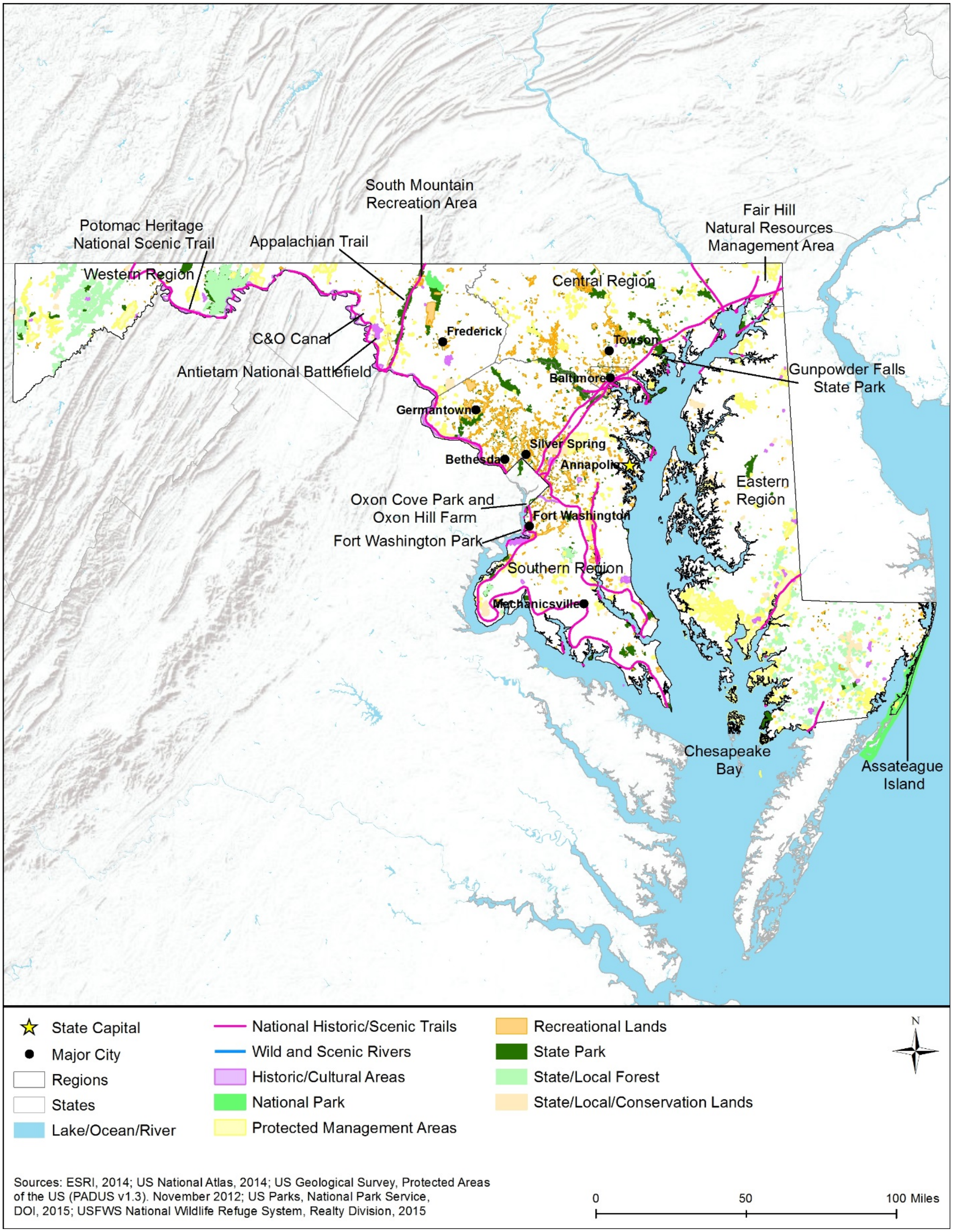


Figure 7.1.7-3: Maryland Recreation Resources

A popular destination for recreation, hiking and camping is Deep Creek Lake, Maryland's largest lake. The lake offers water activities in the spring and summer, and ice fishing in the winter (State of Maryland Tourism, 2015a).

The South Mountain Recreation Area includes a section of the Appalachian Trail and four state parks: Greenbrier, South Mountain; Gathland; and Washington Monument State Parks. The area also includes the South Mountain Battlefield. The Appalachian Trail's 40 miles in Maryland are light hiking along the South Mountain ridgeline; with access to the South Mountain Battlefield, the Maryland portion of the trail is the only time the Appalachian Trail nears a Civil War battlefield. Within the state parks, recreational activities include camping, hiking, bicycling, boating, and licensed fishing and seasonal hunting. The South Mountain Battlefield was the site of the first Civil War battle in Maryland, and hosts living history events and battle reenactments (MDOT, 2014).

Central Region

Maryland's Central Region contains waterfront towns on the Chesapeake Bay as well as town on the Piedmont Plateau. This area is visited for historic locations associated with railroads and United States history, with forested parks and annual fairs.

Gunpowder Falls State Park is a non-contiguous park consisting of six areas; it is one of the largest state parks in Maryland. Areas within the park are popular for different recreational activities: hiking, fishing, canoeing, boating, swimming, and visiting locations such as a historic rail line. (MDOT, 2015a) The Soldiers Delight Natural Environment Area is known for hiking trails and licensed, seasonal hunting (FHWA, 2015a). The Piney Run Reservoir is known for fishing tournaments held in the park; the recreation area has fishing, boating, and other water activities (State of Maryland Tourism, 2015c).

The Fair Hill Natural Resources Management Area includes a turf course with horseracing every Memorial Day weekend and fairgrounds which host a variety of annual fairs celebrating Maryland history. Other recreational opportunities include fishing, camping, multi-use trails, and seasonal licensed hunting.

Southern Region

The Southern Region includes the Baltimore-Washington Corridor, and the region has many recreational resources catering to those residing or working in the area, or for visitors to the area. Recreational opportunities within the region focus on outdoor activities accessible for day or weekend trips and places significant to United States history.

Fort Washington Park, overlooking Washington, D.C., holds one of the few remaining Seacoast Forts in the original design; available recreation activities include artillery demonstrations, hiking along a 3-mile hiking trail, picnic facilities, and licensed fishing. Located just outside of Washington, D.C., Oxon Cove Park and Oxon Hill Farm highlights farm programs with a Visitor Barn, farm animals, and exhibits showcasing historic farming practices; the park also has hiking and bicycling trails and picnic areas (NPS, 2015e).

Annapolis is visited by more than four million tourists annually, with attractions including a historic seaport and the United States Naval Academy. The harbor is a Chesapeake Bay Gateway and hosts sailing and powerboat festivals, regattas, and competitions throughout the year (The City of Annapolis, Maryland, 2015).

Places significant to United States history abound in the Southern Region, including restored residences and landmarks closely tied to historic people, Civil War battlefields, and other areas significant to the growth of the United States. The Chesapeake and Ohio (C&O) Canal National Historic Park stretches from Cumberland, MD to Washington, D.C. through the Southern Region. Over five million people annually visit the park for hiking, bicycling, camping, boating, fishing, and rides on a mule-drawn 1870's packet boat. White's Ferry, the last of the 100 operational ferries on the Potomac River, carries cars across the river on a wire cable. The area is popular for picnicking, canoeing, and fishing (Town of Poolesville, Maryland, 2015).

Eastern Region

Maryland's Eastern Region is bordered by both the Atlantic Ocean and the Chesapeake Bay. This area is known for beach and boardwalk cities; Ocean City has a beach side and a bayside, and both are popular vacation spots.

Assateague Island is a 37-mile long barrier island shared between Maryland and Virginia. The northern two miles of the island is the Assateague State Park; the central portion is the Assateague Island National Seashore; and the southern portion, in Virginia, is the Chincoteague National Wildlife Refuge. The island is famous for the free-roaming, feral horses, popular with visitors. Other activities on the island include hiking, bicycling, and horseback riding; camping; swimming and surfing; shell collecting, and shellfish harvesting, and licensed surf fishing.

The Eastern Region is home to three of Maryland's five National Wildlife Reserves: Eastern Neck, Blackwater, and Martin National Wildlife Reserves. Part of the Chesapeake Marshlands National Wildlife Refuge Complex, the refuges are similar to one another in flora and fauna, and are ideal for birdwatching. Eastern Neck and Blackwater both have staffed Visitor's Centers with exhibits, and all refuges promote recreational activities including hiking, paddle boating, and seasonal licensed hunting (USFWS, 2014f).

7.1.7.5. 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.

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 7.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[118] service is based on the airspace classification." (FAA, 2015d)

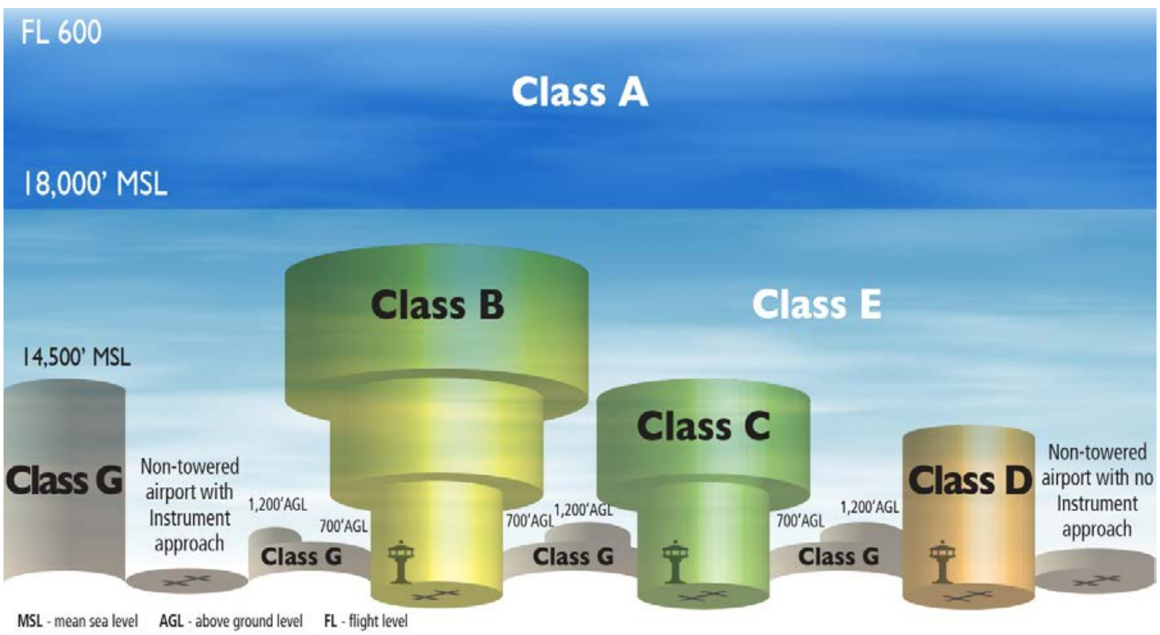


Figure 7.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2015d)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[119]. Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12

[118] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations. (FAA, 2015d)
[119] 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, 2015a).

Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[120]

- **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, 2015d).

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 7.1.7-5).

[120] IFR - Rules for the conduct of flights under instrument meteorological conditions. (FAA, 2015b)

Table 7.1.7-5: 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 U.S. 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 Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Source: (FAA, 2015d)

Other Airspace Areas

Other airspace areas, explained in Table 7.1.7-6, 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 7.1.7-6: 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.

Source: (FAA, 2015d)

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).

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.

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.

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 feet above ground level (AGL)
- 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."

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

Maryland Airspace

The MAA is an office within the MDOT. The MAA "fosters the vitality of aviation statewide and promotes safe and efficient operations, economic viability, and environmental stewardship" (MAA, 2015c). BWI airport and Martin State Airport are operated by the MAA. The Office of Regional Aviation Assistance within the MAA regulates the aeronautical operations for the State of Maryland (MAA, 2015a). There is one FAA FSDO for Maryland in Glen Burnie.

Maryland airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. A SASP documents the plans for maintaining and improving public airports to support aviation needs (NASAO, 2015). Figure 7.1.7-5 presents the different aviation airports/facilities located in Maryland, while Figure 7.1.7-6 and Table 7.1.7-7 present the breakout by public and private airports/facilities. There are approximately 219 airports (public and private) within Maryland as presented in Table 7.1.7-7 and Figure 7.1.7-5 through Figure 7.1.7-7. (DOT, 2015b)

Table 7.1.7-7: Type and Number of Maryland Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	34	115
Heliport	1	65
Seaplane	1	3
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	36	183

Source: (DOT, 2015b)

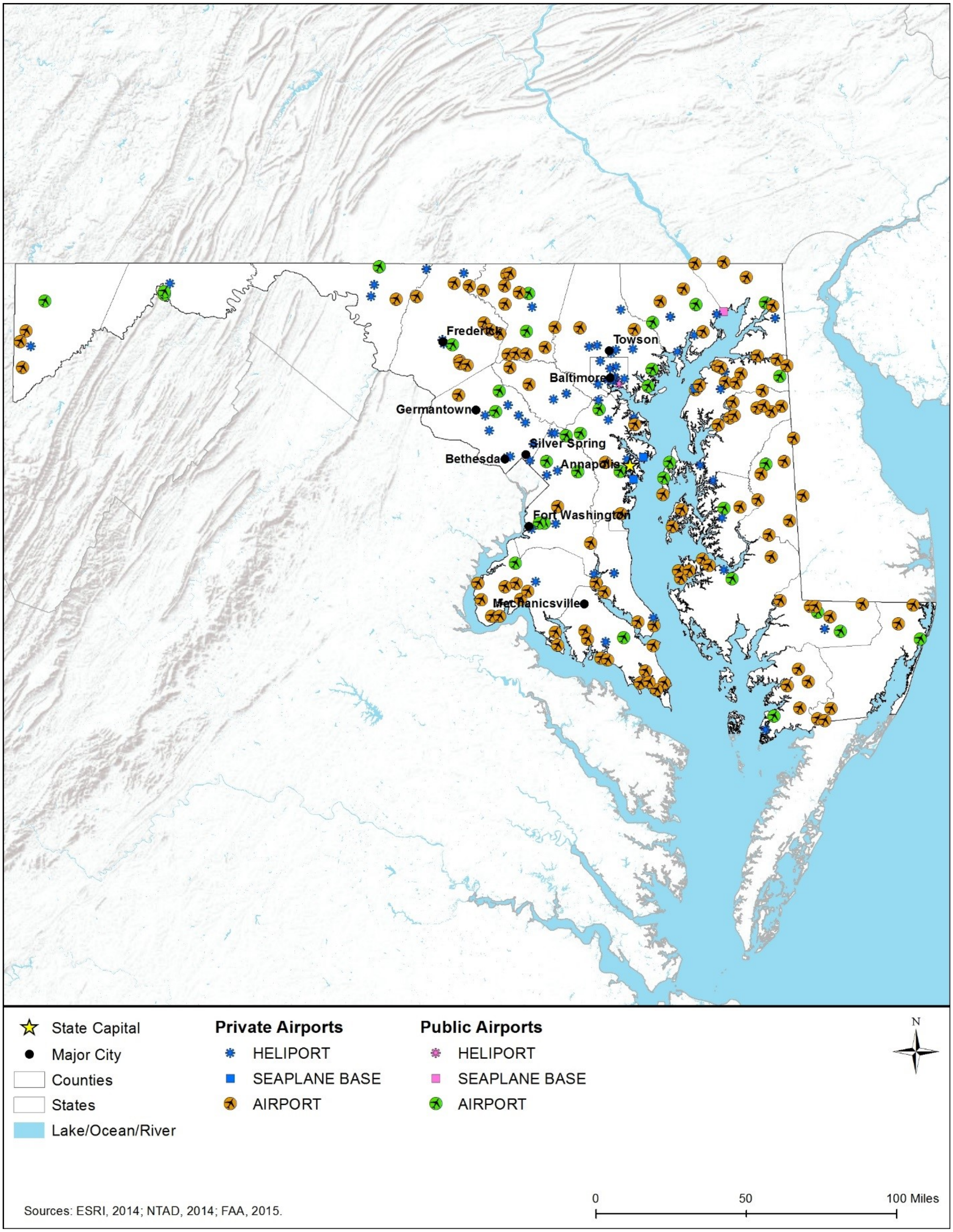


Figure 7.1.7-5: Composite of Maryland Airports/Facilities

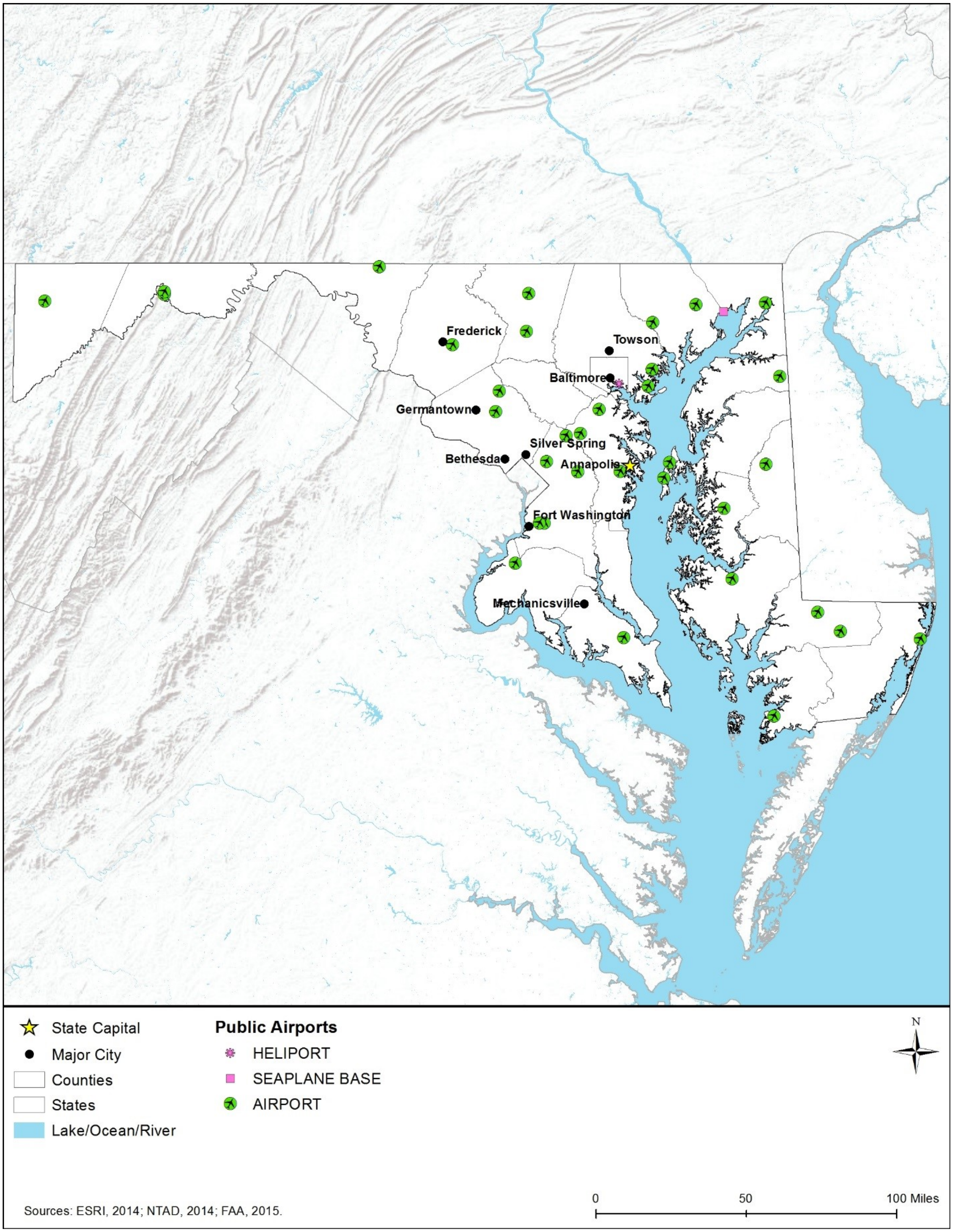


Figure 7.1.7-6: Public Maryland Airports/Facilities

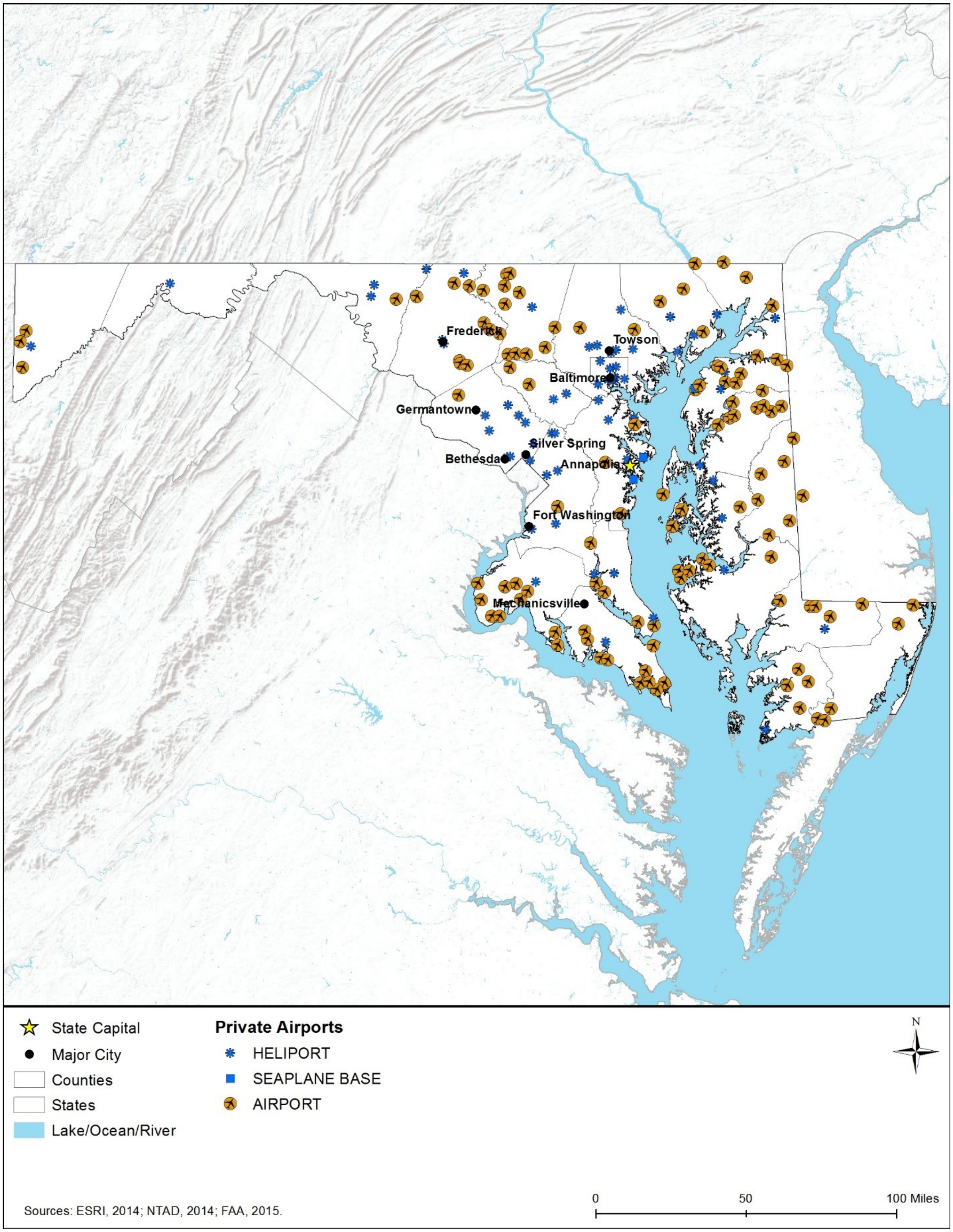


Figure 7.1.7-7: Private Maryland State Airports/Facilities

There are Class B, D, and E controlled airports in Maryland as follows:

- Two Class B –
  - BWI
  - Andrews Air Force Base
- Seven Class D –
  - Phillips Army Airfield (AAF), Aberdeen
  - Martin State Airport, Baltimore
  - Easton Airport/Newman Field, Easton
  - Frederick Municipal Airport
  - Washington County Regional Airport, Hagerstown
  - Naval Air Station Patuxent River (Trapnell Field), Patuxent River/Chesapeake Ranch Airpark, Lusby
  - Salisbury-Ocean City Wicomico Regional Airport
- Six Class E –
  - Phillips AAF
  - Martin State Airport
  - Frederick Municipal Airport
  - Washington County Regional Airport
  - Naval Air Station Patuxent River
  - Salisbury-Ocean City Wicomico Regional Airport

There are numerous SUAs (e.g., restricted and prohibited) located in Maryland due to the proximity to Washington D.C. and Naval Air Station Patuxent River, as presented in Figure 7.1.7-8. Restricted and prohibited areas, as follows, are located primarily in the Aberdeen and Naval Air Station Patuxent River areas:

- Aberdeen Area –
  - R-4001A, B, C – Surface to unlimited, to unlimited, 0700 to 2400 local time and surface to 10,000 feet MSL, 0000 to 0700 local time; higher altitudes by NOTAM issued 24 hours in advance
  - R-4001B– Surface to 10,000 feet MSL, higher altitudes by NOTAM issued 24 hours in advance
  - R-4001C – Surface to 10,000 feet MSL, Continuous
- Naval Air Station Patuxent River Area –
  - R-4002 Bloodsworth Island – Surface to and including 20,000 feet MSL, from sunrise to 2400 hours local time, daily; Other times as specified in a NOTAM 48 hours in advance
  - R-4005 – Surface to but not including FL250 0700-2300 local time, daily; Other times as specified by NOTAM
  - R-4006 – 3,500 feet MSL to but not including FL250, 0700-2300 local time, daily; Other times as specified by NOTAM
  - R-4007 Patuxent River, MD – Surface to but not including 5,000 feet MSL, 0700-2300 local time, daily; Other times as specified by NOTAM
  - R-4008 Patuxent River, MD – FL 250 to FL 850, 0700-2300 local time, daily; Other times as specified by NOTAM

   - R-6609 Tangier Island Range – Surface to FL200
- Thurmont Area -
   - R-4009 – 5,000 feet MSL to 12,500 feet MSL, Continuous; Transit may be authorized by Washington Air Route Traffic Control Center when conditions permit.
   - P-40 – That airspace within a three NM radius of the Naval Support Facility

Warning Area, W386, is located off the Eastern Shore of Maryland. There are five TFRs [32126(1), (2), and (3); 59478, and 50860] and MTRs in Maryland, presented in Figure 7.1.7-9, consist of approximately thirteen Slow Routes (800 through 808, 820, 821, 835, and 845), one Instrument Route 762, and approximately seven Visual Routes (708, 1709, 1711, 1712, 1713, 1756, and 1757).

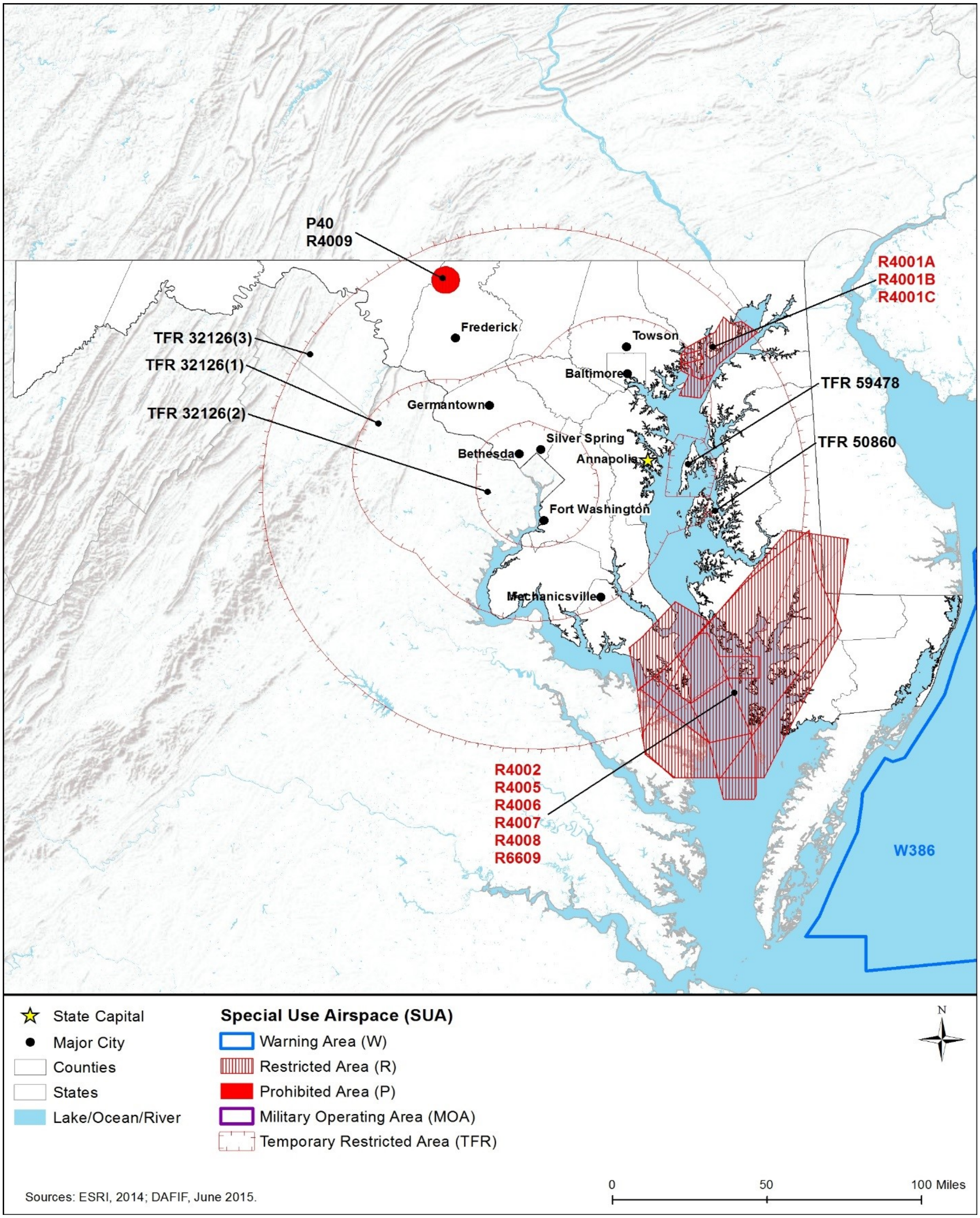


Figure 7.1.7-8: SUAs in Maryland

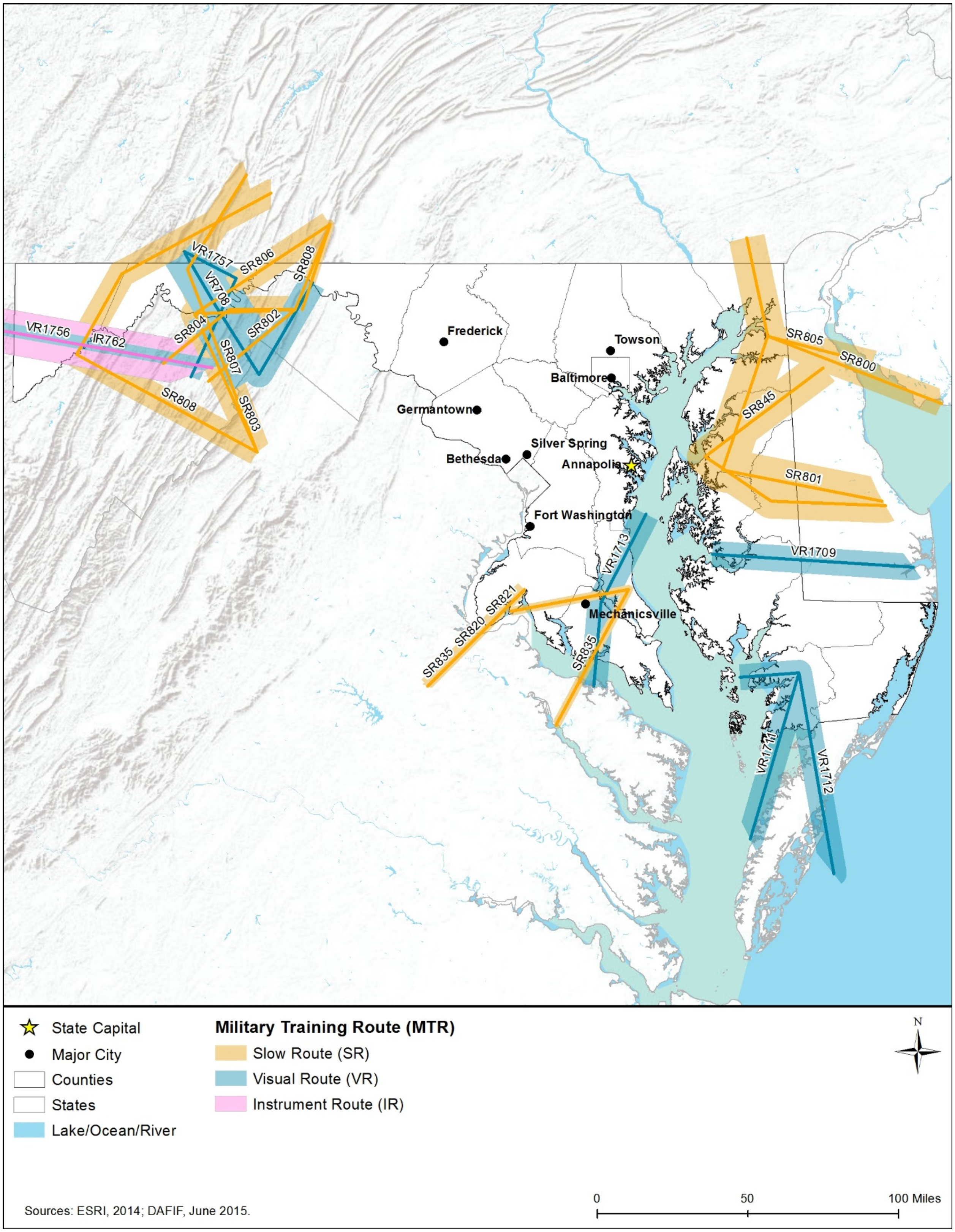


Figure 7.1.7-9: MTRs in Maryland

UAS Considerations

The UAS Research, Development, Regulation, and Privacy Act of 2015 was approved by the Maryland legislature, and signed by the Governor on May 12, 2015. This law "…pre-empts local government so they cannot enact their own UAS ordinances, creates one law for all of Maryland, includes "surveying" as one of the applications for UAS and rather than enacting any limitations, the bill calls for a study of UAS" (AUVSI, 2011).

The 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, 2014d). There are 16 National Park Service units in Maryland that have to comply with this agency directive (NRCS, 2015a).

Obstructions to Airspace Considerations

COMAR 11.03.05 addresses obstructions to air navigation. The MAA is authorized to review proposals pertaining to the construction of tall structures. Any proposed construction meeting the criteria of COMAR 11.03.05 and FAA Regulation Part 77 requires notification to the FAA and MAA. The criteria of COMAR 11.03.05 for a hazard[121] to air navigation from an obstruction is as follows:

- "Is greater than 200 feet above ground level or within 3 nautical miles of the established reference point of any public-use airport licensed by the Administration; or
- Penetrates any imaginary surface[122] specified in this regulation as applied to any airport" (Office of Regional Aviation Assistance, 2014).

Initiation of an airspace analysis by the FAA and MAA begins with the completion and submittal of an FAA Form 7460-1. The MAA will provide their determination to the responsible organization usually within a 30-day period.

7.1.8. Visual Resources

7.1.8.1. 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 (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. 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 National Historic Preservation Act (NHPA) compliance. The flow of the landscape

[121] "Any object which affects the area available for landing, take-off, and maneuvering of aircraft, thus tending to impair or destroy the utility of an airport and present a potential danger to users of the airport and residents of the area." (Office of Regional Aviation Assistance, 2014).
[122] "A series of planes or curve surfaces placed at various angles or arcs in relation to an airport's runways and based on a runway's classification and most precise available or planned aircraft approach path, more fully described in Regulation .04D of this chapter." (Office of Regional Aviation Assistance, 2014).

and the lack of interruptions or obstructions within vistas should be considered. 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).

7.1.8.2. Specific Regulatory Considerations

Table 7.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 7.1.8-1: State Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maryland Historical Trust Act of 1985	Maryland State Historic Preservation Office	Applicable state law to Section 106 of the National Historic Preservation Act (MHT, 2015a)

The Maryland Historical Trust (MHT), part of the Maryland Department of Planning, is the state agency dedicated to preserving Maryland's historical and cultural heritage. The MHT serves as Maryland's State Historic Preservation Office (SHPO) pursuant to the NHPA (MHT, 2015b). However, Maryland does not have regulations related to historic preservation; rather local jurisdictions control actions through local preservation ordinances. Consequently, there are several statewide organizations dedicated to preservation because local regulations vary widely, including the Maryland Association of Historic District Commissions, Maryland Heritage Council, and Preservation Maryland (MHT, 2014).

7.1.8.3. Character and Visual Quality of the Existing Landscape

Maryland is often referred to "America in Miniature" because it has an extensive diversity of habitats and scenery, including the Appalachian Mountains, Chesapeake Bay, and Atlantic Ocean (MDNR, 2015y). It is home to several historic areas, including Annapolis, Baltimore, and Frederick. The western region of the state contains the state's highest mountain and largest manmade lake, and many more forests, lakes, and waterfalls. The metropolitan area of Baltimore has urban cities and suburban communities, as well as agriculture and farmland. Central Maryland includes waterfront villages, mill towns, rolling hills, and the Chesapeake Bay. Southern Maryland is dominated by farming and fishing, and contains forests, ponds, swamps, and beaches. The Eastern Shore is part of the Delmarva Peninsula, between the Chesapeake Bay and Atlantic Ocean, and is mostly farmland and agricultural land where cattle are raised (State of Maryland Tourism, 2015b).

One aspect of importance for visual resources is to maintain the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos would be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood is important to maintain if new development were to occur. Section 7.1.7 discusses land use and contains further descriptions of land cover within 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.

7.1.8.4. 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 7.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Maryland, there are 1,533 NRHP listed sites, which include 2 National Heritage Areas and 72 National Historic Landmarks (NPS, 2015f). Section 7.1.11 provides details on the historic resources in Maryland. Some State Historic Sites may also be included in the NRHP, whereas others are not designated at this time.

The NPS 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, 2015g). 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, 2015g).

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 Maryland may contain scenic or aesthetic areas considered visual resources or visually sensitive. There are two NHAs in Maryland: the Baltimore NHA and the Journey Through Hallowed Ground NHA. The Baltimore NHA includes the Inner Harbor, one of the Nation's oldest seaports, and Fort McHenry, a historic site from the War of 1812. The Journey Through Hallowed Ground includes the homes and birthplaces of nine U.S. presidents (NPS, 2015a).

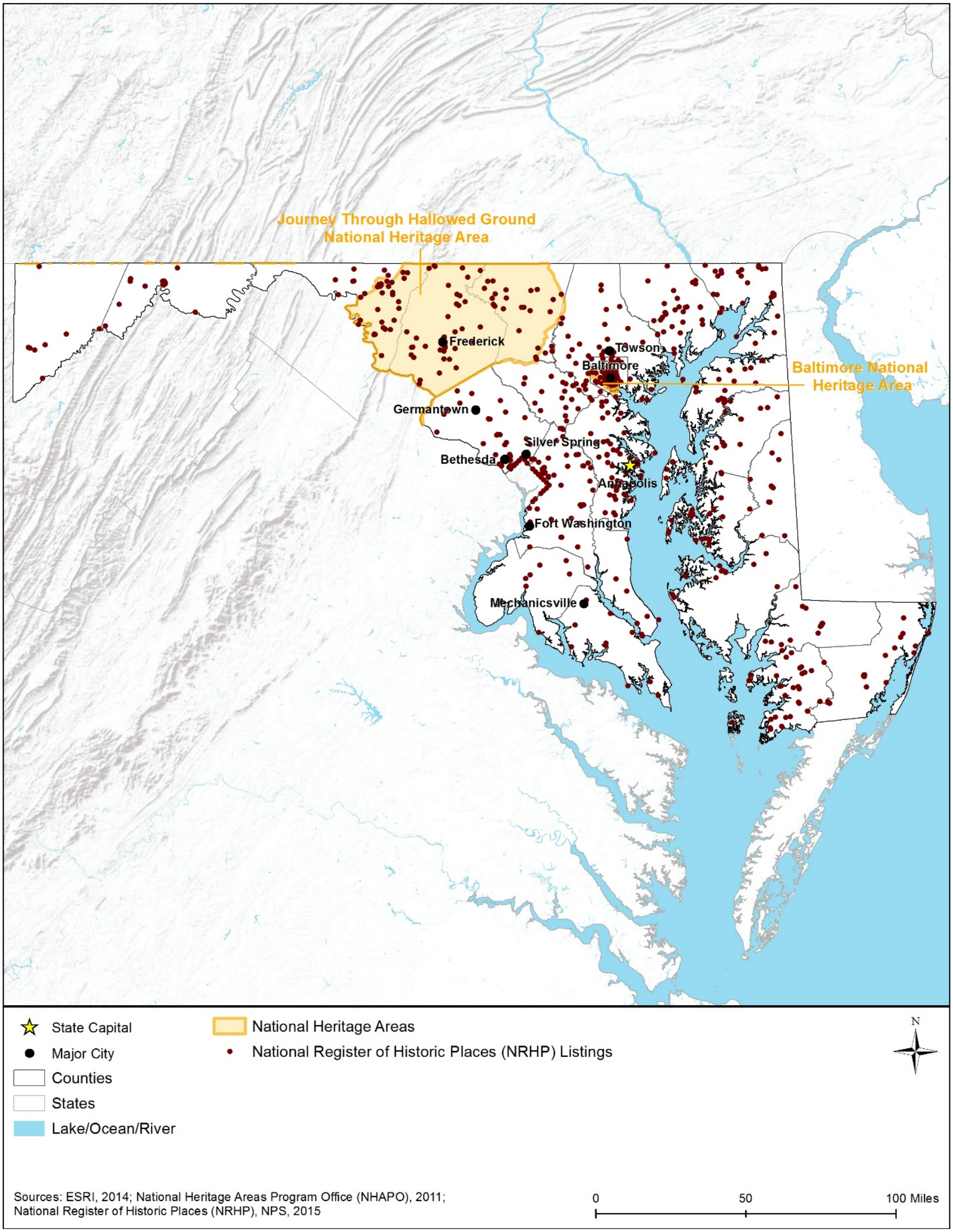


Figure 7.1.8-1: Cultural and Heritage Resources that May be Visually Sensitive

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, 2015c). 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 Maryland, there are 72 NHLs, including sites such as the Colonial Annapolis Historic District, Edgar Allan Poe’s House, and the United States Naval Academy. By comparison, there are over 2,500 NHLs in the United States. More information on Maryland’s NHLs can be found on the NPS’s Maryland NHL page (NPS, 2015d).

The MHT created the Maryland Inventory of Historic Properties, which now includes “more than 13,000 archaeological sites and 40,000 historic and architectural resources” (MHT, 2015c). The inventory is a source of information on sites, buildings, and other objects with historical significance to the state of Maryland.

State Heritage Areas

There are 13 locally designated and state certified Maryland Heritage Areas that represent Maryland’s historical, cultural, and natural resources (Table 7.1.8-2). The Maryland Heritage Areas Authority governs the Maryland Heritage Areas Program, which is administered by the MHT (MHT, 2015d). The Maryland Heritage Areas Coalition is a group of public and private partners committed to preserving these areas. For additional information regarding these properties and resources, see Section 7.1.11, Cultural Resources.

Table 7.1.8-2: Maryland Heritage Areas

Heritage Area Name	
Anacostia Trails (Maryland Milestones) Heritage Area	Lower Susquehanna Heritage Greenway
Baltimore National Heritage Area	Montgomery County Heritage Area
Canal Place Heritage Area	Mountain Maryland Gateway to the West Heritage Area
Four Rivers Heritage Area	Patapsco Heritage Greenway
Heart of Chesapeake Country Heritage Area	Southern Maryland Heritage Area
Heart of the Civil War Heritage Area	Stories of the Chesapeake Heritage Area
Lower Eastern Shore Heritage Area	

Source: (MHT, 2015d)

7.1.8.5. 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 7.1.7-3 in Section 7.1.7, Land Use, Recreation, and Airspace, identifies parks and recreational resources that may be visually sensitive in Maryland. For additional information about recreation areas, including national and state parks, see Section 7.1.7, Land Use, Recreation, and Airspace.

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Maryland residents and visitors. There are 62 state parks throughout Maryland (Figure 7.1.8-2), with several significant Civil War and other historic sites (MDNR, 2015y). In addition, the Harriet Tubman Underground Railroad State Park "commemorating the life and legacy of the legendary abolitionist" is anticipated to open in 2016 (MDNR, 2015z). Washington Monument State Park, the first completed monument commemorating the first U.S. president, is at the center of Mount Vernon Place Historic District, an NHL in the Baltimore NHA (MDNR, 2015aa). The Maryland Park Service also manages parks with natural and recreational significance, such as Assateague State Park (Figure 7.1.8-4), Maryland's only oceanfront park, which is famous for its wild horses (MDNR, 2015ab).

The MDNR, Wildlife and Heritage Service, manages a system of Natural Areas that represent the natural landscape diversity in Maryland. There are 31 Natural Areas in Maryland that "contain outstanding examples of native plant and animal communities, rare species habitats, or significant geological features" (MDNR, 2012). These areas, as listed in Table 7.1.8-3, are set aside for scientific and educational conservation.

Table 7.1.8-3: Maryland Natural Areas

Natural Area Name		
Allens Fresh	Furnace	North End
Andover Flatwoods	Green Run Woods	Otter Point Creek
Battle Creek Cypress Swamp	Hickory Point	Parker's Creek
Bear Pen Run	Idylwild	Patuxent River
Black Marsh	Jug Bay	Plum Creek
Calvert Cliffs	Lostland Run	Potomac Gorge
Cat Rock & Bobs Hill	Masemore Hemlock Ravines	Skimmer Island
Cranesville Swamp	Mattawoman Creek	Soldiers Delight
Douglas Point	Millington	South Savage Mountain
Finzel Swamp	Monroe Run	Swallow Falls
Fishing Bay Marshes		

Source: (MDNR, 2015ac)

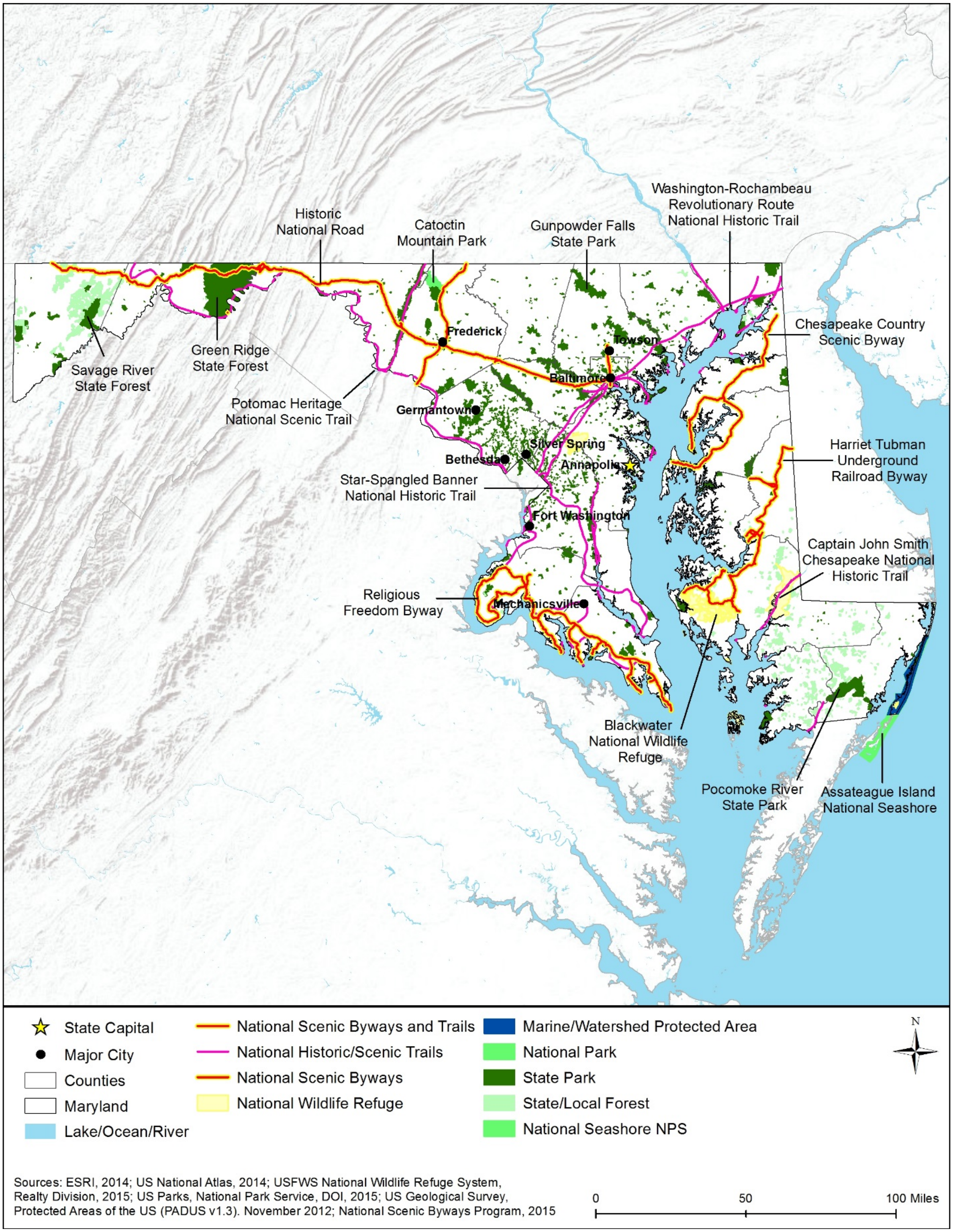


Figure 7.1.8-2: Natural Areas that May be Visually Sensitive in Maryland

National Park Service

The NPS manages a variety of National Park units in Maryland, including National Recreation Areas, National Battlefields, National Seashores, and National Forests; each of these National Park units contain natural, historic, cultural, visual, and recreational resources of significance to the nation. Owned by the U.S. government and operated by various federal agencies, these areas are maintained for the public's use. In Maryland, there are 16 National Park units as identified in Table 7.1.8-4 including Fort McHenry (Figure 7.1.8-3) and Assateague Island National Seashore (Figure 7.1.8-4) (NPS, 2015e).

Maryland is historically significant for its location in the early European colonization and settlement of North America; 2 of the 11 federally-recognized National Battlefields in the U.S. are located in Maryland. Table 7.1.8-4 identifies the NPS units located in Maryland, two of which are also NHLs. These sites have cultural and historical significance representing important events in the American Revolutionary War and Civil War, and U.S. slavery. For additional information regarding parks and recreation areas, see Section 7.1.7, Land Use, Recreation, and Airspace.

Table 7.1.8-4: Maryland National Park Service Areas

National Park Unit[1]
Antietam National Battlefield
Appalachian National Scenic Trail
Assateague Island National Seashore
Baltimore National Heritage Area
Captain John Smith Chesapeake National Historic Trail
Chesapeake & Ohio Canal National Historical Park
Clara Barton National Historic Site*
Fort McHenry National Monument and Historic Shrine
Hampton National Historic Site
Harpers Ferry National Historical Park
Harriet Tubman Underground Railroad National Monument
Monocacy National Battlefield*
Potomac Heritage National Scenic Trail
Star-Spangled Banner National Historic Trail
Thomas Stone National Historic Site
Washington-Rochambeau National Historic Trail

* Also listed as an NHL
[1] Properties may be managed by the NPS or affiliated with the NPS and managed by another Agency
Source: (NPS, 2015e)

Figure 7.1.8-3: Fort McHenry

Source: (NPS, 2015l)

Figure 7.1.8-4: Assateague Island National Seashore

Source: (NPS, 2015h)

State and Federal Trails

Designated under Section 5 of the National Trails System Act (16 U.S. Code [U.S.C.] 1241-1251, as amended), National Scenic Trails (NSTs) 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). There are two National Scenic Trails in Maryland. The Appalachian National Scenic Trail extends 2,185 miles from Maine to Georgia, with 40 miles crossing Maryland along the South Mountain ridgeline. The Potomac Heritage National Scenic Trail connects the Potomac and upper Ohio River basins, highlighting the Chesapeake Bay and Allegheny Highlands (NPS, 2015e).

Three National Historic Trails pass through Maryland and surrounding states: Captain John Smith Chesapeake National Historic Trail, Star-Spangled Banner National Historic Trail, and Washington-Rochambeau National Historic Trail (NPS, 2015e). The Captain John Smith Chesapeake National Historic Trail is the first national water trail in the U.S. (NPS, 2015i), while the Star-Spangled Banner National Historic Trail traverses both land and water (NPS, 2015j). The National Trails System Act defines these trails as "extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historic significance" (NPS, 2012a).

The MDNR is currently working with the NPS and other partners to develop a statewide trail system in Maryland. Several state parks have land and water trails, including hiking, mountain biking, and horseback riding trails, as well as battlefield trails that trace the course of Maryland history (MDNR, 2015ad).

7.1.8.6. 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 Maryland Forest Service manages 145,394 acres of designated state forests (See Table 7.1.8-5). The Chesapeake Forest Lands cover an additional 65,305 acres across 8 counties of Maryland's lower Eastern Shore, which include the former Chesapeake Forest Products Company lands. There are also four demonstration forests that serve "as an educational resource where a variety of silvicultural practices, forest best management practices (BMPs), and wildlife habitat management practices are implemented and studied" (MDNR, 2015x).

Table 7.1.8-5: Maryland State Forests

Maryland State Forests		
Cedarville State Forest	Elk Neck State Forest	St. Inigoes State Forest
Garrett State Forest	Pocomoke State Forest	Salem State Forest
Green Ridge State Forest	Potomac State Forest	Savage River State Forest

Source: (MDNR, 2015x)

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. Maryland does not have any National Wild, Scenic, or Recreational Rivers.

However, Maryland has nine rivers designated as "scenic" by the state: Anacostia, Deer Creek, Monocacy, Patuxent, Pocomoke, Potomac, Severn, Wicomico-Zekiah, and Youghiogheny. Maryland also officially designated a section of the Youghiogheny River as a "wild" river. The Maryland Scenic and Wild Rivers Act of 1968 established the State Scenic and Wild River System managed by MDNR. The Act ensures the preservation, protection, and enhancement of the rivers (MDNR, 2015d).

National Wildlife Refuges and State Wildlife Management Areas

The USFWS manages NWRs throughout the state; 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, 2015al). There are five NWRs in Maryland, four of which are managed as part of the Chesapeake Marshlands NWR Complex: Blackwater, Eastern Neck, Glenn Martin, and Susquehanna. Glenn Martin and Susquehanna are not open to the public in order to protect wetland habitats, and habitats for birds and other Chesapeake Bay wildlife (USFWS, 2015am). President Franklin D. Roosevelt established the fifth NWR, the Patuxent Research Refuge, in 1936 by executive order, and it "is the nation's only national wildlife refuge established to support wildlife research" (USFWS, 2015an). Visual resources within the NWRs include views and sites of the coast, beaches, wildlife, and naturally vegetated areas.

Maryland's Wildlife & Heritage Service (WHS) within MDNR manages nearly 120,000 acres of land in 60 Wildlife Management Areas (WMAs), ranging in size from 1 acre to over 30,000 acres. Much like NWRs, these areas protect diverse wildlife and their habitats, while providing recreation for the public (MDNR, 2015e). For additional information on wildlife refuges and management areas, see Section 7.7, Wildlife.

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, 2014b). These landmarks may be considered visual resources or visually sensitive. In Maryland, there are six designated NNLs located entirely or partially within the state as described below in Table 7.1.8-6. One notable natural feature is Sugarloaf Mountain (Figure 7.1.8-5) known for its hiking and mountain views.

Table 7.1.8-6: Maryland National Natural Landmarks and Associated Visual Attributes

National Natural Landmark	Visual Attributes
Battle Creek Cypress Swamp	Cypress Swamp, wide range of plants and animals
Belt Woods	Old-growth upland hardwood forests with tulip poplar and white oak, diverse bird population
Cranesville Swamp Nature Sanctuary	"[O]ccupies a natural bowl where cool, moist conditions yield plant and animal communities more common in northern latitudes."
Gilpin's Falls	"[B]est outcrop of undeformed early Paleozoic metavolcanic pillow basalts in the Middle Atlantic states. It is also a prime example of a fall zone stream."
Long Green Creek and Sweathouse Branch	Located within Gunpowder Falls State Park, beech-tulip poplar-white oak forest, herbaceous flora.
Sugarloaf Mountain	"[P]rovides evidence regarding age and structural relationships of rocks in the Piedmont biophysiographic province. The site appears to be either an outlier to the east of the main mass of the Catoctin Mountain, or a root remnant of the ancient Appalachia land mass."

Source: (NPS, 2012b)

Figure 7.1.8-5: Sugarloaf Mountain

Source: (Sugarloaf Mountain, 2015)

7.1.8.7. 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 U.S. Department of Transportation, FHWA, manages the National Scenic Byways Program (FHWA, 2015g). Maryland has six designated National Scenic Byways:

- Baltimore's Historic Charles Street (10 miles),
- Chesapeake Country Scenic Byway (419 miles),
- Harriet Tubman Underground Railroad Byway (144 miles),
- Historic National Road (170 miles),
- Journey Through Hallowed Ground (180 miles), and
- Religious Freedom Byway (189 miles) (FHWA, 2015h).

The Harriet Tubman Underground Railroad Byway and Historic National Road are also designated All-American Roads, which are the most scenic byways with multiple inherent qualities (e.g., cultural, historic, scenic) (FHWA, 2012). The Journey Through Hallowed Ground Byway is said to hold "more historic sites than any other in the U.S.," while Historic National Road was the nation's first federally funded interstate highway (FHWA, 2015h).

Maryland's Department of Transportation State Highway Administration manages 2,487 miles of scenic byways. The 18 byways shown in Table 7.1.8-7 represent Maryland's diverse scenery, history, and culture, and feature nationally significant themes (MDOT, 2015c).

Table 7.1.8-7: Maryland Scenic Byways and Associated Visual Attributes

Scenic Byway	Visual Attributes
Mountain Maryland	Keyser's Ridge, historic Cumberland, Youghiogheny River, Allegheny Mountains
Historic National Road	America's first federally funded highway, Baltimore cityscape, small towns, mountain passes, winding riverbanks
Chesapeake & Ohio Canal	236 miles of canal from Washington, D.C. to Cumberland
Journey Through Hallowed Ground	Civil War sites, natural sanctuaries, sacred land
Antietam Campaign	Civil War site
Old Main Streets	Historical architecture and culture
Mason & Dixon	Country vistas, historical sites, recreational areas
Falls Road	Pretty Boy Reservoir, countryside and rural landscapes, Baltimore cityscape, historical, cultural, and recreational attractions
Horses & Hounds	Grassy fields, wildlife
Lower Susquehanna	Maritime history, fishing, river views, historic waterfront Havre de Grace
Baltimore's Historic Charles Street	Historic architecture, museums
Star-Spangled Banner	War of 1812 historic sites
Booth's Escape	Escape route of John Wilkes Booth, Washington, D.C. to Pope's Creek
Roots & Tides	Bird watching, sandy beaches, Chesapeake Bay
Religious Freedom Tour	Some of the nation's oldest churches, small-town landscapes
Chesapeake Country	Chesapeake Bay, tidewater region, historic waterfront villages
Harriet Tubman Underground Railroad	"Secret network of trails, waterways and safe houses used by enslaved people"
Cape to Cape	Bays of Chincoteague, Sinepuxenta and Assawoman, historic beaches and islands

Source: (State of Maryland Tourism, 2015c)

Estuaries

The Chesapeake Bay is the largest estuary in the U.S. and the third largest in the world (NOAA, 2014) (USEPA, 2015af). The NPS manages the Chesapeake Bay Gateways and Watertrails Network, and "the collaborative strategies to support President Obama's Executive Order 13508 for the protection and restoration of the Chesapeake Bay" (NPS, 2015k). The waterways that make up the Chesapeake Bay support a variety of plants, animals, and aquatic life.

7.1.9. Socioeconomics

7.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics; 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 as those 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 (EO) (see Section 1.8). This PEIS addresses environmental justice in a separate section (Section 7.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land Use, Recreation, and Airspace (Section 7.1.7), infrastructure (Section 7.1.1, Infrastructure), and aesthetic considerations (Section 7.1.8, 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 PEIS. In all cases, this section uses the most recent data available for each geography 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). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This 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.

7.1.9.2. 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 PEIS.

7.1.9.3. Communities and Populations

This section discusses the population and major communities of Maryland. It 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 7.1.9-1 presents the 2014 population and population density of Maryland in comparison to the East region[123] and the nation. The estimated population of Maryland in 2014 was 5,976,407. The population density was 616 persons per square mile (sq. mi.), which is considerably higher than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Maryland was the 19th largest state by population among the 50 states and the District of Columbia, 42nd largest by land area, and had the sixth greatest population density (U.S. Census Bureau, 2015d; U.S. Census Bureau, 2015e).

Table 7.1.9-1: Land Area, Population, and Population Density of Maryland

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Maryland	9,707	5,976,407	616

[123] 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.

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

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

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 7.1.9-2 presents the population growth trends of Maryland from 2000 to 2014 in comparison to the East region and the nation. The state's annual growth rate remained steady in the 2010 to 2014 period compared to 2000 to 2010, at 0.87 percent. The growth rate of Maryland in both periods was nearly double the growth rate of the region (0.50 percent in the latter period), and nearly matched the growth rate in both periods compared to the nation's growth rate (0.81 percent in the latter period).

Table 7.1.9-2: Recent Population Growth of Maryland

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
Maryland	5,296,486	5,773,552	5,976,407	477,066	202,855	0.87%	0.87%
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%

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

Sources: (U.S. Census Bureau, 2015y), (U.S. Census Bureau, 2015d)

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide 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 7.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use 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 Maryland's population will increase by approximately 852,000 people, or 14.3 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.84 percent, which is very similar to the historical growth rate from 2010 to 2014 of 0.87 percent. The projected growth rate of the state is nearly double that of the region (0.57 percent) and is similar to the projected growth rate of the nation (0.80 percent).

Table 7.1.9-3: Projected Population Growth of Maryland

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		University of Virginia (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
Maryland	5,976,407	6,763,178	6,893,977	6,828,578	852,171	14.3%	0.84%
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, 2015d), (ProximityOne, 2015; UVA Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 7.1.9-1 presents the distribution and relative density of the population of Maryland. 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, 2015f).

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, 2012; U.S. Census Bureau, 2015g). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

The population in Maryland is mostly concentrated in the central area of the state, in the Washington and Baltimore metropolitan 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. The very sparsely populated Salisbury is in the Eastern Shore region of the Chesapeake Bay. For more information about the Chesapeake Bay area, see Section 7.1.7, Land Use, Recreation, and Airspace.

Table 7.1.9-4 provides the populations of the 10 largest population concentrations in Maryland, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.124 In 2010, the largest population concentrations were located in the Maryland portion of the Washington area, and the Baltimore area, which had over 1.7 and 2.2 million people respectively. The state had no other population concentrations over 1 million.

[124] 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 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.

The rest of the areas had populations below 250,000. The smallest of these 10 population concentrations was the Maryland portion of the Cumberland area, with a 2010 population of 49,619. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Maryland portion of the Lexington Park/California/Chesapeake Ranch Estates area, with an annual growth rate of 3.15 percent. The Baltimore area population grew slowly, at an annual growth rate of 0.60 percent during this period.

Table 7.1.9-4 also shows that the top 10 population concentrations in Maryland accounted for over 82 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 113.5 percent of the entire state's growth. This figure of over 100 percent indicates that the population of the remainder of the state, as a whole, declined from 2000 to 2010.

Table 7.1.9-4: Population of the 10 Largest Population Concentrations in Maryland

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Aberdeen/Bel Air South/Bel Air North	174,598	213,751	216,043	3	39,153	2.04%
Baltimore	2,076,354	2,203,663	2,221,658	1	127,309	0.60%
Cumberland (MD/WV/PA) (MD Portion)	38,555	49,619	48,494	10	11,064	2.55%
Frederick	119,144	141,576	143,043	4	22,432	1.74%
Hagerstown (MD/WV/PA) (MD Portion)	85,342	101,406	101,396	6	16,064	1.74%
Lexington Park/California/Chesapeake Ranch Estates*	43,196	58,875	60,063	9	15,679	3.15%
Salisbury (MD/DE) (MD Portion)	57,986	73,493	74,037	7	15,507	2.40%
Waldorf**	NA	109,919	111,830	5	NA	NA
Washington (D.C./VA/MD) (MD Portion)	1,572,634	1,749,163	1,776,534	2	176,529	1.07%
Westminster/Eldersburg	65,034	72,714	74,260	8	7,680	1.12%
Total for Top 10 Population Concentrations	4,232,843	4,774,179	4,827,358	NA	541,336	1.21%
Maryland	5,296,486	5,773,552	5,834,299	NA	477,066	0.87%
Top 10 Total as Percentage of State	79.9%	82.7%	82.7%	NA	113.5%	NA

AARC = Average Annual Rate of Change (compound growth rate)
*Population data for 2000 are for the "Chesapeake Ranch Estates-Drum Point, MD urban cluster."
**The Census Bureau did not define a Waldorf urban area in 2000.
Sources: (U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015i)

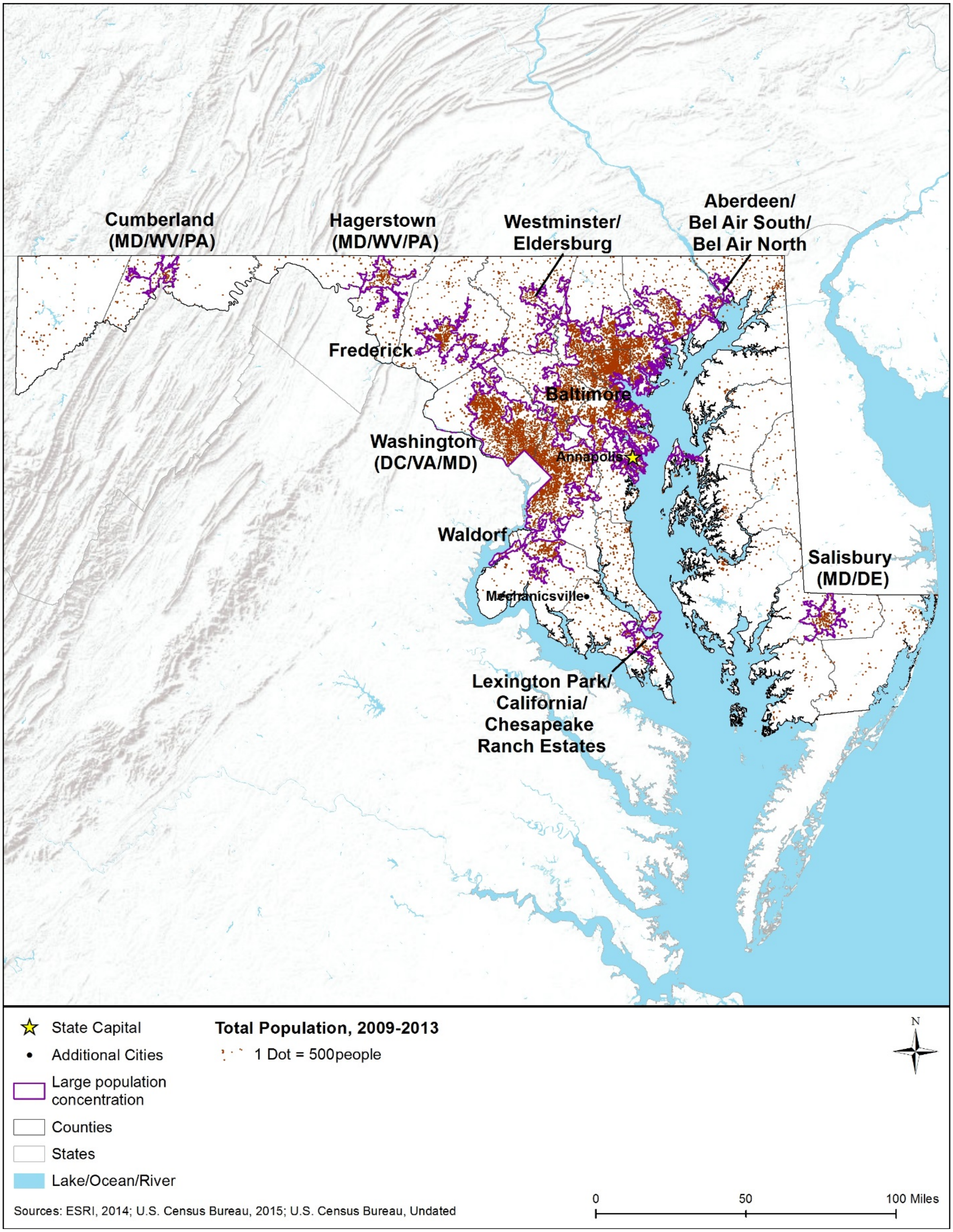


Figure 7.1.9-1: Population Distribution in Maryland, 2009-2013

7.1.9.4. 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 PEIS addresses public services in Section 7.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 7.1.9-5 compares several economic indicators for Maryland to the East region and the nation. The table presents two indicators of income[125] – 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 7.1.9-5, the per capita income in Maryland in 2013 ($36,177) was $3,325 higher than that of the region ($32,852), and $7,993 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 7.1.9-5 shows that in 2013, the MHI in Maryland ($72,482) was $11,978 higher than that of the region ($60,504), and $20,232 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 7.1.9-5 compares the unemployment

[125] 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, 2015p)

rate in Maryland to the East region and the nation. In 2014, Maryland's statewide unemployment rate of 5.8 percent was slightly lower than both the rate for the region (6.0 percent) and the nation (6.2 percent).[126]

Table 7.1.9-5: Selected Economic Indicators for Maryland

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Maryland	$36,177	$72,482	5.8%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

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

Figure 7.1.9-2 and Figure 7.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015j) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Table 7.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015g). Following these two maps, Table 7.1.9-6 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 Maryland.

Figure 7.1.9-2 shows that, in general, counties with a MHI below the national median were located in the southeastern portion of the state in the Chesapeake Bay Eastern Shore region, and the western portion of the state near Cumberland (Maryland portion). In addition, Baltimore City (a county equivalent) had a MHI below the national average. Most of the remainder of the state had MHI levels above the national average. Table 7.1.9-6 is consistent with those observations. It shows that MHI in the Baltimore metropolitan area ($65,278), of which Baltimore City is a part, was below the state average ($73,538). Most other areas had MHI levels above the state average. MHI was below the state average in the Maryland portions of the Cumberland, Hagerstown, and Salisbury areas. The Cumberland area, in western Maryland, had a considerably lower MHI ($35,312) compared to the other two just-mentioned areas.

Figure 7.1.9-3 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 found in the central area of the state, with the exception of Baltimore City, which had an unemployment rate greater than 8.6 percent. Other counties with unemployment rates above the national average were located in the Chesapeake Bay Eastern Shore region and the western portion of the state. When comparing unemployment in the population concentrations to the state average (Table 7.1.9-6), the areas that had a 2009–2013 unemployment rate higher than the state average are the areas with the lowest MHI. The Washington and Baltimore metropolitan areas had unemployment rates consistent with the state

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

average. The unemployment rate was lowest in the Westminster/Eldersburg area at 5.0 percent, slightly below the state average.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 7.1.9-7 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 lower in Maryland than in the East region and the nation. The percentage of government workers was considerably higher in the state than in both the region and nation. Self-employed workers were slightly lower in the state compared to both the region and the nation.

By industry, Maryland has a mixed economic base and some notable figures in the table are as follows. Maryland in 2013 had a considerably lower percentage of persons working in "manufacturing" than did the region or the nation. It had a higher percentage of workers in "professional, scientific, management, administrative, and waste management services," and nearly double the percentage of persons working in "public administration" compared to the region or nation. All other percentages by industry were within one or two percentage points compared the region or nation.

Table 7.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Maryland, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Aberdeen/Bel Air South/Bel Air North	$79,712	7.6%
Baltimore	$65,278	8.9%
Cumberland (MD/WV/PA) (MD Portion)	$35,312	10.3%
Frederick	$81,263	6.6%
Hagerstown (MD/WV/PA) (MD Portion)	$50,773	9.5%
Lexington Park/California/Chesapeake Ranch Estates	$83,113	6.3%
Salisbury (MD/DE) (MD Portion)	$48,018	11.1%
Waldorf	$92,867	7.7%
Washington (D.C./VA/MD) (MD Portion)	$85,130	8.1%
Westminster/Eldersburg	$85,868	5.0%
Maryland (statewide)	$73,538	8.2%

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

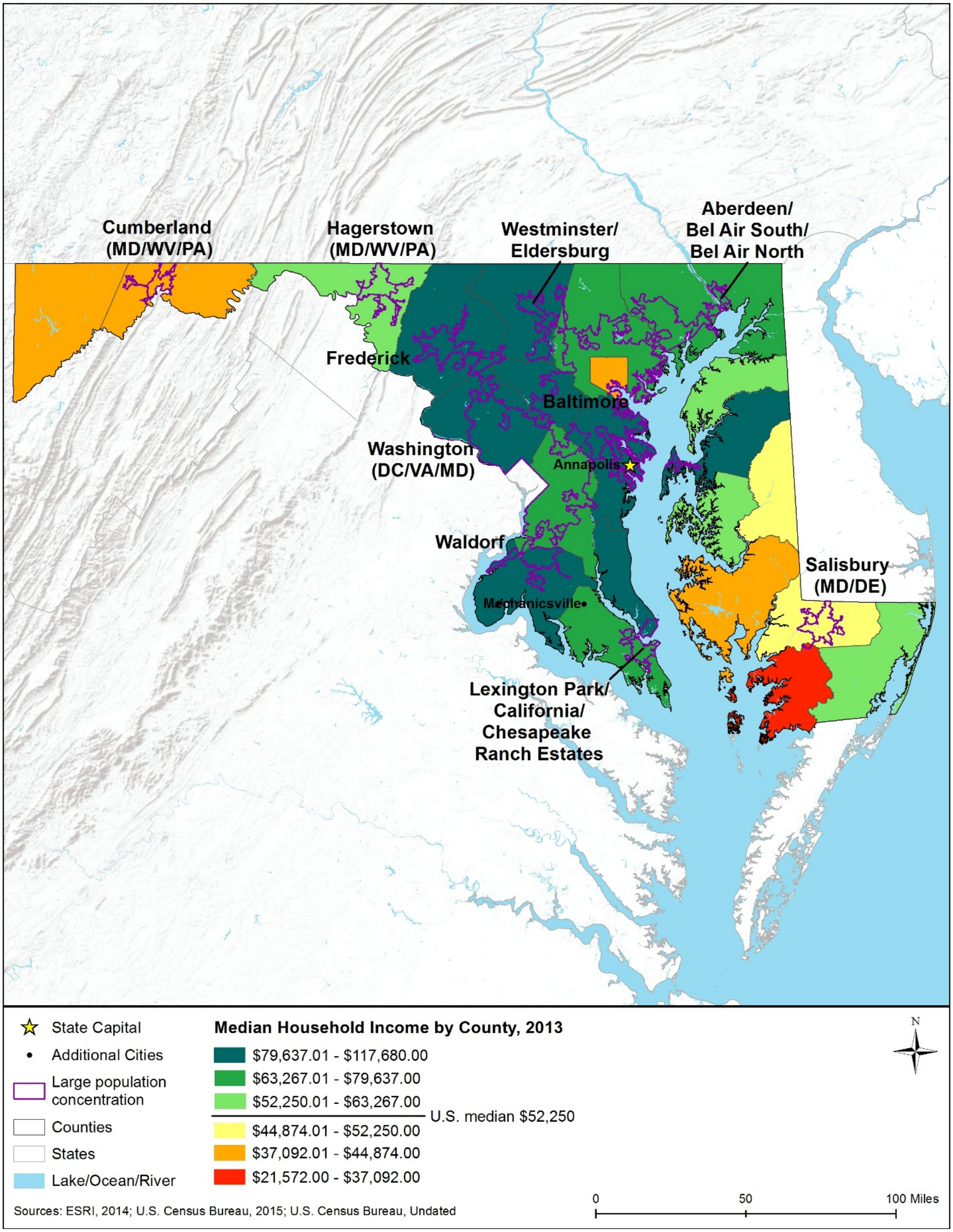


Figure 7.1.9-2: Median Household Income in Maryland, by County, 2013

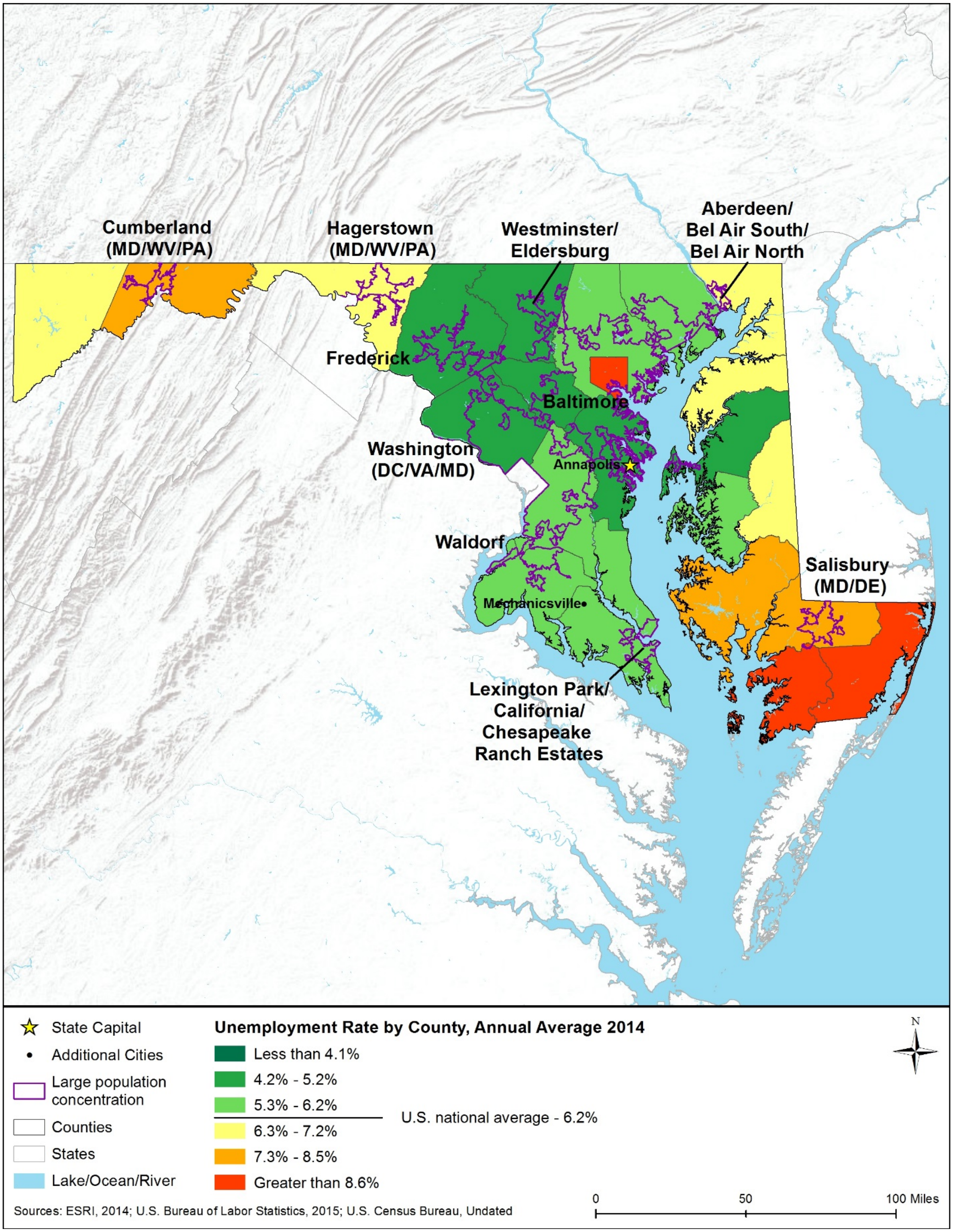


Figure 7.1.9-3: Unemployment Rates in Maryland, by County, 2014

Table 7.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Maryland	East Region	United States
Civilian Employed Population 16 Years and Over	2,983,367	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	73.1%	79.3%	79.7%
Government workers	22.2%	15.1%	14.1%
Self-employed in own not incorporated business workers	4.6%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	0.5%	0.9%	2.0%
Construction	6.5%	5.8%	6.2%
Manufacturing	4.6%	8.5%	10.5%
Wholesale trade	2.0%	2.5%	2.7%
Retail trade	9.6%	11.1%	11.6%
Transportation and warehousing, and utilities	4.1%	4.6%	4.9%
Information	2.1%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	6.6%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	15.2%	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	8.2%	8.9%	9.7%
Other services, except public administration	5.4%	4.9%	5.0%
Public administration	11.2%	5.5%	4.7%

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

Table 7.1.9-8 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 were slightly different from those in Table 7.1.9-7 for 2013. The selected industries were those with the greatest potential to be affected by FirstNet projects. Specifically, they were industries that may be involved in real estate transactions for FirstNet infrastructure, and in the design, deployment, and management of that infrastructure. In most of the 10 areas, the percentage of employment in the “Construction” industry was within 1.5 percentage points of the state average (6.8 percent).

Table 7.1.9-8: Employment by Relevant Industries for the 10 Largest Population Concentrations in Maryland, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative, and Waste Management Services
Aberdeen/Bel Air South/Bel Air North	6.9%	4.7%	2.0%	12.1%
Baltimore	5.6%	4.6%	2.2%	14.0%
Cumberland (MD/WV/PA) (MD Portion)	5.5%	5.6%	2.1%	6.5%
Frederick	6.3%	2.5%	3.0%	17.8%
Hagerstown (MD/WV/PA) (MD Portion)	6.7%	5.8%	2.3%	10.7%
Lexington Park/California/Chesapeake Ranch Estates	5.4%	4.5%	1.3%	19.6%
Salisbury (MD/DE) (MD Portion)	7.2%	4.6%	1.4%	7.6%
Waldorf	5.3%	4.9%	1.8%	15.4%
Washington (D.C./VA/MD) (MD Portion)	6.7%	3.8%	2.8%	18.8%
Westminster/Eldersburg	6.9%	3.2%	2.5%	13.3%
Maryland (statewide)	6.8%	4.3%	2.3%	15.1%

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

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 7.1.9-9 compares Maryland to the East region and nation on several common housing indicators. As shown in this table, in 2013 Maryland had a higher percentage of housing units that were occupied (89.9 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, Maryland also had a similar percentage of owner-occupied units (66.5 percent) to the region (62.8 percent) and nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in Maryland in 2013 was 51.3 percent, consistent with the percentage for the region (52.7 percent) and lower than that for the nation (61.5 percent). The vacancy rate among rental units was slightly higher in Maryland (7.0 percent) than in the region (5.5 percent) or nation (6.5 percent).

Table 7.1.9-9: Selected Housing Indicators for Maryland, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Maryland	2,404,177	89.9%	66.5%	1.5%	7.0%	51.3%
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, 2015o)

Table 7.1.9-10 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.

As shown in this table, during this period the percentage of occupied housing units ranged between 85.5 to 96.2 percent across these population concentrations, which is consistent with the state percentage (89.9 percent). The Westminster/Eldersburg area had the highest percentage of occupied housing units and the Cumberland area (Maryland portion) had the lowest. In these 10 communities, the percentage of occupied housing units that were owner-occupied ranged from 56.3 percent (Salisbury area, Maryland portion) to 78.5 percent (Aberdeen/Bel Air South/Bel Air North area), with a state average of 89.9 percent.

Table 7.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Maryland, 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
Aberdeen/Bel Air South/Bel Air North	84,650	94.2%	78.5%	1.4%	8.8%	55.9%
Baltimore	940,754	89.9%	62.5%	2.3%	6.7%	38.3%
Cumberland (MD/WV/PA) (MD Portion)	22,102	85.5%	63.6%	2.7%	7.7%	64.5%
Frederick	56,030	95.0%	68.1%	1.1%	3.1%	47.6%
Hagerstown (MD/WV/PA) (MD Portion)	41,949	91.6%	56.8%	1.8%	7.2%	49.5%
Lexington Park/California/Chesapeake Ranch Estates	24,235	89.6%	63.3%	2.6%	7.2%	61.2%
Salisbury (MD/DE) (MD Portion)	30,236	87.8%	56.3%	2.7%	7.0%	65.0%
Waldorf	41,502	93.0%	77.0%	2.2%	6.6%	65.8%

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Washington (D.C./VA/MD) (MD Portion)	672,132	94.1%	65.2%	1.4%	5.4%	49.3%
Westminster/Eldersburg	27,354	96.2%	76.3%	0.5%	5.1%	67.2%
Maryland (statewide)	2,387,285	89.9%	67.6%	1.9%	7.4%	51.7%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Further, FirstNet projects could potentially affect property values. Table 7.1.9-11 provides indicators of residential property values for Maryland 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, 2015p). The table shows that the median value of owner-occupied units in Maryland in 2013 ($280,200) was higher than the corresponding values for the East region ($249,074) and the nation ($173,900).

Table 7.1.9-11: Residential Property Values in Maryland, 2013

Geography	Median Value of Owner-Occupied Units
Maryland	$280,200
East Region	$249,074
United States	$173,900

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

Table 7.1.9-12 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 the Maryland portion of the Washington metropolitan area ($347,900) and the Westminster/Eldersburg area ($329,200) had median values higher than the state median value ($292,700). All other population concentrations had property values below the state value. The lowest values were in the same three areas – Maryland potion of the Cumberland ($118,900), Salisbury ($178,900), and Hagerstown ($189,100) areas – that had the lowest median household incomes (Table 7.1.9-6).

Table 7.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Maryland, 2009–2013

Area	Median Value of Owner-Occupied Units
Aberdeen/Bel Air South/Bel Air North	$271,700
Baltimore	$265,500
Cumberland (MD/WV/PA) (MD Portion)	$118,900
Frederick	$291,200
Hagerstown (MD/WV/PA) (MD Portion)	$189,100
Lexington Park/California/Chesapeake Ranch Estates	$273,600
Salisbury (MD/DE) (MD Portion)	$178,900
Waldorf	$282,400
Washington (D.C./VA/MD) (MD Portion)	$347,900
Westminster/Eldersburg	$329,200
Maryland (statewide)	$292,700

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

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[127] 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 7.1.9-13 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 7.1.9-13 shows that the state government in Maryland received more total revenue in 2012 on a per capita basis than counterpart governments in the nation, and less than counterparts in the region. Local governments in Maryland collected less revenue per capita than their counterparts in the region and nation. The Maryland state government had similar levels of intergovernmental revenues from the federal government as other state governments in the

[127] 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.

region and nation. Maryland local governments had higher levels of intergovernmental revenues[128] from the federal government than their counterparts elsewhere. Maryland state and local governments obtained considerably higher (well more than double) revenue from property taxes, on a per capita basis, compared to both the region and nation. General sales taxes were similar on a per capita basis for the Maryland state government compared to its counterparts in the region and nation. Local governments in Maryland did not report revenue from general sales taxes. Selective sales tax revenues per capita were similar for the Maryland state government and other state governments, and higher for Maryland local governments than their counterparts in the region and nation. Public utility taxes were lower on a per capita basis for the Maryland state government, and considerably higher for Maryland local governments, compared to their counterparts in the region and nation. Individual income tax revenues for the Maryland state government, on a per capita basis, were lower than those collected by state governments in the region, but higher than for counterparts at the national level. Individual income tax revenues for Maryland local governments were considerably higher than those for the region and nation. Corporate income taxes for the Maryland state government, on a per capita basis, were similar to those for the East region and the nation. Maryland local governments did not report corporate income taxes.

Table 7.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Maryland		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$36,104	$27,096	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$6,135	$4,605	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$10,030	$1,469	$135,435	$20,289	$514,139	$70,360
	Per capita	$1,705	$1,105	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$7,196	$0	$120,274	$0	$469,147
	Per capita	$0	$5,414	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$344	$0	$9,810	$0	$19,518	$0
	Per capita	$58	$0	$134	$0	$62	$0
Property Taxes	($M)	$756	$7,302	$2,215	$144,319	$13,111	$432,989
	Per capita	$128	$5,493	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$4,077	$0	$49,123	$15,874	$245,446	$69,350
	Per capita	$693	$0	$671	$217	$782	$221
Selective Sales Taxes	($M)	$3,097	$760	$38,070	$5,996	$133,098	$28,553
	Per capita	$526	$572	$520	$82	$424	$91
Public Utilities Taxes	($M)	$127	$484	$4,314	$2,261	$14,564	$14,105
	Per capita	$22	$364	$59	$31	$46	$45
Individual Income Taxes	($M)	$7,117	$4,361	$102,813	$18,838	$280,693	$26,642
	Per capita	$1,209	$3,281	$1,404	$257	$894	$85

[128] Intergovernmental revenues are those revenues received from the federal government or other government entities such as shared taxes, grants, or loans and advances.

Type of Revenue	Maryland		Region		United States	
	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Corporate Income Taxes ($M)	$880	$0	$14,112	$6,733	$41,821	$7,210
Per capita	$150	$0	$193	$92	$133	$23

Sources: (U.S. Census Bureau, 2015q; U.S. Census Bureau, 2015r)
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.
Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

7.1.10. Environmental Justice

7.1.10.1. Definition of the Resource

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. 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 DOC 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's Office of Environmental Justice (USEPA, 2015ag) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015ah).

The CEQ guidance provides several important definitions and clarifications that this 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 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)

7.1.10.2. Specific Regulatory Considerations

Governor Glendening formally established Maryland's Commission on Environmental Justice and Sustainable Communities (CEJSC) in accordance with EO 01.01.2001.01, issued on January 1, 2001. The Commission held its inaugural meeting on May 11, 2001 and was established by statute (Chapter 460, Acts of 2003) in 2003. The Commission:

(1) Advises Maryland agencies on environmental justice-related issues;
(2) Reviews and analyzes laws and policies to ensure adequacy in addressing issues of environmental justice and sustainable communities;
(3) Coordinates with the Children's Environmental Health and Protection Advisory Council on issues related to environmental justice and sustainable communities;
(4) Develops assessment criteria for Maryland communities to identify existing environmental justice issues; and
(5) Provides recommendations to the Governor and the General Assembly for addressing environmental justice-related issues. (MDE, 2015m)

Building on the USEPA's definition, CEJSC defines environmental justice as follows:

> "Environmental justice seeks equal protection from environmental and public health hazards for all people regardless of race, income, culture and social class. Additionally, environmental justice means that no group of people including racial, ethnic or socioeconomic groups should bear a disproportionate share of the negative environmental consequences resulting from industrial, land-use planning and zoning, municipal and commercial operations or the execution of federal, state, local and municipal program and policies." (MDE, 2015m)

This definition is imbedded into numerous state laws. Maryland's Regulatory Agency, the MDE, and all state/local agencies are legally obligated to enforce these requirements (MDE, 2015m; MDE, 2015n). MDE developed guides for businesses to implement best practices, including the following:

- Identify stakeholders (e.g., community organizations, local and state legislators).
- Identify environmental risks of proposed actions/projects and offer possible solutions.
- Identify potential benefits of the proposed project (e.g., jobs, road improvements).
- Create an action plan that identifies strategies for stakeholder's participation/involvement.
- Conduct direct outreach to specific communities affected by the project.
- Consider effective strategies for reaching stakeholder audience (e.g., signs, newspapers, social media).
- Provide notices in plain language, not legalese, and provide translation of documents as needed.
- Hold meetings with MDE and the community early in the planning process.
- Explain the reason(s) for selection of particular location.

- Continue to engage and notify the community throughout the permitting process and after permit approval. This includes notifying the community when the permit scope changes or environmental studies occur. (MDE, 2015n)

7.1.10.3. Minority and Low-Income Populations

Table 7.1.10-1 presents 2013 data on the composition of Maryland's population by race and by Hispanic origin. The state's population has higher percentages of individuals who identify as Black/African American (29.6 percent) and Asian (6.0 percent) than the populations of the East region and the nation. (Those percentages are, for Black/African American, 14.4 percent for the East region and 12.6 percent for the nation; and for Asian, 5.8 percent and 5.1 percent respectively). The state's population of persons identifying as White (57.6 percent) is considerably smaller than that of the East region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in Maryland that identifies as Hispanic (9.0 percent) is smaller than in the East region (12.2 percent), and considerably lower 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. Maryland's All Minorities population percentage (46.8 percent) is considerably higher than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 7.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. Maryland (10.1 percent) is substantially lower than that for the East region (13.3 percent) and for the nation (15.8 percent).

Table 7.1.10-1: 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		
Maryland	5,928,814	57.6%	29.6%	0.3%	6.0%	0.1%	3.6%	2.9%	9.0%	46.8%
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, 2015s)
"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than 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 7.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Maryland	10.1%
East Region	13.3%
United States	15.8%

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

7.1.10.4. 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 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 using 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 7.1.10-1 visually portrays the results of the environmental justice population screening analysis for Maryland. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015u; U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x) and Census Bureau urban classification data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015g). Figure 7.1.10-1 shows that Maryland has many areas with high potential for environmental justice populations. The largest concentrations of areas with high potential for environmental justice populations are in central Maryland, Baltimore, Washington metro, and Waldorf areas. The distribution of areas with moderate potential for environmental justice populations is fairly even across the state.

It is important to understand how the data behind Figure 7.1.10-1 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 7.1.10-1 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. When FirstNet implements projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map 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). Section 7.2.10 addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

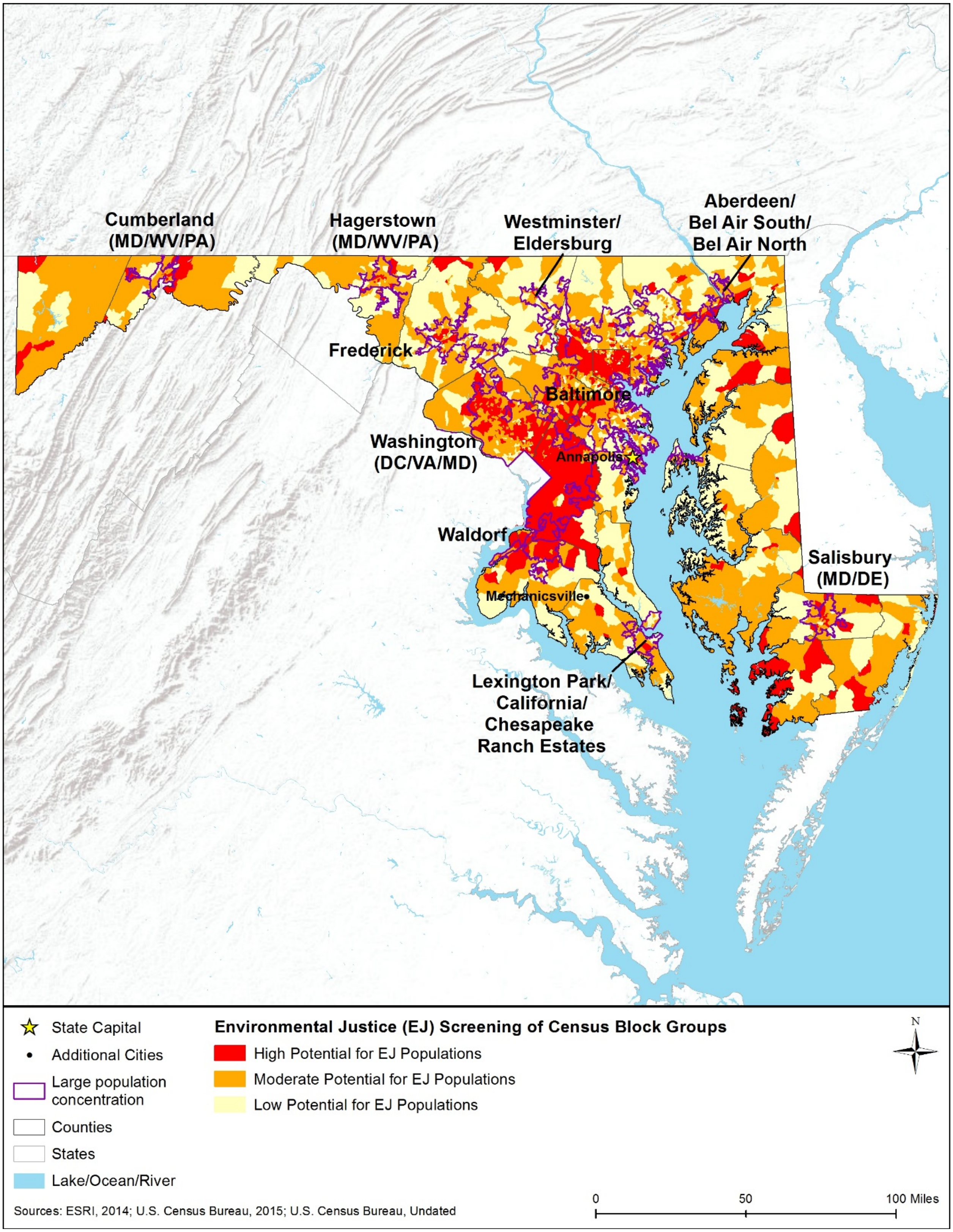


Figure 7.1.10-1: Potential for Environmental Justice Populations in Maryland, 2009-2013

7.1.11. Cultural Resources

7.1.11.1. Definition of the 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 NRHP.

This definition is consistent with the 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, 2015m); and
- 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).

7.1.11.2. Specific Regulatory Considerations

Applicable federal laws and regulations that apply to Cultural Resources, such as the NHPA (detailed in Section 1.8), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

Maryland has a state law and regulation that is similar to NEPA (refer to Table 7.1.11-1). However, federal laws and regulations supersede those of the state. 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 7.1.11-1: Relevant Maryland Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
The Maryland Historical Trust Act of 1985 as amended, State Finance and Procurement Article §§ 5A-325 and 5A-326 of the Annotated Code of Maryland	Maryland Historical Trust (SHPO)	Establishes the authority of the Maryland SHPO to review state government projects for adverse effects to state Historic Register-listed properties.

7.1.11.3. Cultural Setting

The Maryland region has been inhabited by human beings for some 12,000 years (Cantwell and diZerega Wall 2001, Haynes, Johnson and Stafford 1999, Pauketat 2012); however, due to a relatively wet climate that degrades and moves artifacts, the state's archaeological record is less reliable than that of more arid parts of the United States (Ritchie 1969). The majority of Maryland's early human habitation evidence comes from the study of archeological sites of pre-European contact and historic populations. In addition to the hundreds of archaeological sites listed in the state’s inventory, there are 59 archaeological sites and archaeological districts listed on the NRHP in Maryland, of which there are 29 prehistoric archaeological sites, 24 historic archaeological sites, 4 historic/prehistoric archaeological sites, 1 shipwreck archaeological site, and 3 archaeological districts (National Public Safety Telecommunications Council, 2014).

Archaeologists typically divide large study areas into regions as shown in Figure 7.1.11-1. Maryland contains two Regions: The Appalachian Highlands and Atlantic Plain, which together encompass five physiographic provinces. The Appalachian Plateau is the western most province extending from the state boundary to the base of the Catoctin Mountains. The Valley and Ridge/Blue Ridge provinces are characterized by forested mountain areas with heavy agriculture in the lower valleys. The Piedmont province is an area with gently rolling topography connecting the mountainous and coastal provinces of the state. The Coastal Plain represents the most heavily developed region.

Evidence at most archeological sites in Maryland 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).

The following sections provide additional detail about Maryland’s prehistoric periods (approximately 12,000 before B.C. to A.D. 1600) and the historic period since European colonization in the 1600s. Section 7.1.11.4 presents an overview of the initial human habitation in Maryland and the cultural development that took place prior to European contact. Section 7.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 7.1.11.6 provides a current list of significant archaeological sites in Maryland and tools that the state has developed to ensure their preservation. Section 7.1.11.7 summarizes the historic context of the state since European contact, and Section 7.1.11.8 addresses the architectural context of the state during the historic period.

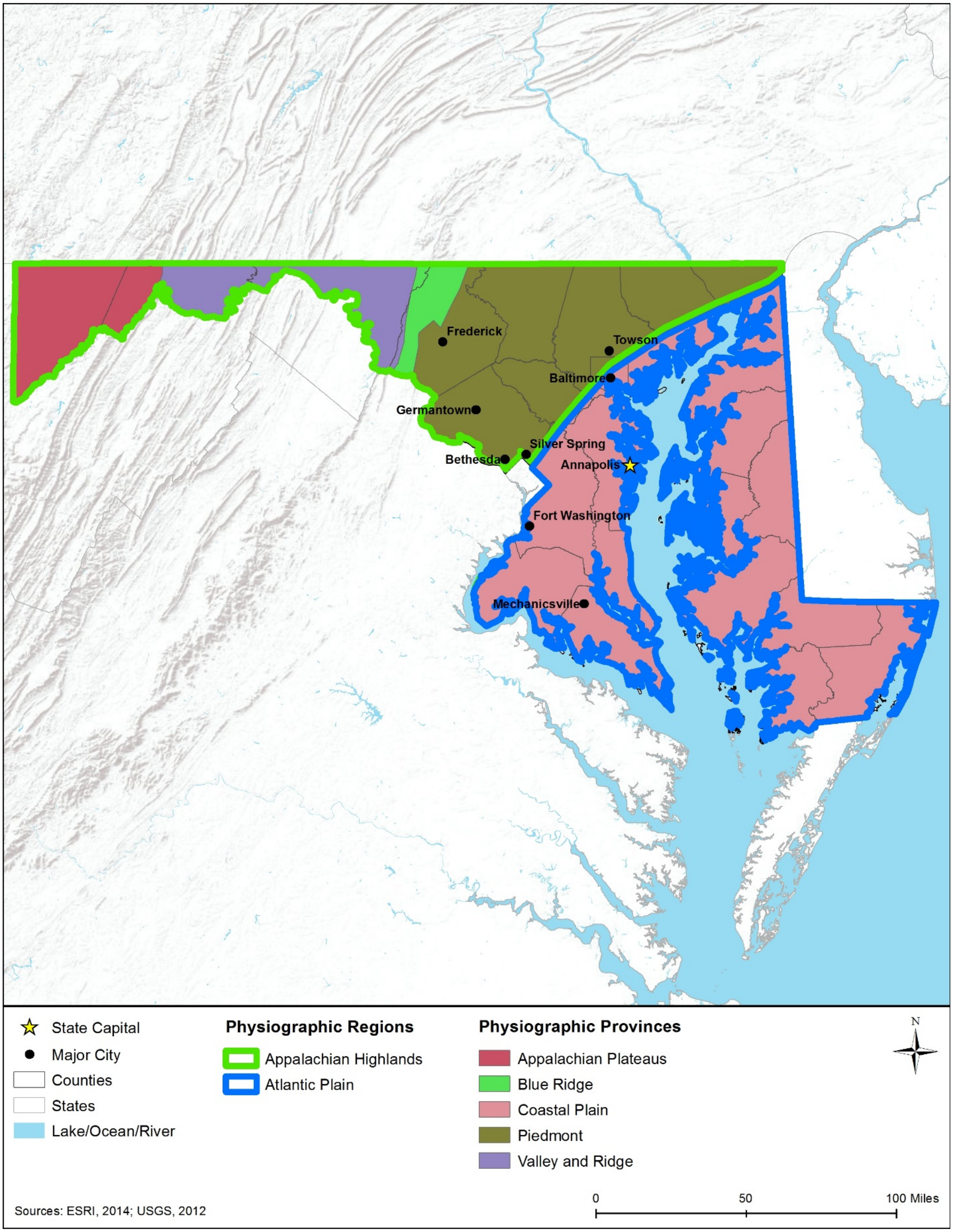


Figure 7.1.11-1: Physiographic Map of Maryland

7.1.11.4. Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited present day Maryland 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) (Pauketat 2012, Institute of Maritime History 2015, Holiday, Johnson and Stafford 1999). Figure 7.1.11-2 shows a timeline representing these periods of early human habitation in North America, including present day Maryland. It is important to note that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation have been discovered in each of Maryland's Physiographic Regions and Provinces. During early archaeological research, there was often no clear distinction between prehistoric periods in the archaeological record, due to overlaps between phases of cultural development (Ritchie 1969). Due to advancements in radiocarbon dating techniques, dates of each period in the archaeological record have been increasingly more accurate, and there is no longer such a significant overlap in the timeline of human occupation in North America (Pauketat 2012). Radiocarbon dating techniques and associating artifacts discovered with similar ones previously assigned to a particular range of the archaeological record continue to become increasingly accurate (Pauketat 2012, Haynes, et al. 1984, Haynes, Johnson and Stafford 1999).

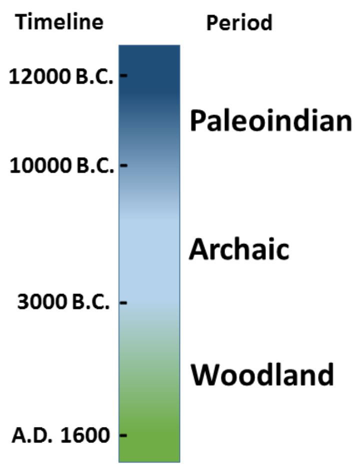


Figure 7.1.11-2: Timeline of Prehistoric Human Occupation in Maryland

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

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

The Paleoindian Period represents the earliest known human habitation of the northeast United States. The earliest people to occupy the state were small groups of nomadic hunters and gatherers that used chipped-stone tools, including the "fluted javelin head" arrow and spear points, also referred to as the Clovis fluted point. 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 (Ritchie 1969). 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. Most of the oldest known evidence of human settlement in Maryland is based on the discovery of fluted points found in surface and shallow deposits throughout the state. Archaeologists hypothesize that the people of this period ranged across the state in small bands that followed migratory game. Early Paleoindian settlers likely used the Clovis fluted point technology to hunt large game such as mastodon, caribou, stag-moose, giant beaver, and California condor. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch) (Ritchie 1969, Laub 2000, Robinson 2011, Wesler 1983).

Archaic Period (10,000 – 3,000 B.C.)

During the Archaic Period, American Indian peoples lived in small family-based units throughout present day Maryland. As the climate warmed, ice sheets retreated into modern day Canada, flora and fauna presently found in Maryland began to be established, and the environment became increasingly more habitable for human groups and community formation. Like the Paleoindians that preceded them, Archaic Period people were hunter-gathers whose diet consisted of wild plants and animals. They traded soapstone (steatite) with people in other regions of northeastern United States (Shaffer 2008). They used this material to make cooking utensils, pipes, and beads. The people of the Archaic period exploited the resources found in the Chesapeake Bay area. They formed camps away from the Bay area to avoid being periodically inundated by rising water (Chesapeake Bay Program 2012, Wesler 1983).

As presented in the sections below, the Archaic Period is subdivided into the stages of cultural development — Early, Middle, and Late — largely defined by the warming climate, expanding food resources, increasing populations, and the development of sociocultural traditions from contact with other groups through travel or trade (Ritchie 1969, Levine 2004).

In the Early Archaic Stage, trees that thrived in cold climates, such as spruce, and deciduous trees, such as oak, chestnut, and maple, were gradually replacing the existing pine and hemlock forests. The semi-nomadic people of this stage began to populate the Maryland area (Chesapeake Bay Program 2012, Stewart 1982). There is evidence of tools being produced from soapstone in Maryland, and prehistoric soapstone (steatite) quarries have been discovered by archaeologists in Maryland (e.g., the Orr Prehistoric Steatite Quarry, site HA-1227) (Spencer and Ballweber 1991, Shaffer 2008).

By the Middle Archaic Stage, the climate in Maryland and the greater northeastern region had moderated enough to support a forest environment with conditions similar to those that exist today. The region had an abundance of food sources, including wild game, fowl, nuts, berries, tubers, roots, and herbs, which supported growing populations of semi-nomadic peoples. Very little is known about the people from this period and the majority of undocumented sites are likely covered by the rising waters of the Chesapeake Bay and the Atlantic Ocean (Lowrey and Martin 2009). Stone tools were manufactured during the Middle Archaic Period in Maryland, and evidence has been recorded along the Stanley River (Wesler 1983). Nearly all of the projectile points from this period have been recorded in the Piedmont and Great Valley of

Maryland, and rhyolite had been replaced by other types of stone used for the manufacturing of tools (Stewart 1987, Spencer and Ballweber 1991).

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

The main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which spread northward from its origins during the late Archaic from the coastal Southeast to Maryland and elsewhere (Sassaman 1998). People of this period began to settle down and become more sedentary. They began building small villages or hamlets and implementing small-scale agriculture practices. The people were re-using previous sites, which may be an indication that there were seasonal migrations occurring by this period (Chesapeake Bay Program 2012, Stewart 1995).

There is a continuous shift towards a more sedentary lifestyle into the Middle Woodland period, and societies were becoming more complex. Reliance on shellfish and other estuarine species continued to increase throughout the Middle Woodland and into the Late Woodland. Trade amongst other people throughout the region began to increase and this is evident from the non-local materials that have been discovered in Maryland (Stewart 1995).

By the Late Woodland Stage, the archaeological record indicates a change of diet that resulted from a permanent shift to sedentary lifestyles for people in present day Maryland. Cultivation of crops such as maize were beginning to develop. Societies were more permanent as opposed to the use of base or seasonal camps (Custer 1994).

7.1.11.5. Federally Recognized Tribes of Maryland

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are no federally recognized tribes in Maryland (NRCS, 2015e) (GPO, 2010). Figure 7.1.11-3 presents the general locations of tribes that were known to exist in this region of the United States, but are not officially federally recognized.

7.1.11.6. Significant Archaeological Sites of Maryland

As previously presented in Section 7.1.11.3, there are 59 archaeological sites in Maryland listed on the NRHP. Table 7.1.11-2 lists the names of the sites, the city they are closest to, and type of each site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites can be found on the NPS NRHP website at http://www.nps.gov/nr/.

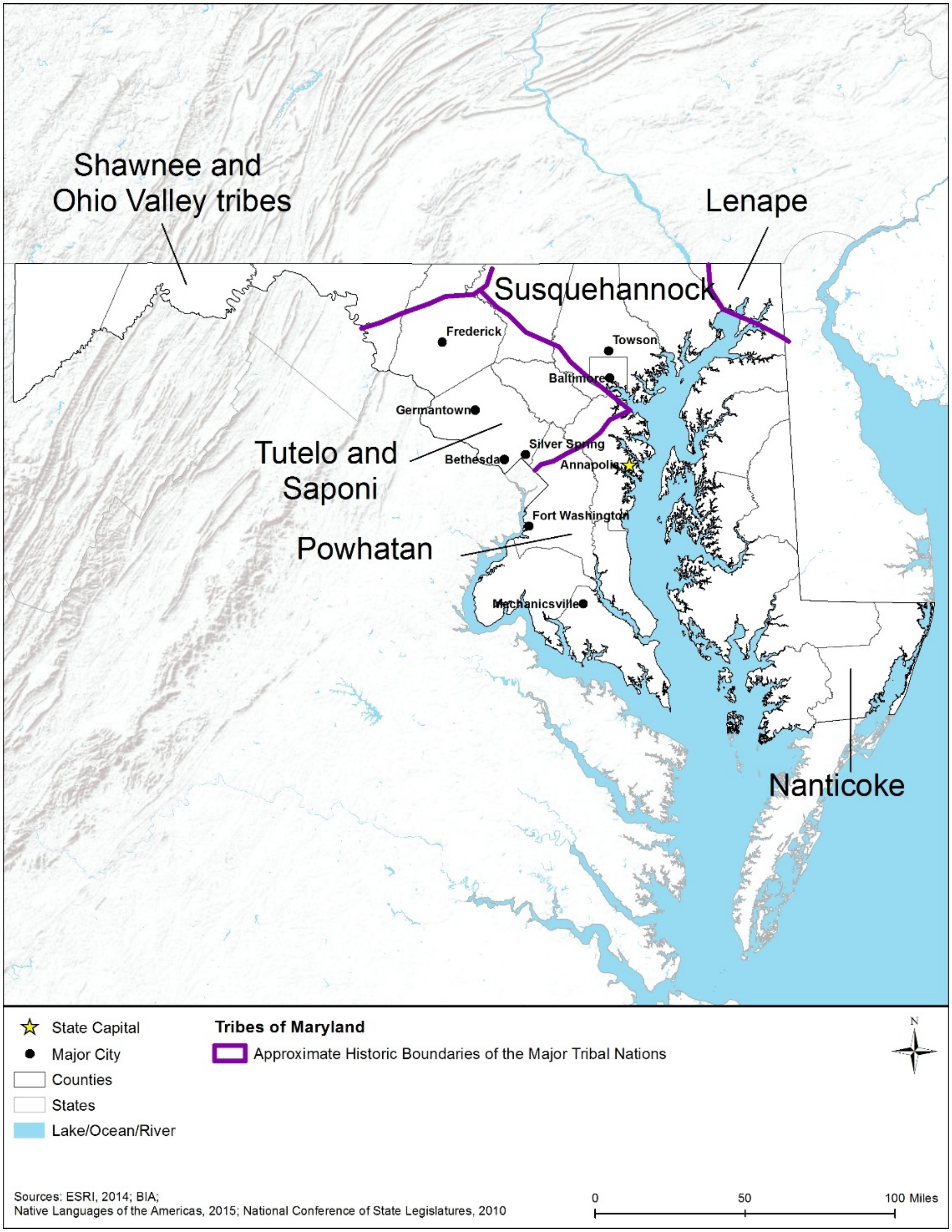


Figure 7.1.11-3: Native American Tribes in Maryland (not federally recognized)

Note: Although not depicted on the map, the Pamunkey Tribe of Virginia was federally-recognized in July 2015; they are believed to have had a presence in southern Maryland as evidenced by the area known as “Pomonkey” in Charles County, MD. The Pamunkey tribe were part of the Powhatan Confederacy.

Maryland State Cultural Resources Database and Tools

Maryland Inventory of Historical Properties (MIHP)

The Maryland Inventory of Historic Properties is a research and documentation instrument that serves as an archive of information to further the understanding of the State's architectural, archeological, and cultural resources. To date, the MIHP is comprised of nearly 90,000 resources, including archaeological sites, buildings, structures, objects, and survey districts. The Maryland Inventory should not be confused with the NRHP, the Maryland Register of Historic Properties, or local lists of locally-designated historic resources, although resources listed in all of the above categories are included in the Maryland Inventory. Maintained by the Maryland State Archives, users may access the website at http://mdihp.net/.

Maryland Historical Trust (MHT)

The Maryland Historical Trust (MHT) is the state agency dedicated to preserving and interpreting the legacy of Maryland's past. Through research, conservation, and education, MHT assists the people of Maryland in understanding their historical and cultural heritage. Part of the Maryland Department of Planning, MHT serves as Maryland's SHPO pursuant to the National Historic Preservation Act of 1966. In addition to its administrative office in Crownsville, MHT includes the Jefferson Patterson Park & Museum in St. Leonard, Maryland, which houses the Maryland Archaeological Conservation Laboratory. The agency provides multiple cultural resources on their website (http://mht.maryland.gov/home.shtml) (MHT, 2015d).

Table 7.1.11-2: Archaeological Sites on the NRHP in Maryland

Closest City	Site Name	Type of Site
Accokeek	Piscataway Park	Historic
Accokeek	Accokeek Creek Site	Prehistoric
Annapolis	Burle's Town Land	Historic
Annapolis	Fort Nonsense	Historic - Military
Annapolis	Martins Pond Site	Prehistoric
Antietam	Antietam Iron Furnace Site and Antietam Village	Historic
Baltimore	Arundel Cove Archaeological Site	Prehistoric
Baltimore (Independent City)	Fort McHenry National Monument and Historic Shrine	Historic - Military
Berlin	Buckingham Archeological Site	Prehistoric
Buckeystown	Buckingham House and Industrial School Complex	Prehistoric
Cambridge	Brinsfield I Site	Prehistoric
Clinton	Woodyard Archeological Site	Historic
College Park	National Archives Site	Prehistoric
Crofton	Katcef Archeological Site	Prehistoric
Crystal Beach	Grear Prehistoric Village Site	Prehistoric

Closest City	Site Name	Type of Site
Cumberland	Barton Village Site	Historic - Aboriginal, Prehistoric
Cumberland	Folck's Mill	Historic - Military
Davidsonville	Beck Northeast Site (18AN65)	Prehistoric
Dickerson	Monocacy Site	Historic, Prehistoric
Easton	Wye House	Historic
Easton	Doncaster Town Site	Historic
Eldorado	Willin Village Archeological Site	Prehistoric
Elkridge	Elkridge Site	Prehistoric
Elkton	Bumpstead Archeological Site	Prehistoric
Elkton	Heath Farm Camp Archeological Site	Prehistoric
Elkton	Heath Farm Jasper Quarry Archeological Site	Prehistoric
Elkton	Iron Hill Cut Jasper Quarry Archeological Site	Prehistoric
Elkton	McCandless Archeological Site	Prehistoric
Emmitsburg	Shoemaker III Village Site	Prehistoric
Frederick	Monocacy National Battlefield	Historic - Military
Frederick	Biggs Ford Site	Prehistoric
Frederick	L'Hermitage Slave Village Archeological Site	Historic
Hagerstown	Antietam Furnace Complex Archeological Site	Historic
Harwood	Skipworth's Addition	Historic
Joppatowne	Old Joppa Site	Historic
Kalmia	Husband Flint Mill Site	Historic
Lexington Park	Mattapany-Sewall Archeological Site	Historic
Oakland	Hoye Site	Prehistoric
Ocean City	Sandy Point Site	Prehistoric
Oldtown	Shawnee Old Fields Village Site	Historic - Aboriginal
Pasadena	Magothy Quartzite Quarry Archeological Site	Prehistoric
Perryville	Principio Furnace	Historic
Poolesville	Walker Prehistoric Village Archeological Site	Prehistoric
Port Deposit	Snow Hill Site	Historic
Princess Anne	Somerset Academy	Historic
Riva	Aisquith Farm E Archeological Site	Prehistoric
Rose Haven	Old Colony Cove Site	Prehistoric
Sharpsburg	Antietam National Battlefield	Historic - Military
Snow Hill	Nassawango Iron Furnace Site	Historic
St. Leonard	Patterson Archeological and Historic District	Historic, Prehistoric
St. Mary’s City	St. Mary’s City Historic District	Historic
Stevenson	Fort Garrison	Historic - Military
Tilghman	Paw Cove Site	Prehistoric
Towson	Hampton National Historic Site	Historic
Tuscarora	Nolands Ferry I Archeological Site (18FR17)	Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Upper Marlboro	Nottingham Site	Prehistoric
Westernport	Meyer Site	Prehistoric
Whiteford	Broad Creek Soapstone Quarries	Prehistoric
Mallows Bay	Mallows Bay Archaeological and Historic District	Shipwreck

Source: (NPS, 2014a)

7.1.11.7. Historic Context

Maryland was first settled in 1634, after a proprietary charter was granted to Cecil Calvert, the second Lord Baltimore. Charles Calvert, the first Lord Baltimore, lobbied King Charles I for the right to establish a Catholic colony in the Mid-Atlantic, but died before the charter was granted. On March 27, 1634, the Ark and the Dove, two ships carrying settlers to the new colony, landed at St. Clement's Island, about 20 miles up the Potomac River from where St. Mary's City would be established as the first permanent settlement. In addition to extracting a profit from the new colony, the Calverts, who were themselves Catholic, hoped to create a colony that would allow Catholics to worship free from persecution. Maryland was not officially established as a Catholic colony; rather, most Christian sects were permitted to practice their respective faiths (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). In the mid-17th Century, Jesuit priests established the first permanent Catholic churches in Maryland; the church in St. Mary's City has now been reconstructed for interpretation (Historic St. Mary's City, 2015).

Much of the 17th and 18th Centuries were defined by political and civil conflict stemming from tensions between Catholic and Protestant colonists. In 1689, following the Glorious Revolution in England, the Calvert family's proprietary charter was revoked and the colony was brought under direct control of England. In 1692, Protestantism was established as the colony's official religion, Catholics lost the right to vote, and in 1697, the capital was moved to Annapolis (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). Catholics were forced to convert to Protestantism or practice privately, leading to the construction of private chapels, such as that which still in exist at the house His Lordships Kindness (The Maryland-National Capital Park and Planning Commission, 1993). Maryland was primarily agricultural and produced a great deal of tobacco, both for domestic consumption and export to Europe. Early settlement occurred primarily around the Chesapeake Bay, particularly in what are now St. Mary's, Charles, Calvert, Prince George's, and Anne Arundel Counties (Brugger, Requardt, Cottom, Jr., & Hayward, 1988).

In 1715, proprietary rights were restored to the Calverts, with Benedict Leonard Calvert, fourth Lord Baltimore, becoming governor of Maryland. In 1729, the city of Baltimore, which would eventually become the largest city in the state, received its charter. No major battles occurred in Maryland during the American Revolution; however, Marylanders were heavily involved in the conflict. Following the war, Annapolis temporarily became the nation's capital and General George Washington resigned his military post in the Maryland State House. Along with Virginia, Maryland ceded the land for the creation of Washington, D.C. in 1791. During the War of 1812, heavy fighting occurred in Maryland, including the bombardment of Fort McHenry, which inspired Francis Scott Key's writing of the Star Spangled Banner, and the Battle of

Bladensburg (1814), which ultimately allowed British troops to advance and burn the capital city (Brugger, Requardt, Cottom, Jr., & Hayward, 1988).

During the first half of the 19th Century, Maryland remained fairly rural and heavily involved in agricultural and maritime activities. The C&O Canal and the Baltimore & Ohio (B&O) Railroad were both started in 1828 as early inland transportation improvements that would foster economic development and settlement throughout the state. During the Civil War, Maryland remained in the Union, but also remained a slave state. Several major battles occurred in Maryland, including Monocacy and Antietam. Antietam was one of the bloodiest battles of the conflict, and it was after the Battle of Antietam that President Lincoln issued the Emancipation Proclamation (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). In 1865, following his assassination of President Lincoln, John Wilkes Booth fled into Prince George's County, collecting supplies at the house of Mary Surratt, and through Charles County before he was ultimately killed after crossing the Potomac River and entering Virginia. Marry Surratt was hanged for her role in the Lincoln assassination, and her house is now interpreted historically.

During the late 19th and early 20th Centuries, further transportation improvements allowed for increased settlement of the more rural western areas of the state. Many mills shifted from water to steam power, allowing for greater flexibility with respect to locating these facilities. In western Maryland, coal production grew in importance, becoming a major export, while the areas around Baltimore were more deeply involved with heavy industry and maritime activities such as ship building, fishing, and oyster harvesting. On the eastern shore, beach-related tourism grew in popularity, with Ocean City becoming a major vacation destination that included examples of Gilded Age architecture (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). In 1909, in College Park, just outside of Washington D.C., what is now the College Park Airport was used for early pilot training with the Wright A, "the Army's first 'official' airplane" (Pedrotty, Webster, & Chmiel, 1999).

During World War I (WWI), Baltimore produced goods for the war, including ships and uniforms. Maryland's population grew during this time, especially in Montgomery Country and Prince George's County (which immediately surround Washington, D.C.), due to the need for people to support the war effort within the capital (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). During the Great Depression, Maryland benefited from many New Deal programs. A notable example is the construction of Greenbelt, a planned community in Prince George's County. When it was built, Greenbelt was fairly controversial, as people felt that the government should not affect the way communities are planned. During World War II (WWII), Marylanders once again produced goods for the war effort, with ship production again being key. Following WWII, many Marylanders left the cities in favor of a suburban lifestyle (Brugger, Requardt, Cottom, Jr., & Hayward, 1988). Baltimore suffered most heavily from this trend. Maryland continues to experience suburban development, especially in the areas around Washington D.C., such as Prince George's County.

Maryland has 1,533 NRHP listed sites, as well as 72 NHLs (NPS, 2014a). Maryland contains two National Heritage Areas, the Journey through Hallowed Ground National Heritage Area and the Baltimore National Heritage Area (NPS, 2015n). Additionally, the state recognizes 12 State

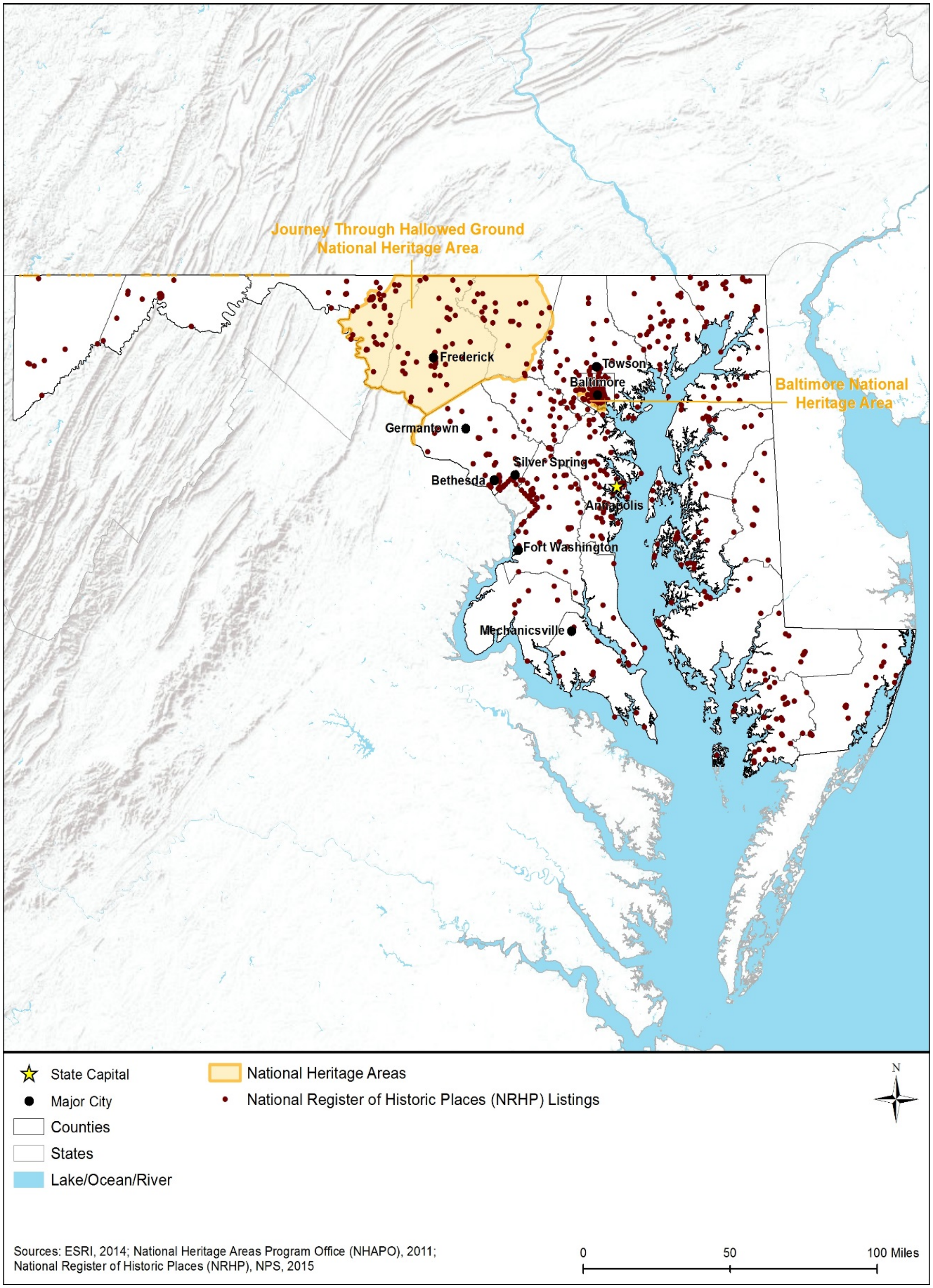


Figure 7.1.11-4: National Heritage Areas (NHA) and NRHP Sites in Maryland

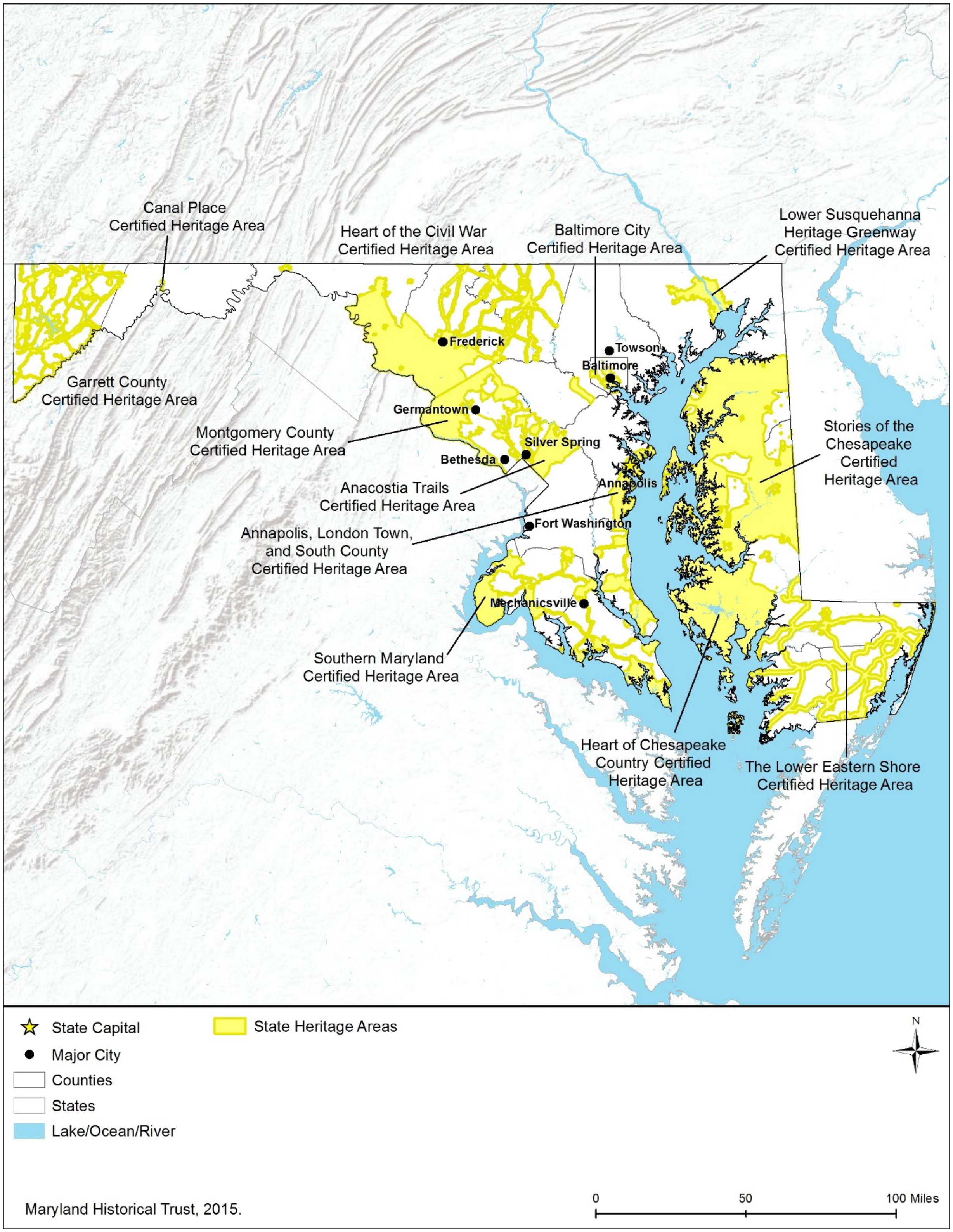


Figure 7.1.11-5: State Heritage Areas in Maryland

Heritage Areas (MHT, 2015d). Figure 7.1.11-4 shows the locations of NHAs and NRHP sites within the state of Maryland, while Figure 7.1.11-5 shows the locations of State Heritage Areas.[129]

7.1.11.8. Architectural Context

The earliest forms of European architecture in Maryland date to the 17th Century and replicated English architectural traditions brought by colonists. Many of these traditions were quickly abandoned or adapted to fit the demands of life in the colonies. Early buildings were constructed quickly in a utilitarian manner, as immediate shelter was important to survival (Carson, The Chesapeake House: Architectural Investigation by Colonial Williamsburg, 2013). Tobacco, which was the primary crop, also required farmers to change fields as soil became exhausted quickly. As a result, buildings were sometimes abandoned in favor of new construction near a newly planted field, providing less of an incentive to construct long lasting structures (Carson, Barka, Kelso, Stone, & Upton, 1981). Early architecture was usually post-in-ground construction, often times with only one or two rooms and a loft for sleeping. Wood was plentiful (as stone was unavailable in most settled areas within the coastal plain) and buildings were usually wood-framed with traditional techniques; some structures were later bricked over as owners sought to display their prosperity (Carson, The Chesapeake House: Architectural Investigation by Colonial Williamsburg, 2013).

In the early 18th Century, Georgian architecture became popular, bringing with it a sense of symmetry and formalism. House façades usually comprised a central doorway with one or two windows on either side. Houses ranged from one to two stories in height and included decorative dentil molding along the eaves. Early structures often left framing members exposed on the interior, while later structures employed carved paneling and molding (Lanier & Herman, 1997). Decorative brick patterning was common in high style Georgian houses, similar to examples found in New Jersey and Delaware; particularly on the eastern shore. Melwood Park (1711-1714), located in Prince George’s County, is an example of early Georgian style, while Whitehall, located in Annapolis, is a more evolved example of a three-part plan Georgian style house (Worthington, 2014). Following the American Revolution, the Federal style became popular, and details became lighter and more refined. As with the Georgian style, Federal architecture was adapted to fit both rural and urban needs (Lanier & Herman, 1997). Examples of both Georgian and federal architecture are common throughout the eastern portions of the state, particularly in St. Mary’s, Charles, Calvert, Prince George’s, and Anne Arundel Counties.

Greek Revival architecture became popular in the second quarter of the 19th Century, marking a break from previous architectural styles. Buildings were designed to resemble Greek temples, with wide friezes along cornice line and large porch pediments. In the mid-19th Century, Gothic Revival became popular, especially in rural areas where it fit with natural and picturesque settings. Also growing popular in the mid-19th Century, Italianate can be recognized by its bracketing, shallow roof pitch, and cupolas. Other Victorian-styles such as Second Empire, Queen Anne, and Stick and Shingle (to a lesser degree), were common during the late 19th and

[129] See Section 7.1.7.4 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

early 20th Centuries. Colonial Revival architecture became popular early in the 20th Century and remained so up through the middle of the 20th Century. In the 1930s and 1940s, bungalows were common, often executed in a Craftsmen style, while minimal traditional houses became popular following WWII as an affordable means to house returning veterans (Lanier & Herman, 1997).

Maryland experienced an explosion of suburban development following WWII, and this trend continues today. In the 1950s and 1960s, many houses were built in Mid-Century styles including ranch houses (“ramblers”) and split-levels. These housing developments were accompanied by commercial suburban developments as people and businesses continued to move out of the cities. Today, historic homes in rural areas of the state, Prince George’s County being a prime example, are threatened by suburban development activities of both a residential and commercial nature (The Maryland-National Capital Park and Planning Commission, 2010).

Other building types found in Maryland, include commercial, institutional, and industrial resources. Maryland contains a host of church buildings, in both rural and urban settings, including multiple private Catholic chapels associated with Maryland’s early Catholic heritage, and the persecution of Catholics following the establishment of Protestantism as the state religion (Hardy, 1993). Maryland’s cities, Annapolis and Baltimore in particular, contain historic commercial, institutional, and industrial buildings ranging in date from the 18th Century up through the 20th Century. Historic educational facilities can be found throughout the state, such as the Naval Academy in Annapolis. Other facilities can also be found throughout the state, including mill-related architecture, such as the Oella Mill near Ellicott City; transportation facilities, such as the C & O Canal stretching from Cumberland into Georgetown in Washington, D.C.; and maritime resources, such as those found in Annapolis and Chestertown. Figure 7.1.11-6 portrays examples of architectures of Maryland buildings and facilities.

Figure 7.1.11-6: Representative Architectural Styles of Maryland

Top Left – Chesapeake and Ohio Canal – (National Photo Company, 1925)
Bottom Left – Whitehall (Annapolis, MD) – (Historic American Buildings Survey, 1933a)
Top Center – Greenbelt Community (Greenbelt, MD) – (Rothstein, 1938)
Bottom Center – Burnside Bridge (Sharpsburg, MD) – (Historic American Landscapes Survey, 2000)
Right – Maryland State House (Annapolis, MD) – (Historic American Buildings Survey, 1933b)

7.1.12. Air Quality

7.1.12.1. 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[130] 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)[131] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[132] This section discusses the existing air quality in Maryland. The USEPA designates areas within the United States as attainment,[133] nonattainment,[134] maintenance,[135] or unclassifiable[136] 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.

7.1.12.2. 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 establish various standards, either primary[137] or secondary,[138] 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 MD Appendix B, Table B-1.

[130] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[131] Equivalent to 1 milligram per liter (mg/L).
[132] 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, 2015ai)
[133] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015aj)
[134] 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, 2015aj).
[135] 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, 2015aj)
[136] 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, 2015aj)
[137] 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, 2014a)
[138] 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, 2014a)

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 solvents) (USEPA, 2011). 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. Maryland Appendix B, Table B-2, presents a list of federally regulated HAPs.

Maryland adopted the NAAQS, but also has additional state-specific standards for fluorides (see Table 7.1.12-1) (Maryland Division of State Documents, 2015d).

Table 7.1.12-1: Maryland Ambient Air Quality Standards for Fluorides

Pollutant	**Averaging Time**	**Primary Standard**		**Secondary Standard**	
		μg/m³	**ppm**	**μg/m³**	**ppm**
Fluorides (Gaseous)	24-hour	1.2	-	-	-
	72-hour average	0.4	-	-	-

Source: (Maryland Division of State Documents, 2015d)

Title V Operating Permits/State Operating Permits

Maryland 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, 2015ak). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015ak). COMAR 26.11.03 describes the applicability of Title V operating permits (MDE, 2015p). Maryland 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 7.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 7.1.12-2: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014b)

Exempt Activities

Select activities, as defined by COMAR 26.11.02.10, are exempt from the registration and permitting provisions identified in COMAR 26.11.02:

- "…Fuel-burning equipment and space heaters using gaseous fuels or No. 1 or No. 2 fuel oil with a heat input less than 1,000,000 Btu (1.06 gigajoules) per hour…;
- Stationary internal combustion engines with an output less than 500 brake horsepower (373 kilowatts) and which are not used to generate electricity for sale or load shaving…;[139]
- Other installations if:
  - The proposed installation is not subject to any source-specific State or federal limitation or emissions standard, including any mass emissions rate limitation, pollutant concentration limitation, material formulation standard, equipment performance standard, or work practice standard;
  - The emissions contain not more than 1 pound per day of a Class I toxic air pollutant" (See MD Appendix B); and
  - "The pre-control potential-to-emit from the proposed installation, combined with any potential increase in emissions from other installations that could be caused by the proposed installation, is less than 1 ton per calendar year for:
    - Volatile organic compounds;
    - Each pollutant for which there is a federal ambient air quality standard; and
    - Each Class II toxic air pollutant (See MD Appendix B), as defined in COMAR 26.11.15.01B(5)." (Maryland Division of State Documents, 2015e)

Temporary Emissions Sources Permits

COMAR 26.11.03.22 defines a temporary emission source as "… a Part 70 source[140] that the applicant intends to relocate from one site to another site at least once during the term of the permit…"

- The Department may issue a single Part 70 permit for the operation of a temporary source. Part 70 permits for temporary sources include:
  - "…Conditions to assure compliance with all applicable requirements of the Clean Air Act at all authorized sites;
  - A requirement that the owner or operator notify the Department at least 10 days in advance of each change in site;
  - State-only enforceable conditions that assure compliance with all other applicable requirements of the State air pollution control law; and
  - Conditions that assure compliance with all other provisions of this regulation…" (Maryland Division of State Documents, 2015a)

State Preconstruction Permits

- An entity must obtain a preconstruction permit from MDE prior to commencing construction or modification to any major stationary source or source in an attainment area. Maryland's

[139] Load shaving unit: "an engine that operates for other than an emergency to generate electricity for use on-site of for sale." (MDOT, 2015a)

[140] Part 70 source: A stationary source required to have a Title V Operating permit pursuant to COMAR 26.11.03.01 that may contain one or more emission units (Maryland Division of State Documents, 2015c). The Maryland COMAR regulation only contains language for issuing temporary emission source permits for Part 70 sources.

preconstruction permit program applies to any major stationary source and modification to the source in an attainment area or area unclassifiable for any NAAQS pursuant to §107 of the CAA (42 U.S.C. 7407) when it would violate the NAAQS (Maryland Division of State Documents, 2015b).

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 (GPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[141] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 7.1.12-3).

Table 7.1.12-3: De Minimis Levels

Pollutant	Area Type	Tons per year
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 ozone transport region	100
	Maintenance	100
CO, Sulfur Dioxide (SO_2), Nitrogen Dioxide (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: (GPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 7.1.12-3, 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 7.1.12-3, then the

[141] Small amount or minimal

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[142], 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;
- 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, 2010).

State Implementation Plan Requirements

Maryland's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Maryland's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Maryland's SIP actions are codified under 40 CFR 52 Subpart V. A list of all SIP actions for all six criteria pollutants can be found on the MDE website:
http://www.mde.maryland.gov/programs/air/airqualityplanning/pages/programs/airprograms/air_planning/index.aspx (MDE, 2015q).

- Maryland revised their SIP to include preconstruction permitting requirements for $PM_{2.5}$. These requirements comply with the CAA and apply to Maryland's major nonattainment New Source Review Program. The revision became effective as of August 12, 2015 (USEPA, 2015al).

7.1.12.3. 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 7.1.12-1 and Table 7.1.12-4, below, present the current nonattainment areas in Maryland as of January 30, 2015. Table 7.1.12-4 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 the atomic absorption spectrophotometry for that pollutant; note that, for $PM_{2.5}$, O_3, and SO_x, both standards listed are in effect. Unlike Table 7.1.12-4, Figure 7.1.12-1 does not

[142] Conformity: Compliance with the State Implementation Plan.

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.

Table 7.1.12-4: Maryland Nonattainment and Maintenance Areas by Pollutant Standard 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
Anne Arundel						M		X-3	X-4		
Baltimore (City)	M					M		X-3	X-4		
Baltimore						M		X-3	X-4		
Calvert								X-4	X-5		
Carroll						M		X-3	X-4		
Cecil								X-4	X-5		
Charles						M		X-4	X-5		
Frederick						M		X-4	X-5		
Harford						M		X-3	X-4		
Howard						M		X-3	X-4		
Kent								M			
Montgomery	M					M		X-4	X-5		
Prince George's	M					M		X-4	X-5		
Queen Annes								M			
Washington						M					

Source: (USEPA, 2015ao)

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

MDE measures air pollutants at 26 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (MDE, 2015r). Annual Maryland State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. The MDE reports real-time pollution levels of O_3 and $PM_{2.5}$ on their website (http://mde.maryland.gov/programs/Air/AirQualityMonitoring/Pages/index.aspx) to inform the public, as O_3 and $PM_{2.5}$ are the main pollutants of concern in Maryland.

Throughout 2014, O_3 measurements exceeded the federal standard of 0.075 ppm five times at stations across Maryland in Aldino, Davidsonville, Edgewood, Padonia, Prince George's Equestrian Center, and Fair Hill. The greatest exceedance occurred in Fair Hill with 85 ppb (0.085 ppm) (MDE, 2015s). No other criteria pollutants exceed federal standards.

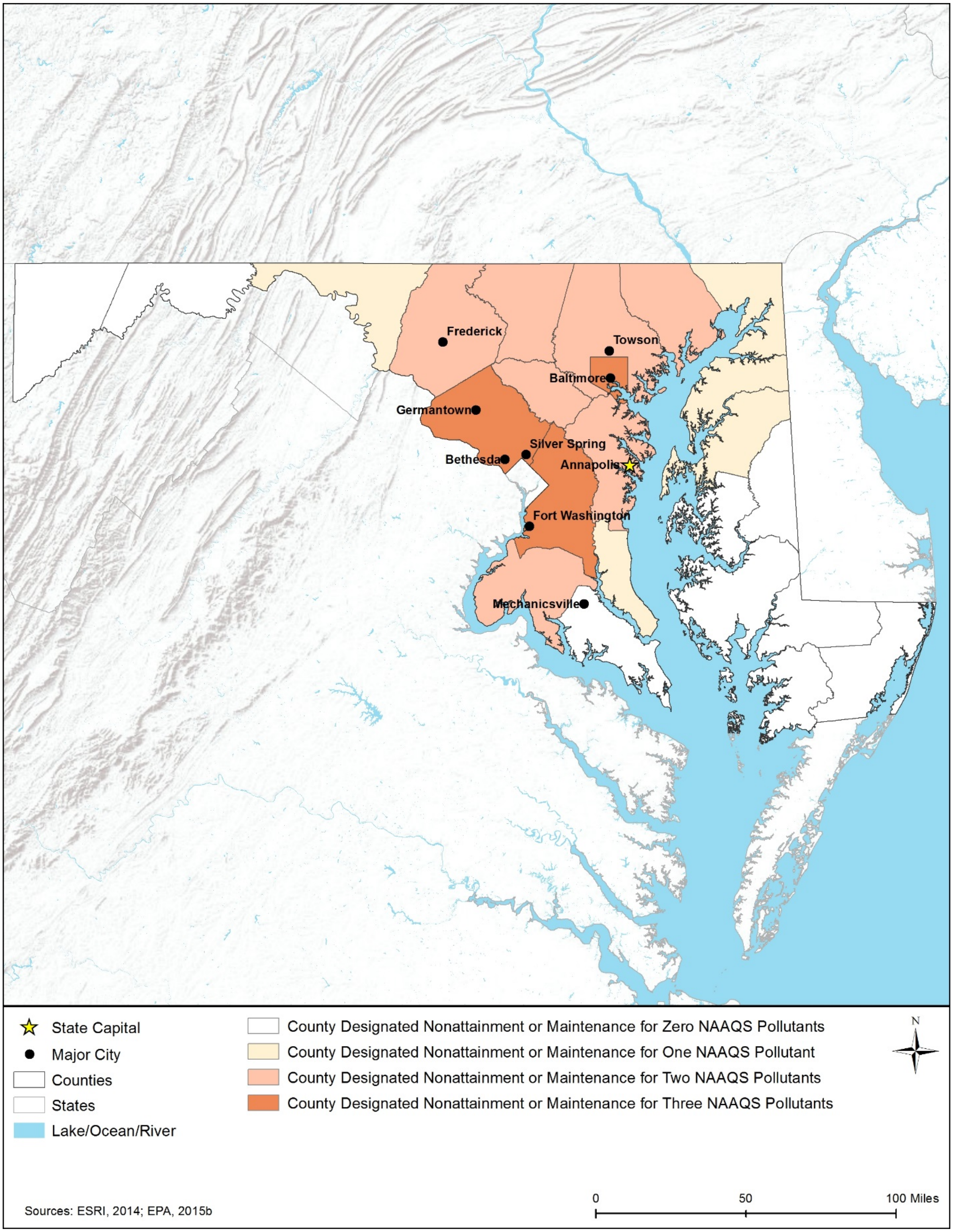


Figure 7.1.12-1: Nonattainment and Maintenance Counties in Maryland

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). 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[143] of a Class I area. "The USEPA'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 USEPA 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[144] (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).
- Maryland does not contain any Federal Class I areas; all land within the state is classified as Class II (USEPA, 2012b). If an action is considered a major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Both Virginia and West Virginia have Class I areas where the 100-kilometer buffer intersects Maryland counties. Any PSD-applicable action within these counties would require FLM notification from the appropriate Regional Office. Figure 7.1.12-2 provides a map of Maryland highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses. The numbers next to each of the highlighted Class I areas in Figure 7.1.12-2 correspond to the numbers and Class I areas listed in Table 7.1.12-5.

[143] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.
[144] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

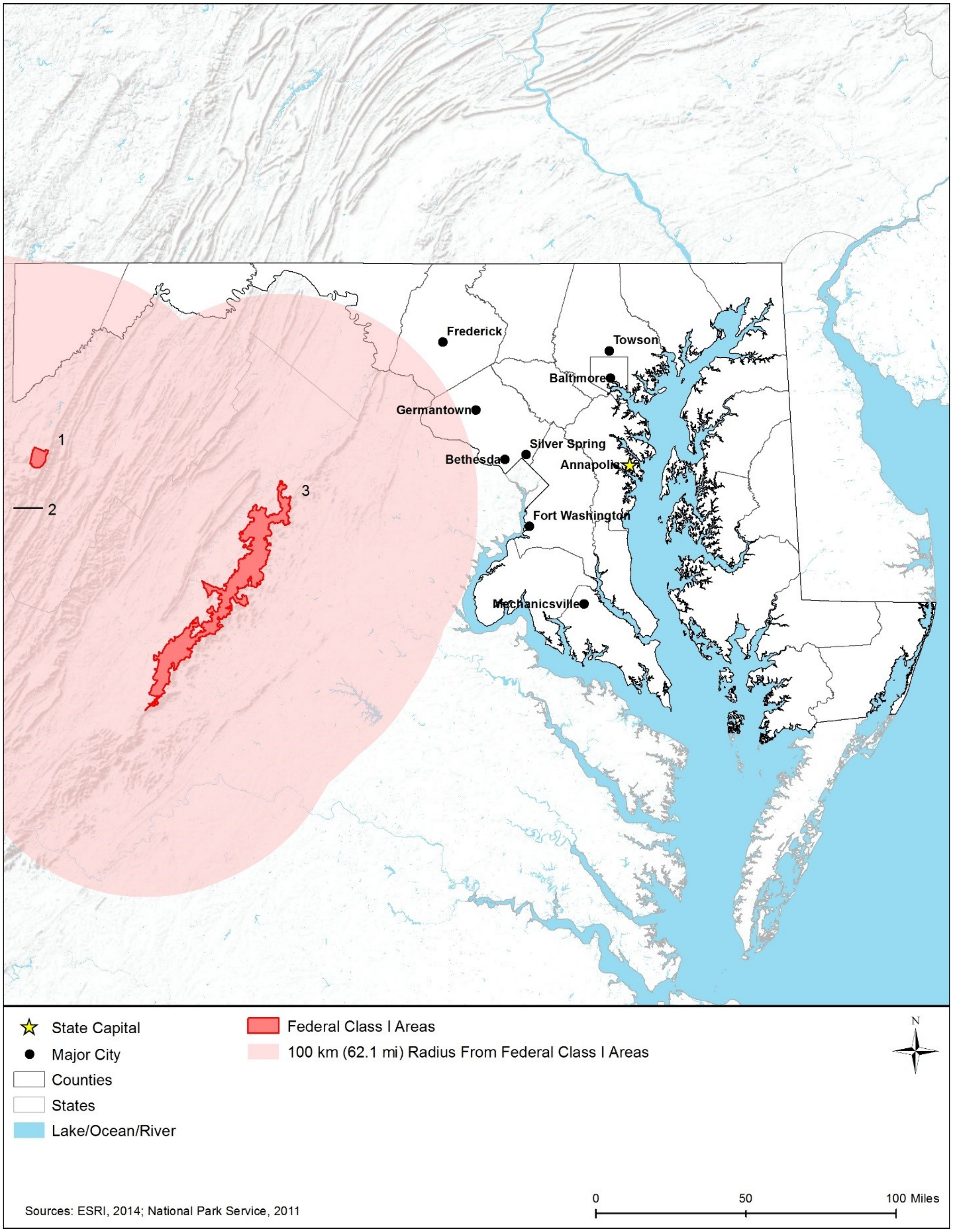


Figure 7.1.12-2: Federal Class I Areas with Implications for Maryland

Table 7.1.12-5: Relevant Federal Class I Areas

#	Area	Acreage	State
1	Dolly Sod Wilderness	10,215	WV
2	Otter Creek Wilderness	20,000	WV
3	Shenandoah National Park	190,535	VA

Source: (USEPA, 2012b)

7.1.13. Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

7.1.13.1. Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012c). 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, 2015c). 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.
- The changes in frequency characteristics or pressure levels through time.

Figure 7.1.13-1 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.

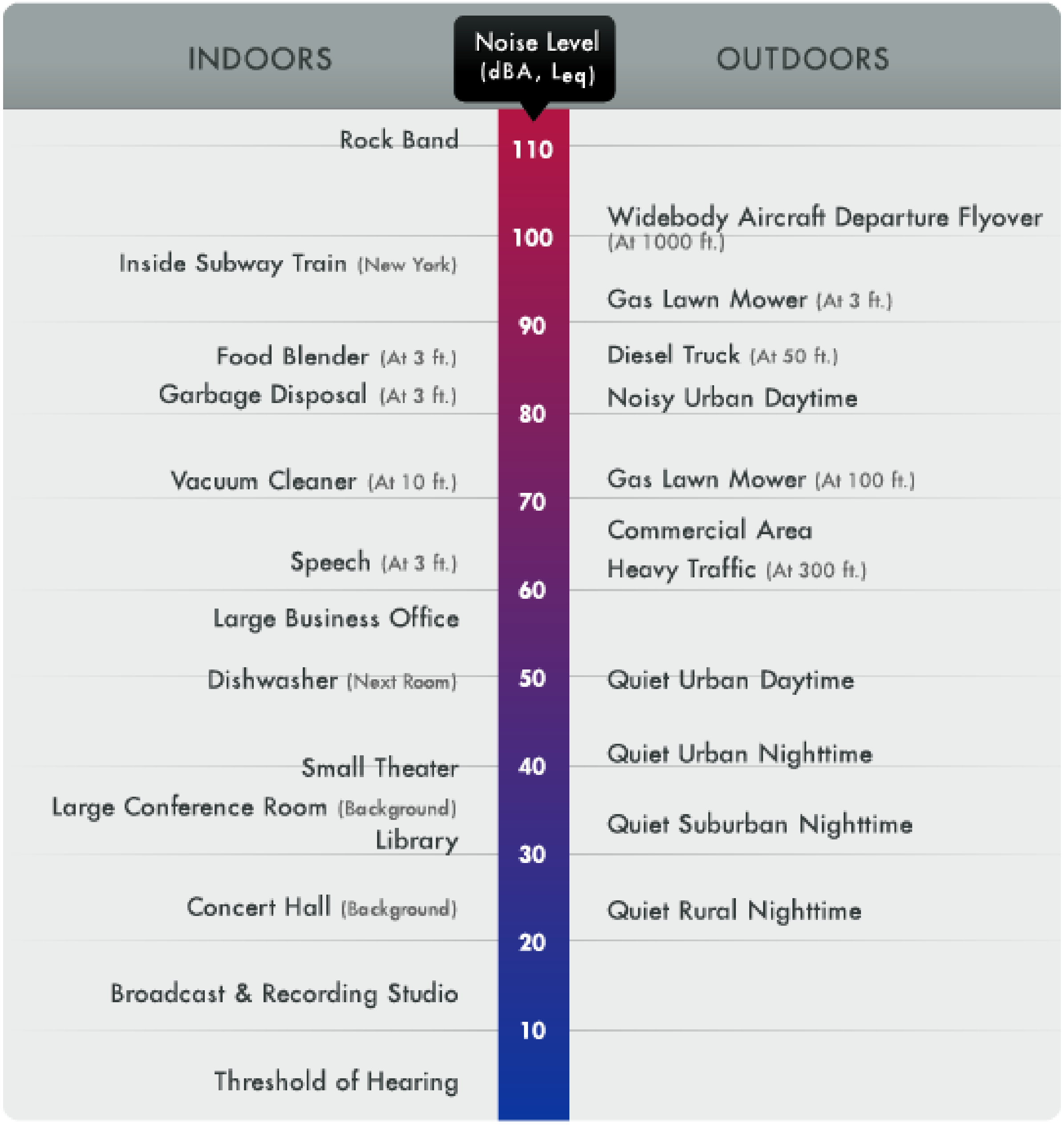


Figure 7.1.13-1: Sound Levels of Typical Sounds

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.

7.1.13.2. 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.

Maryland has statewide noise laws that are governed by MDOT and MDE. Within MDOT, Titles 5, 21, and 22 have provisions that regulate noise related to aviation, roads, and motor vehicles, respectively. Within MDE, Title 3 provides authority to MDE to develop noise limits (State of Maryland, 2015b). In addition to statewide laws, many cities and towns may have local noise ordinances to 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 Baltimore, 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 7.1.13-1 summarized the relevant Maryland laws for noise.

Table 7.1.13-1: Relevant Maryland Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
MDOT Title 21: Rules of the Road	MDOT	Prohibits driving which would result in excessive noise being produced
MDOT Title 22	MDOT	Controls excessive or unusual motor vehicle noise
MDE Title 3	MDE	Gives authority to MDE to set noise limits

Source: (State of Maryland, 2015b)

7.1.13.3. Ambient Noise

The range and level of ambient noise in Maryland varies widely based on the area and environment of the area. The population of Maryland can choose to live and interact in areas that are large cities, rural communities, and national and state parks. Figure 7.1.13-1: Sound Levels of Typical Sounds illustrates noise values for typical community settings and events that are representative of what the population of Maryland may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Maryland. As such, this section describes the areas where the population of Maryland 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) (DOI, 2008). The areas that are likely to have the highest ambient noise levels in the state given their population size and locations near major roadways are Baltimore, Columbia, Germantown, and Silver Spring.

- **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 Maryland, BWI, Salisbury-Ocean City Wicomico Regional (SBY), and Hagerstown Regional-Richard A. Henson Field (HGR) have more than 343,000 annual operations combined, with BWI accounting for approximately 245,000 operations annually (FAA, 2015b). These operations result in increased ambient noise levels in the surrounding communities. See Section 7.1.1.4, Infrastructure, and Figure 7.1.7-5 to Figure 7.1.7-7 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, 2015i). 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, 2015i). See Section 7.1.1.4, Infrastructure, and Figure 7.1.1-1 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 (Federal Railroad Administration, 2015). Maryland has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Washington, D.C. to Frederick, MD; Washington, D.C. to Baltimore, MD; and Washington D.C. to Perryville, MD. There are also a number of other rail corridors that join these major rail lines and connect with other cities (MDOT, 2013b). See Section 7.1.1.4, Infrastructure, and Figure 7.1.1-1 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 with one aspect to "maintain the resilience of the natural soundscape"[145] (Freimund, 2010). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014c). Maryland has 16 National Parks (NPS, 2015o). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 7.1.7, Land Use, Recreation, and Airspace, and 7.1.8, Visual Resources for more information about national and state parks for Maryland.

7.1.13.4. 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 Maryland 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 Maryland.

7.1.14. Climate Change

7.1.14.1. 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

[145] A soundscape is the acoustic environment that encompasses an area, and includes natural and human/manmade sounds.

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 (MDNR, 2015e). 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[146]), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tonnes (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "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 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (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, are considered in this PEIS (see Section 7.2, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses 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).

7.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. Maryland has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 7.1.14-1, three key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

[146] CO_2e 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 of carbon dioxide equivalents ($MMTCO_2e$). 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, 2015an)

Table 7.1.14-1: Relevant Maryland Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
EO 01.01.2014.14: Strengthening Climate Action in Maryland	Maryland State	EO establishes goal to reduce GHG emissions in Maryland with the development of a plan to achieve an 80% reduction in Maryland's GHG emissions by 2050.
Maryland Greenhouse Gas Reduction Plan	Maryland State (Maryland's General Assembly	Development of a GHG Reduction Plan in order to reduce GHG emissions by 25% by the year 2020.
Maryland Climate Action Plan	Maryland State	Identifies climate change adaptation strategies to address impacts with sea level rise and coastal storms and changes in precipitation patterns and temperature for potential impacts to human health, natural resources, and population growth and infrastructure.

Sources: (MDOT, 2014) (MGS, 2015b) (MDE, 2015s)

In addition, Maryland has established other goals that address various aspects of climate change such as energy consumption. The state initiative "EmPOWER Maryland" has worked to reduce energy consumption by 15 percent by 2015. "To help achieve this goal, the Maryland Department of Environment, Maryland Energy Administration, Maryland Department of Housing and Community Development, the Public Service Commission and all five utilities (Baltimore Gas and Electric [BGE], Delmarva Power, Pepco, Potomac Edison, and Southern Maryland Electric Cooperative) are working together to provide Marylanders with programs that can help lower utility bills and keep money in their pockets." (Maryland: Smart, Green and Growing 2015d) Maryland 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).

7.1.14.3. Maryland Greenhouse Gas Emissions

Estimates of Maryland's total GHG emissions vary based on the source of the estimate. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates data on national-level emissions of 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. The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2016c). 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 PEIS, EIA data on CO_2 emissions from fossil fuels will be used as the benchmark metric in order to ensure consistency and comparability across the 50 states. However, if additional data sources for GHGs are available for a given state, they will be noted and cited. Total CO_2 emissions from fossil fuels for 2013 are presented in Table 7.1.14-2 and Figure 7.1.14-1.

Maryland emissions totaled 57.6 MMT of CO_2 in 2012. Maryland's CO_2 emissions grew steadily year over year from 1990 to a peak of 81.3 MMT in 2005, before declining. Overall, Maryland's GHG emissions declined 17.5 percent, or 12.3 MMT between 1990 and 2013. These declines are led by reductions in emissions from coal-burning power plants, and reductions in petroleum products in the transportation sector (EIA, 2016). Maryland is ranked 34th in the U.S. for CO_2 emissions (EIA, 2015b).

Table 7.1.14-2: Maryland CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	17.3	Residential	6.2
Petroleum Products	29.6	Commercial	4.7
Natural Gas	11.0	Industrial	2.6
		Transportation	27.0
		Electric Power	17.4
TOTAL	**57.9**	**TOTAL**	**57.9**

Source: (EIA, 2015c)

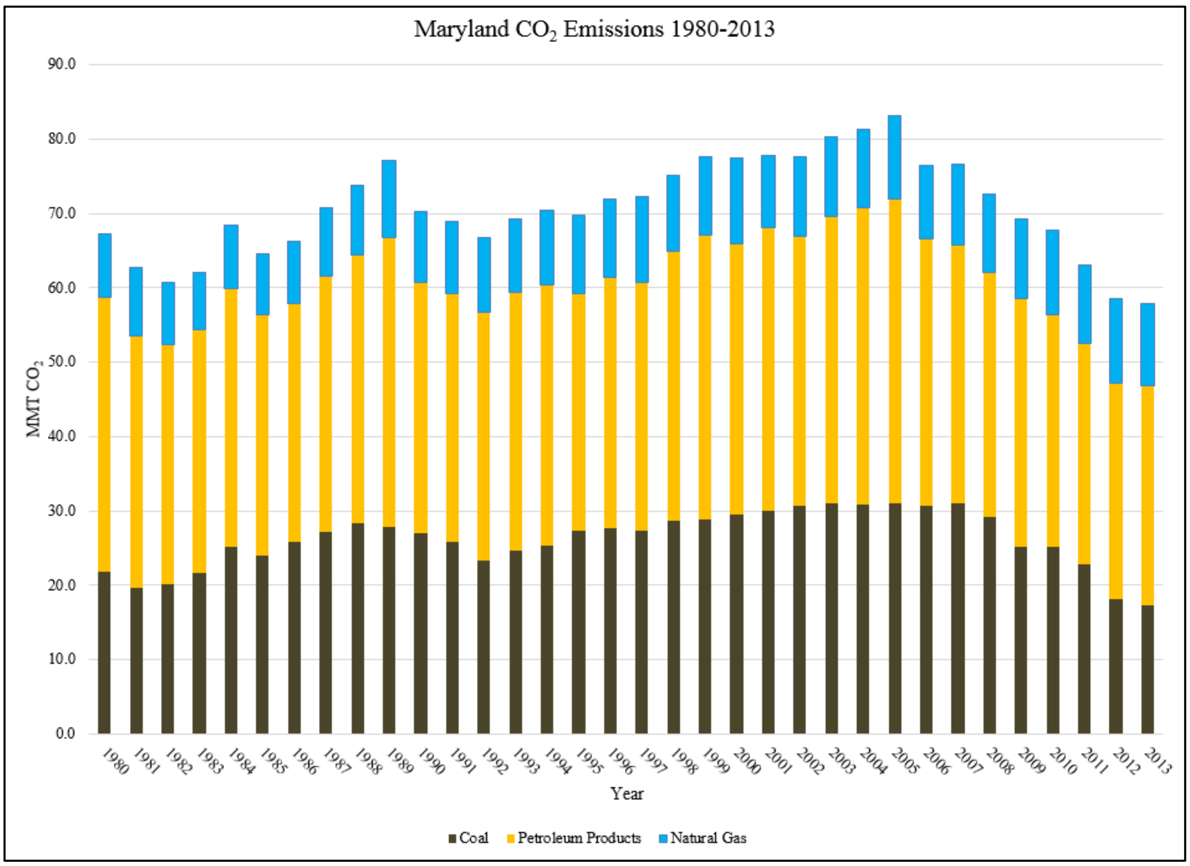


Figure 7.1.14-1: Maryland CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015c)

According to the EIA, Maryland emitted a total of 57.9 MMT of CO_2 in 2013, with transportation being the highest emitter (Table 7.1.14-2) ((EIA, 2015c). Annual emissions between 1980 and 2013 are represented in Figure 7.1.14-1. CO_2 emissions rose and fell between 1980 and 1991, then began a growth period from 1992 to 2005 where they peaked at 81.3 MMT, from which they declined through 2013. Declines were driven largely by reductions in emissions from coal in the electric power sector, and reductions in petroleum products in the transportation sector. Maryland is ranked 34th in the U.S. for total CO_2 emissions, and 44th overall for per capita CO_2 emissions (EIA, 2015b).

Maryland maintains its own GHG inventory which was most recently updated with 2011 data (MDE, 2015o). Maryland's total GHG emissions in 2011 were 99.2 MMT CO_2e, reduced from 107.2 MMT CO_2e in 2006. Total U.S. GHG greenhouse were 6,673 MMT in 2013 (USEPA, 2015ar). The majority of Maryland's GHG emissions is CO_2 resulting from fossil fuel combustion for energy, mostly petroleum from the transportation sector and natural gas for electricity generation as well as heat and hot water in residential and commercial buildings (MDE, 2015o). Maryland acquires the majority of its petroleum, coal, and natural gas from other states. Energy in the state is primarily generated by coal burning power plants. The combustion of natural gas is another major emitter of fossil fuels burned in Maryland primarily in the industrial, residential and commercial sectors (EIA, 2015b).

Other emissions came from agriculture, forestry and waste, and include methane (CH_4) and N_2O, as well as small quantities of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). Other major GHGs emitted in Maryland are methane, nitrous oxide, hydrofluorocarbons sulfur hexafluoride and, perfluorocarbons (MDE, 2015o).

7.1.14.4. 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 temperature characteristics (NWS, 2011b).

Across the U.S., the five most common climate groups are (A), (B), (C), (D), and (E). The majority of Maryland falls into climate group (C) (Figure 7.1.14-2). Climates classified as (C) generally have "warm and humid summers with mild winters" and in winter "the main weather feature is the mid-latitude cyclone" (NWS, 2008a). Also, there are many thunderstorms during summer months. Maryland has one sub-climate category, which is described below.

Sub-climates

(Cfa) – Maryland falls into the climate group (C) (see Figure 7.1.14-2). Climates classified as (C) are generally warm, with humid summers and mild winters (NWS, 2008a). Maryland's secondary classification indicates year-round rainfall, but it is highly variable; convective thunderstorms are dominant during summer months. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2008a). The tertiary classification indicates mild, hot summers with average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F (NWS, 2008b).

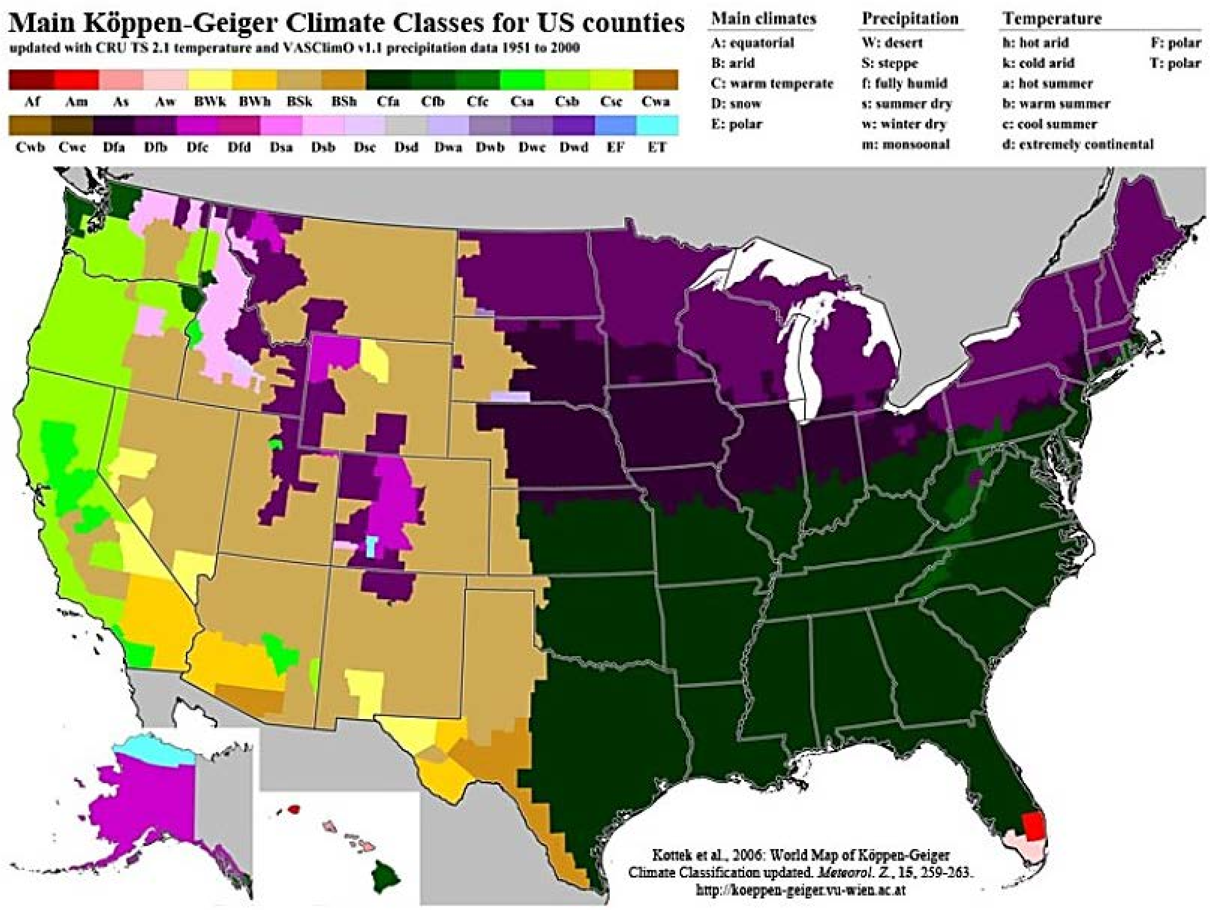


Figure 7.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

This section discusses the current state of Maryland's climate with regard to temperature, precipitation, sea level, stream flow, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in Maryland's climate region, (Cfa).

Air Temperature

Although the entirety of Maryland is classified within the climate classification group (Cfa), there are slight temperature variations within the state. For example, "the eastern region of Maryland is significantly influenced by the Chesapeake Bay and Atlantic Ocean, while the western region of Maryland is influenced by the Appalachian Mountains" (Maryland State Climatologist Office, 2015a). Maryland is also "classified [as] being temperate [in] climate"

(Maryland State Archives, 2015b). “Temperate climates are noted for possessing four distinct seasons” (Maryland State Archives, 2015b).

The following paragraphs describe temperatures in Maryland as they occur within a (Cfa) climate classification zone:

Cfa – Temperatures in Maryland are “fairly mild year round, though temperatures vary between areas of the State” (Maryland State Archives, 2015b). Variations in temperature are generally due to differences in elevation and proximity to the coast. For example, Savage River Dam in Garrett County is approximately 1,495 feet above sea level and has a mean temperature of 26.2 °F during January and other winter months. By comparison, Royal Oak, located on the Eastern Shore, is only 10 feet above sea level, and has a mean temperature of 36.1 °F during January and other winter months (Maryland State Archives, 2015b). “This discrepancy continues in July, the warmest month, when the mean temperatures are 69.7 °F for Savage River Dam, and 78.6 °F for Royal Oak” (Maryland State Archives, 2015b).

Statewide, temperatures in Maryland average 55.1 °F (Maryland State Archives, 2015b). “High temperatures occur in July, the warmest month, averaging in the mid to upper 80s” (Maryland State Archives, 2015b). “Low temperatures in January, the coldest month, average in the low to mid 20s” (Maryland State Archives, 2015b). Since 1871, “the mean temperature for Baltimore has been 54.6 °F” (Maryland State Climatologist Office, 2015b). The highest temperature to occur in Maryland was in July 1898, August 1918, and July 1936, all with a record high of 109 °F. The coldest temperature to occur in Maryland was on January 13, 1912 with a record low of negative 40 °F.

During summer months, “the average temperature is 72.7 °F” (Maryland State Archives, 2015b). “Maryland summers vary from mild to hot, with greater levels of humidity in eastern and southern areas” (Maryland State Archives, 2015b). During winter months, “the temperature averages 34.1 °F” (Maryland State Archives, 2015b). “The Eastern Shore and Southern Maryland remain cool, while western countries experience colder weather, and more snow” (Maryland State Archives, 2015b). “Duration of the freeze-free period averages 185 days, ranging from 130 days in Garrett County to 230 days in southern Maryland and the lower Eastern Shore” (Maryland State Archives, 2015b).

Baltimore, the state capital of Maryland, is within the climate classification group Cfa. The average annual temperature for this area is approximately 55.2 °F (NOAA, 2015g). During winter months, the average annual temperature in Baltimore is 35.1 °F; 74.9 °F during summer months; 53.4 °F during spring months; and 56.8 °F during autumn months (NOAA, 2015g).

Salisbury, located on the Eastern shore of Maryland, is within the climate classification group Cfa. The average annual temperature for this area is approximately 58.4 °F (NOAA, 2015g). During winter months, the average annual temperature in Salisbury is 39.8 °F; 76.6 °F during summer months; 56.6 °F during spring months; and 60.4 °F during autumn months (NOAA, 2015g).

Cumberland, located inland and in western Maryland, is within the climate classification group Cfa. The average annual temperature for this area is approximately 54.9 °F (NOAA, 2015g).

During winter months, the average annual temperature in Cumberland is 34.1 °F; 74.9 °F during summer months; 54.0 °F during spring months; and 56.3 °F during autumn months (NOAA, 2015g).

Precipitation

Although the entirety of Maryland is classified within the climate classification group Cfa, there are slight temperature variations within the state. For example, "the eastern region of Maryland is significantly influenced by the Chesapeake Bay and Atlantic Ocean, while the western region of Maryland is influenced by the Appalachian Mountains" (Maryland State Climatologist Office, 2015a). The following paragraphs describe precipitation in Maryland within a Cfa climate classification zone:

Cfa **–** Topography within the State and proximity to the coast strongly influences the distribution of rainfall. Overall, Maryland has an even distribution of precipitation throughout the year, as there are no distinct wet or dry seasons. The average annual precipitation in Maine is approximately 40.76 inches, with "peaks in July and August when thunderstorms average once every five days" (Maryland State Archives, 2015b). Since 1871, "Baltimore's recorded precipitation has averaged 41.94 inches a year" (Maryland State Archives, 2015b). The highest rainfall accumulation to occur in Baltimore was in 2003, with a total of 62.66 inches (Maryland State Archives, 2015b). The lowest rainfall accumulation to occur in Baltimore was in 1930, with a total of 21.55 inches (Maryland State Archives, 2015b). In addition to rainfall, Maryland commonly experiences abundant snowfall. On average, the state receives 20.6 inches of total snowfall accumulation per year. However, as with rainfall, snowfall varies greatly in accordance with topography and proximity to the coast. For example, snowfall "ranges from 10 inches on the lower Eastern Shore to 110 inches in Garrett County" (Maryland State Archives, 2015b). The greatest annual snowfall accumulation in Maryland occurred at Keyser's Ridge in Garrett County during the winter of 2009 and 2010, with a total accumulation of 262.5 inches (Maryland State Archives, 2015b).

Sea Level

Maryland has approximately 7,719 miles of tidal shoreline "bordering the Chesapeake Bay, its tributaries, the coastal bays, and the Atlantic coast" (MDNR, 2013). Much of this shoreline is at risk for damage from strong winds, heavy rainfall, flooding, and hurricanes. These risks, coupled with sea level rise, make Maryland one of the most vulnerable states to climate change (MDNR, 2013). Since 1900, sea level in Maryland has risen approximately one foot (MDNR, 2013). As sea level continues to rise, the risks associated with living along the coast also rise. In addition to sea level rise, coastal and tidal areas of Maryland are experiencing land subsidence (MDNR, 2013). Further land subsidence is putting already low-lying areas of Maryland at an even greater risk for flooding, storm surges, and inundation (MDNR, 2013).

Severe Weather Events

Hurricanes are common in Maryland, with storms occurring "almost every year, most often in August and September" (Maryland State Archives, 2015b). "High winds, heavy floods, and sometimes flash floods accompany these storms" (Maryland State Archives, 2015b). "Rarely has a hurricane directly hit the State (only twice since recording began in 1851), and never has a major hurricane (category 3 or higher) directly hit" (Maryland State Archives, 2015b). During the winter of 1935 to 1936, heavy snowfall, followed by heavy snowmelt and springtime rainstorms lead to severe and record breaking riverine flooding. The March 1936 flood "reached 17 feet above the C&O Canal towpath level, destroying lock houses and other operational aspects of the canal" (NOAA, 2015h). In addition, "15 feet of water covered Main Street in Hancock, and the bridges crossing the Potomac in Hancock, Harpers Ferry, and Shepherdstown were destroyed" (NOAA, 2015h). This flood resulted in approximately $9.5M in damages throughout the Potomac Basin. In June of 1972, Hurricane Agnes brought 15 inches of rainfall to Westminster (Carroll County) and "Parkton (Baltimore County) recorded nearly a foot of rain in just 48-hours" (NOAA, 2015h). "Numerous smaller streams in the state set record high river levels that still stand today, including the Monocacy River, Patapsco River, northwest Branch Anacostia River, and the Little Patuxent River" (NOAA, 2015h). This storm "crested more than 12 feet above flood stage, but well below the 1936 flood crest" (NOAA, 2015h). This flood resulted in approximately $110M in damages in Maryland and the District of Columbia (NOAA, 2015h).

Nor'easters, sometimes referred to as "White Hurricanes," are Maryland's greatest winter storms (NOAA, 2007). "White Hurricanes" develop when "dense cold air is unable to move west over the Appalachian Mountains and so it funnels south down the valleys and along the Coastal Plain" (NOAA, 2007). "To the east of the cold air is the warm water of the Gulf Stream" (NOAA, 2007). This contrast, between "the cold air sliding south into the Carolinas and the warm air sitting over the Gulf Stream, creates a breeding ground for storms" (NOAA, 2007). According to historical records, "Maryland experiences a strong nor'easter with significant snow on average about once every other year" (NOAA, 2007). In the greatest seasonal snowfall total, Oakland received an estimated 204 inches during the winter of 1995 to 1996 (NOAA, 2007). During the same winter, Frostburg received an estimated 180 inches of total snowfall accumulation (NOAA, 2007). Maryland's biggest storm also occurred in Oakland, between November 12 and 18, 1955 with a total accumulation of 40 inches (NOAA, 2007).

Ice storms are also a common severe weather event throughout Maryland. "In February 1994, a series of ice storms struck Maryland" (NOAA, 2007). "During the February 1994 storms, several inches of sleet (five to seven inches over parts of Frederick, Carroll, and Montgomery Counties) were enough to cause considerable problems on roadways" (NOAA, 2007).

Maryland also commonly experiences "Lake Effect Snow," with concentrated and "significant accumulations over Garrett County and Allegany County west of Cumberland" (NOAA, 2007). "Winds out of the northwest blow across the Great Lakes," and are consequently "warmed by the water beneath" (NOAA, 2007). As evaporation occurs, the amount of humidity in the air is increased. "The warmer, moister air off the lake's surface begins to rise," and "as the air rises, it cools forming clouds and snow" (NOAA, 2007). These snow bands, or "Snow Squalls," move "across Pennsylvania, into the Appalachian Mountains" and into Maryland (NOAA, 2007). "As the air rises up the west side of the Appalachians into areas such as Garrett County, Maryland, the snow intensifies" (NOAA, 2007). In addition to its proximity to the mountains, Garrett

County is also higher above sea level, and therefore commonly experiences temperatures that are 10 degrees colder than other more eastern cities, such as Baltimore (NOAA, 2007). A combination of the "Lake Effect Snow," and the "snow on the west side of the Appalachians" leads to an average accumulation of "over 100 inches of snow per year" (NOAA, 2007). In November 1995, several Lake Effect and upslope snows in Oakland produced a total monthly snowfall accumulation of 58 inches, a Maryland historical record. "Other types of weather systems generally do not cause major problems for Maryland" (NOAA, 2007).

Tornados are also common in Maryland, with an average of "three reported tornados each year, most often occurring between May and July" (Maryland State Archives, 2015b). The most powerful tornado to occur in Maryland was on April 29, 2002 within Calvert and Charles counties. "Briefly reaching F5 status," the tornado "covered more than 30-miles, and had winds in excess of 260 miles per hour (mph)" (Maryland State Archives, 2015b).

7.1.15. Human Health and Safety

7.1.15.1. 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 or, vehicular traffic and, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 7.2.1, Infrastructure.

7.1.15.2. Specific Regulatory Considerations

Federal organizations, such as the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Maryland, occupational safety and health is regulated by the Maryland Department of Labor, Licensing and Regulation, Division of Labor and Industry (MDDLI), and MDE regulates environmental pollution. Federal OSHA regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. Maryland has an OSHA-approved "State Plan," Maryland Occupational Safety and Health (MOSH), which allows for enforcement of public sector occupational safety and health regulations for Maryland state and local employees, through MDDLI. Federal employees, as well as most private sector regulations in the State of Maryland are enforced by OSHA. Health and safety of the general public is regulated by the Maryland Department of Health and Mental Hygiene (MDHMH).

Federal laws relevant to protect occupational and public health and safety are summarized in Appendix C. Table 7.1.15-1 summarizes the major Maryland laws relevant to human health and safety.

Table 7.1.15-1: Relevant Maryland Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
COMAR, Title 7, Subtitle 5	MDE	Describes regulations and requirements to encourage cleanup of properties with known or perceived contamination to protect the public health and the environment.
COMAR, Title 7, Subtitle 2	MDE	Provides remedies to abate and control pollution and the cleanup of hazardous waste sites; also known as the State Superfund Program.
COMAR, Title 9, Subtitle 12, Chapter 33 – Occupational Safety and Health	MDDLI	Provides requirements for occupational safety and health reporting of injuries and illnesses, as well as guidelines for potentially hazardous environments, such as confined spaces and contaminated sites.
COMAR, Title 26, Subtitle 2 – Occupational, Industrial, and Residential Hazards	MDE	Outlines the requirements for employee personal protective equipment, as well as mitigation measures governed under MOSH regulations for occupational lead exposure in the construction industry.
2013 Maryland Labor and Employee Code, Section 6 – High Voltage Lines	MDDLI/MOSH; BGE	Outlines the requirements of an owner of a high voltage line to perform certain activities to ensure safety of anyone operating within 10 feet and, for operators working within 10 feet to make proper notifications (must notify BGE) and take proper actions to ensure worker safety.
Miss Utility Law	Maryland Underground Facilities Damage Prevention Authority	Outlines steps anyone that is digging into the ground must follow to ensure buried utilities are not disturbed.

7.1.15.3. 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 and possibly in 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, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Health and Safety Hazards

Working from height, overhead work, and slip, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights exceeding up to 2,000 feet above the ground's surface (OSHA, 2015a). 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, as well as to the general public who may be observing the work or transiting the area (International Finance Corporation, 2007).

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[147] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and in small trenches (generally 6 to 12 inches in width). 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, 2016b).

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, 2016b).

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

[147] Manholes may be used for telecommunications activities, especially in cities and urban areas, depending on the location of other utilities. In cities, power, water, and telecommunication lines are often co-located; if access is through a manhole in the street, that access will be used.

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 (U.S. Fiber Optic Association, 2010).

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 7.1.13 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, 2016b).

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. 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. Hazardous waste is likely to be stored properly in containers onsite, whereas less obvious hazardous materials might also be present, such as lead-based paint on old tower equipment and asbestos tiles and insulation in equipment sheds. 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, 2016b).

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, 2016b).

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, 2016b).

Telecommunication Worker Occupational Health and Safety

As of May 2014, Maryland employed 3,580 telecommunication line installers and repairers, and 3,280 telecommunication equipment installers and repairers (see Figure 7.1.15-1) (BLS, 2015c). In 2013, the most recent data available, Maryland had 2.0 reportable cases of nonfatal occupational injuries and illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 2.1 nonfatal occupational injuries and illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014a).

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, 2013b). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Maryland has not reported any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data were first reported (BLS, 2015d). However, in the broader installation, maintenance, and repair occupations (Standard Occupational Classification [SOC] code 49-0000), there were 62 total fatalities in Maryland between 2003 and 2013, with the highest being 10 fatalities in 2010. One fatality in 2013 was reported under the radio, cellular, and tower equipment installers and repairers occupation (SOC code 49-2021), but not directly associated with the telecommunications equipment installers and repairer occupation (SOC code 49-2022) (BLS, 2015d).

Public Health and Safety

The general public are not likely to encounter occupational hazards at telecommunication sites, due to limited access. Maryland has not recorded incidents of injuries from the public to these sites. Among the general public, trespassers entering telecommunication sites would be that the greatest risk for exposure to health and safety hazards.

7.1.15.4. 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.

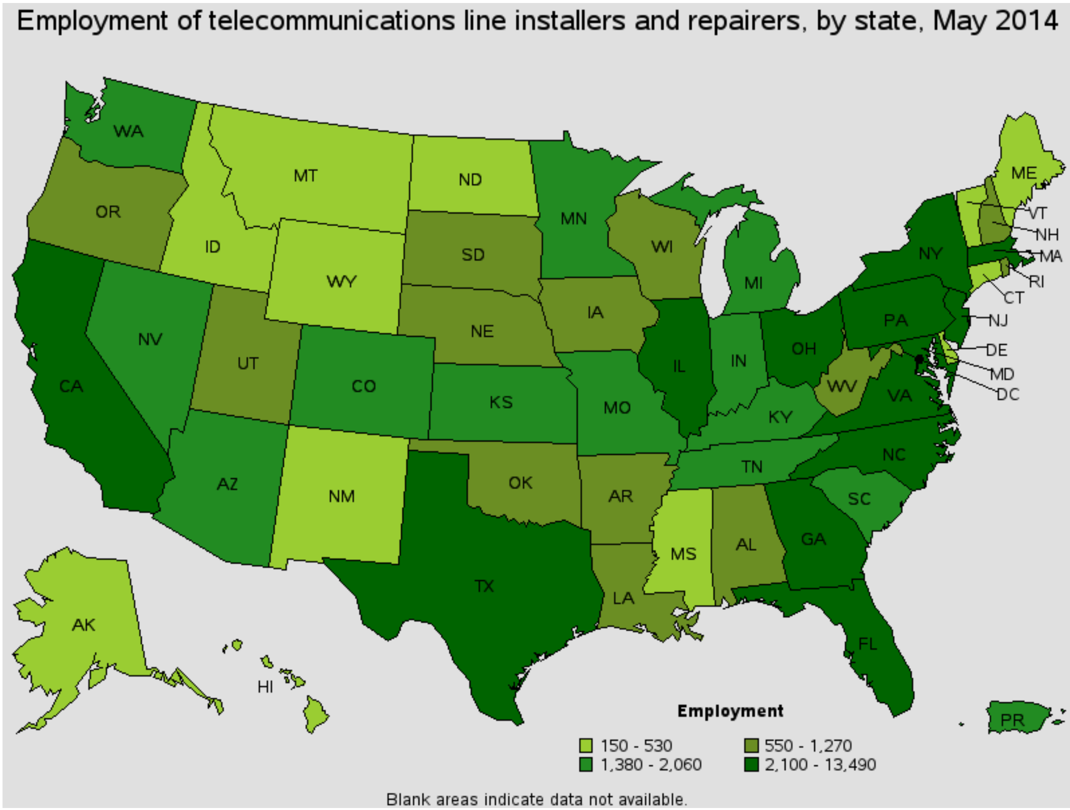


Figure 7.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015e)

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[148] 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.

In Maryland, the State Superfund Program used to remediate contaminated sites is known as the Controlled Hazardous Substance (CHS) Enforcement Division (MDE, 2015t). The CHS Enforcement Division oversees the cleanup of hazardous sites that have not been placed on the

[148] 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 and Regulations. (USEPA, 2011).

USEPA's NPL. As of September 2015, Maryland had 43 RCRA Corrective Action sites,[149] 195 brownfields, and 21 proposed or final Superfund/NPL sites (USEPA, 2015ap). Based on a September 2015 search of USEPA Cleanups in My Community (CIMC) database, there is one Superfund site (Kane & Lombard Street Drums) where contamination had been detected at an unsafe level, or a reasonable human exposure risk exists (USEPA, 2015ap). Brownfield sites in Maryland are managed through the State Voluntary Cleanup Program, which encourages the cleanup and redevelopment of contaminated sites, and works with the State Brownfields Revitalization Incentive Program that offers financial incentives such as tax credits and grants (MDE, 2015t).

In addition to contaminated properties, certain industrial facilities are permitted to actively 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 TRI Program tracks the management of specific toxic chemicals that may be a threat to human health and safety from permitted facilities. As of September 2015, Maryland had 173 TRI reporting facilities. According to the USEPA, in 2013, the most recent data available, Maryland released 8,278,066 pounds toxic chemicals through onsite and offsite disposal, transfer, or other releases. Most of Maryland's releases were from the electric utilities industry. This accounted for 0.20 percent of total nationwide TRI releases, ranking Maryland 30 of 56 states and territories (USEPA, 2014c).

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 (NIH), 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 7.1.15-2 provides an overview of potentially hazardous sites in Maryland.

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, Maryland had seven total occupational fatalities in 2013 from exposure to "harmful substances or environments," although these were not specific to the telecommunications industry or telecommunications occupations (BLS, 2013c). By comparison, there were three fatalities in 2011 and three preliminary fatalities in 2014 nationwide within the

[149] Data gathered using the USEPA's Cleanups in My Community (CIMC) search on August 25, 2015, for all sites in the State of Maryland, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active).

telecommunications industry, due to exposure to harmful substances or environments (BLS, 2015f). In 2014, BLS also reported four preliminary fatalities[150] 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, 2014b).

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication 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. The MDHMH is responsible for collecting public health data resulting from exposure to environmental contamination, and provides publicly available health assessments and consultations for documented hazardous waste sites (MDHMH, 2015).

7.1.15.5. Abandoned Mine Lands at or near Telecommunications Sites

Another health and safety hazard in Maryland includes surface and subterranean mines. As described in Section 7.1.3.7, in 2015, the Maryland mining industry ranked 35th for non-fuel minerals, generating a value of $306M (USGS, 2016b). In 2013, the most recent data available, coal production in Maryland ranked 9th in the United States, with 22 coal mining operations (4 underground and 18 surface) (EIA, 2013).

[150] 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)

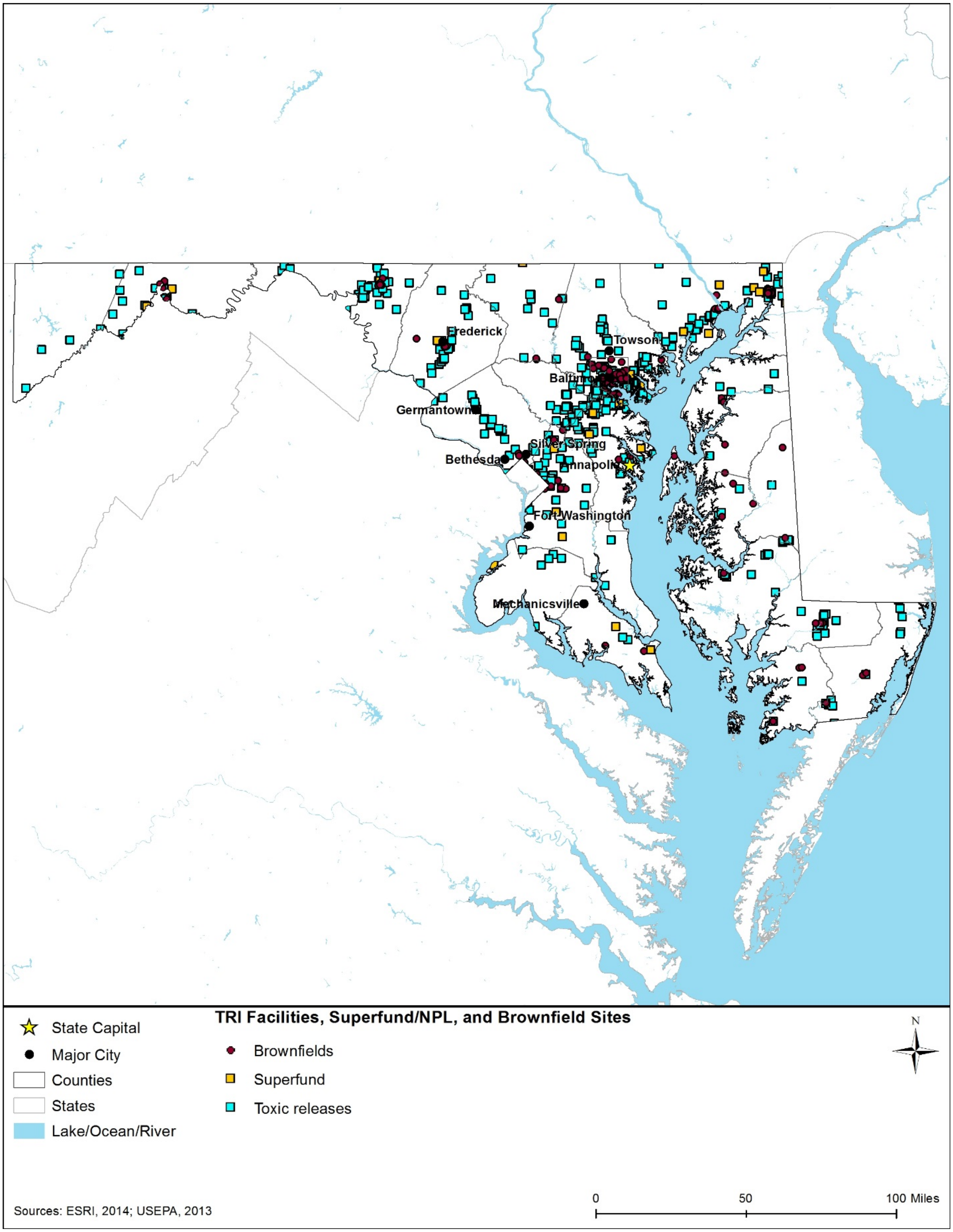


Figure 7.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Maryland (2013)

Health and safety hazards known 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). Acidic water outflow from metal and coal mines, known as acid mine drainage, also presents a risk to health and safety, primarily to recreational visitors ingesting fish caught in impaired waters, and affected residential populations through contaminated drinking water supplies. According to a nationwide 1979 AML inventory, Maryland contained over 450 miles of impaired streams due to acid mine drainage (MDE, 2015u). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 3.4.4.3, Geology.

The Abandoned Mine Lands Division of the MDE Mining Program administers the Maryland Abandoned Mine Land program, as authorized by the Surface Mining Control and Reclamation Act of 1977, and is responsible for managing AML health and safety hazards resulting from pre-1977 coal mining operations (MDE, 2015u). As of 2015, there are 200 abandoned mines in

Spotlight on Maryland Superfund Sites: U.S. Army Fort Meade

U.S. Army has occupied Fort Meade in Anne Arundel County, MD, since 1917. The USEPA added Fort Meade to the NPL on July 28, 1998, due to its historical storage and disposal of hazardous substances, which included solvents, pesticides, PCBs, metals, and waste fuel and oil.

These contaminants have been detected in groundwater resources at and near the fort, as well as in the Patuxent River watershed. Nearby residential wells in Odenton, MD, which borders the eastern edge of Fort Meade, are also contaminated. Exposure to water containing PCBs may cause rashes, immune system problems, and an increased cancer risk. Additionally, unexploded ordnance has been discovered throughout the firing range areas of the fort, and in portions of the Little Patuxent River (see Figure 7.1.15-3). The Army has been working to restore the site under supervision of the USEPA since 1998. (USEPA, 2015ai)

Figure 7.1.15-3: Unexploded Ordnance Discovered at Fort Meade

Source: (USEPA, 2015ai)

Maryland, primarily in the western region of the state (DOI, OSMRE, 2015a). Figure 7.1.15-4 shows the distribution of AMLs in Maryland.

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be at or near AMLs or coalmine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. The U.S. Department of Labor, Mine Safety and Health Administration (MSHA) is responsible reporting occupational fatalities related to mining operations (see Figure 7.1.15-4). As of September 22, 2015, Maryland has reported a total of three coal mining fatalities since 2004 (one in 2006 and two in 2007) (MSHA, 2015a). Between January 1 and September 24, 2015, MSHA reported 24 mining fatalities nationwide (9 fatalities in the coal mining industry and 15 in metals/nonmetals industry) (MSHA, 2015b). Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during new construction operations.

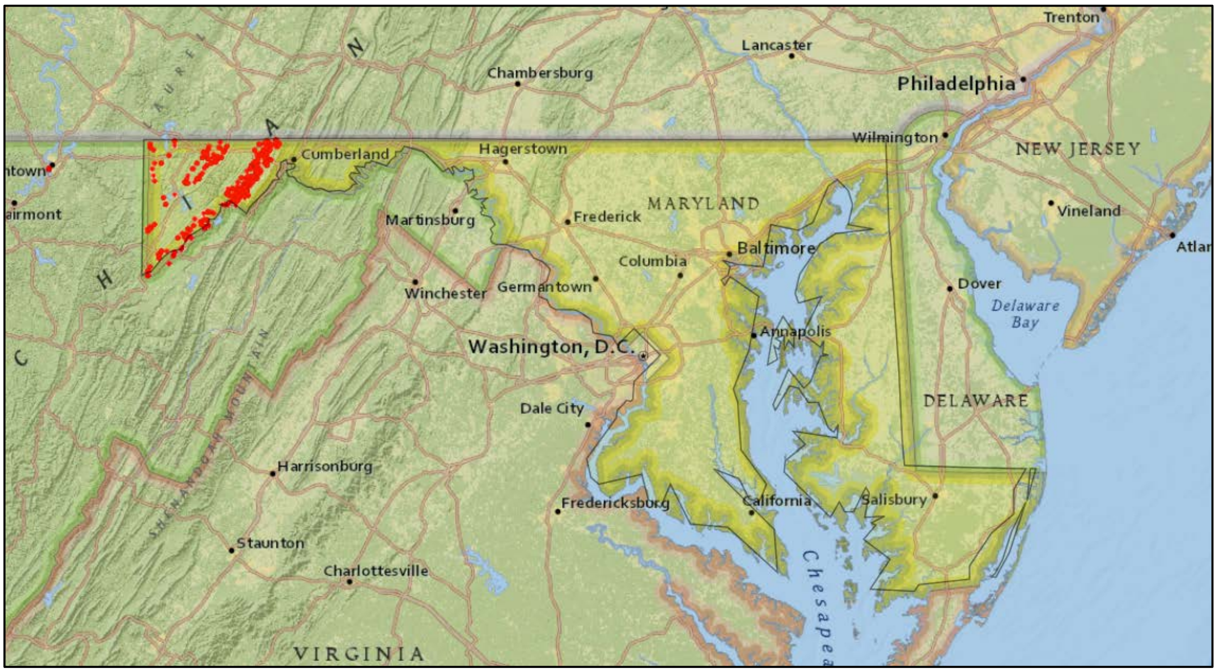


Figure 7.1.15-4: Abandoned Mine Lands in Maryland (2015)

Source: (DOI, OSMRE, 2015a)

Public Health and Safety

Coalmine fires present additional health and safety risks, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, the fire can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and coalmine fires in particular, can result in evacuations of entire communities. (DOI, OSMRE, 2015b)

7.1.15.6. Natural & 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 general 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.). Floodwaters are often contaminated by hazardous chemicals and sanitary wastes, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). Since 1962, Maryland has declared 25 natural disasters. Six of these were winter storms yielding dangerous ice and snow-hazards. The remaining 19 were related to tropical storms, flooding, high winds, and hurricanes. (FEMA, 2014a)

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

Spotlight on Maryland Natural Disaster Sites: Hurricane Irene

In August 2011, Hurricane Irene hit the coastline of eastern Maryland with tropical storm force winds and rain, which caused flooding and up to a 4.5-foot storm surge in lowland areas. Trees were downed, many roads were impassible, and more than 8 million customers lost electric power (see Figure 7.1.15-5). In Ocean City, MD, flooding and damages were comparable to Hurricane Isabel in 2003. (NWS, 2012a)

During the storm, a transformer was destroyed after being struck by debris, which triggered an automatic shutdown of the Calvert Cliffs 1 nuclear power plant (U.S. Nuclear Regulatory Commission, 2011). The resulting loss of power closed, roads, and train stations (NWS, 2012a).

Figure 7.1.15-5: Crews Preparing for Hurricane Irene by Clearing Power Lines

Source: (FEMA, 2011)

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 early responders to natural and manmade disasters 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 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 and over-extend first responder staff and medical facilities that are delivering care to victims of the initial incident.

Currently, MDDLI/MOSH and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. Of the 267 NRC-reported incidents for Maryland in 2015 with known causes, four incidents were attributed to natural disaster (e.g., natural phenomenon), while 263 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (USCG, 2015).

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and affecting all populations within the area. Maryland is the eighth smallest state by area, but the nineteenth most densely populated (U.S. Census Bureau, 2010). Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities and potential for exposure to unknown chemical and biologic hazards. Infrastructure damage was extensive during Hurricane Irene, with several storage tank spills due to flooding and fallen transformers. According to the National Response Center, there were multiple incidents related to Hurricane Irene, including damaged power lines and leaking transformers, transportation incidents, and fuel storage tank ruptures and releases (U.S. Coast Guard, 2011). In 2014, Maryland experienced eight weather-related injuries and six fatalities (NWS, 2015). For comparison, in 2011, the year Hurricane Irene affected the northeast, there were 5 weather-related fatalities and 10 weather-related injuries (NWS, 2012b).

7.2. 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.

7.2.1. Infrastructure

7.2.1.1. Introduction

This section describes potential impacts to infrastructure in Maryland associated with construction, deployment, and operation of the Proposed Action and alternatives. Chapter 17 identifies BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 7.2.1-1. As described in Section 7.2, 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 infrastructure addressed in this section are presented as a range of possible impacts.

7.2.1.3. 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 7.2.1-1, 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 construction 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 construction 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, local health officials, and public safety officials to communicate during emergency response situations. Based on the impact significance criteria presented in Table 7.2.1-1, such potential negative and positive impacts would be less than significant.

Table 7.2.1-1: Impact Significance Rating Criteria for Infrastructure

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
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 7.2.1-1, 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 infrastructure, thus such telecommunication 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.[151] 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 7.2.1-1.

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

[151] 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.

7.2.1.4. 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)[152] , huts, or other associated facilities or hand-holes[153] 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 telecommunication 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. However, impacts to infrastructure resources could potentially occur as result of the construction of landings

[152] Points of Presence are connections or access points between two different networks, or different components of one network.
[153] A small hole typically large enough for one to insert a hand and arm into for inspection and maintenance activities.

and/or facilities on shore to accept submarine cable, depending on the exact site location and proximity to existing infrastructure.

- 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 telecommunication infrastructure, or other temporary impacts.

- 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 and 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 site 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 rights-of-way (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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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.

7.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.

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 road or utility ROW, 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 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 7.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

7.2.2. Soils

7.2.2.1. Introduction

This section describes potential impacts to soil resources in Maryland associated with construction/deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 7.2.2-1. As described in Section 7.2, 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.

7.2.2.3. 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 Maryland 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 Maryland that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquents, Aquepts, Aquolls, Aquults, Fluvents, Psamments, Udalfs, Udepts, and Udults (see Section 7.1.2.3, Soil Suborders and Figure 7.1.2-2).

Table 7.2.2-1: 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 7.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant given the short-term and temporary duration of the activities.

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 7.2.2-1, 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. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 7.1.2.3, Soil Suborders). 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 database (see Section 7.1.2.3, Soil Suborders). The most compaction susceptible soils in Maryland are hydric soils with poor drainage conditions, which include Aquents, Aquepts, Aquolls, and Aquults. These soils constitute approximately 11 percent of Maryland’s land area,[154] and are found mostly in north-central and southeastern areas of the state (see Figure 7.1.2-2). 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 7.2.2-1, 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.

7.2.2.4. 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, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical

[154] 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.

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 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 and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable.[155] 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 deployment 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

[155] Potential impact of submarine fiber optic plant installation to waterbody sediments is evaluated in Water Resources. (Section 7.2.4)

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 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 soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way 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. These 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.

7.2.2.5. 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 7.1.2, Soils.

7.2.3. Geology

7.2.3.1. Introduction

This section describes potential impacts to Maryland geology resources associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 7.2.3-1. As described in Section 7.2, 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 geology addressed in this section are presented as a range of possible impacts.

7.2.3.3. 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, landslides, and volcanic activity, 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 7.1.3.8 and shown in Figure 7.1.3-6, Maryland is not at risk to significant earthquake events. No earthquake over magnitude 6.0 on the Richter scale has ever occurred in the state. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. Based on the impact significance criteria presented in Table 7.2.3-1, seismic impacts would not be potentially significant because FirstNet's deployment locations in Maryland would not be within high-risk earthquake hazard zones or active fault zones. Given the potential for minor earthquakes in parts of Maryland, some amount of infrastructure be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for Maryland, as they do not occur in Maryland; therefore, volcanoes do not present a hazard to the state.

Landslides

As discussed in Section 7.1.3.8, widespread portions of Maryland are at moderate to high risk of experiencing landslide events. The highest potential for landslides in Maryland is found along the Fall Line and in the Blue Ridge, Valley and Ridge, and Appalachian Plateaus Provinces. Based on the impact significance criteria presented in Table 7.2.3-1, 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. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Maryland's major cities, including Baltimore and Frederick, are in areas that are susceptible to

Table 7.2.3-1: 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
Volcanic Activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located near a volcanic ash area of influence	No likelihood of a project activity located within a volcano hazard zone
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory		Volcano ash areas of influence occur within the state/territory, but may be avoidable	Volcano hazard zones 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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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 highly prevalent within the state		Areas with a high hazard for subsidence occur within the state, but may be avoidable	Areas with a high hazard for subsidence do not occur within the state/territory
	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		Mineral or fossil fuel extraction areas occur within the state, 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		Areas with known paleontological resources occur within the state, 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

landslides, some amount of infrastructure be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 7.1.3.8 and shown in Figure 7.1.3-8, portions of Maryland are vulnerable to land subsidence due to karst topography; Maryland's Coastal Plain Province is also susceptible to land subsidence and inundation due to aquifer compaction. Based on the impact significance criteria presented in Table 7.2.3-1, 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 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[156] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas of karst topography, or in locations that are subject to sea level rise. However, given that karst topography exists in many counties throughout the state, some amount of infrastructure may subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 7.2.3-1, 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. 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 7.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's deployment locations were to cause impacts to paleontological resources. 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

[156] 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, 2003c)

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 7.2.3-1, impacts could potentially be 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 avoid or minimize the potential impacts.

7.2.3.4. 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

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 geology 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 and fuel resources and paleontological resources. The types of infrastructure development scenarios or 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 POPs, 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 landslides, earthquakes, and other geologic hazards, 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 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 to 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 and fuel 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 partners would require, as practicable or feasible, to further 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.

7.2.3.5. 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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, volcanic 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 was 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 7.1.3, Geology.

7.2.4. Water Resources

7.2.4.1. Introduction

This section describes potential impacts to water resources in Maryland associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 7.2.4-1. As described in Section 7.2, 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 water resources addressed in this section are presented as a range of possible impacts.

7.2.4.3. 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.

Table 7.2.4-1: Impact Significance Rating Criteria for Water Resources

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
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, 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 or 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

Most of Maryland's surface waters are impaired (see Table 7.1.4-2, Figure 7.1.4-5: Section 303(d) Impaired Waters of Maryland, 2012) (USEPA, 2016b). For example, the Susquehanna River has sediment contaminated with PCBs, Assawoman Bay has low dissolved oxygen due to excess phosphorous, and Liberty Reservoir is contaminated with mercury in fish tissue from atmospheric deposition[157] (USEPA, 2016b). Elevated levels of mercury, PCBs, and pesticides in fish tissue have resulted in fish consumption advisories for many species in the state (MDE, 2016). Groundwater quality within the state is generally good (MDE, 2012).

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 or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a storm water 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 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 and mitigation measures, where practicable and feasible, could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA and SDWA), 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 7.2.4-1, water quality impacts would likely be less

[157] 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, 2015aq)

than significant particularly if BMPs and mitigation measures 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 [158] 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 Maryland dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would either be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most Maryland aquifers, 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 characteristics, and based on the impact significance criteria presented in Table 7.2.4-1, 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, then site-specific analysis, BMPs, and mitigation measures could 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 7.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet’s likely deployment activities, on the watershed or subwatershed level, would likely occur inside the 500-year floodplain, use minimal fill, do not substantially increase impervious surfaces, do not impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year, [159] or occur only during an emergency.

[158] 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).

[159] 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.” (U.S. Geological Survey 2014)

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. Storm water 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 storm water drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage can cause increased erosion, changes in storm water 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); storm water increases; or altered flow patterns.

According to the significance criteria in Table 7.2.4-1, 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.

Since the proposed activities would not substantially alter drainage patterns in a way that result in, or 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 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 7.2.4-1. 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 storm water 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 7.1.4.7, more than 1 million residents get their drinking water from Maryland's groundwater resources. Generally, the water quality of Maryland's aquifers is suitable for drinking and daily water needs (MDE, 2012). Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. 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 the safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of petroleum or chemical products over groundwater or an aquifer would be unlikely to cause any impacts to water quality. This is especially important when land uses in the area rely on those groundwater sources for potable water. Such uses can pose possible impacts to groundwater, and may affect its potential use as a drinking water or irrigation source. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.

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 7.2.4-1, 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.

7.2.4.4. 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, 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, 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 water 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 POPs, 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 water. Site-specific impact assessment would be required to marine and shoreline environments prior to installation to fully assess potential impacts to coastal and marine 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 and potential 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 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 disturbances, 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 and aviation 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 surfaces 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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. 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, 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 exiting roads and utlity rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the described deployment impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected.

7.2.4.5. 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. 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 and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up. 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, 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 7.1.4, Water Resources.

7.2.5. Wetlands

7.2.5.1. Introduction

This section describes potential impacts to wetlands in Maryland associated with construction/deployment and operation of the Proposed Action and alternatives. Chapter 17 identifies BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 7.2.5-1. As described in Section 7.2, 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 wetlands addressed in this section are presented as a range of possible impacts.

7.2.5.3. 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

Table 7.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	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	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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	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
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

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories. 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 species habitat, biodiversity, recreational/social value.

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 663,000 acres of wetlands throughout Maryland (USFWS, 2014b). Palustrine (freshwater) wetlands are found on river and lake floodplains across the state, and estuarine/marine (tidal) wetlands around the Chesapeake Bay and along the Atlantic coast, (Figure 7.1.5-1).

Based on the impact significance criteria presented in Table 7.2.5-1, 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 Maryland, as discussed in Wetlands, Section 7.1.5.4, regulated high quality wetlands include nontidal wetlands of “Special State Concern,” bogs, Delmarva bays, and wetlands associated with the Chesapeake Bay NERR.

- Under Maryland's Nontidal Wetlands Protection Act, nontidal wetlands of "Special State Concern" are designated for extra protection, including a 100 foot buffer from development. These wetlands typically have rare, threatened, or endangered species, or unique habitat, and include bogs, Delmarva bays (found in Caroline, Kent, and Queen Anne's counties), and coniferous swamp forest (found in Garrett County). The highest acreage of wetlands of Special State Concern are found in near Fishing Bay, the Nanticoke River, and the Lower Pocomoke River, and there are 365 wetland sites total across the state. (Clearwater, Turgeon, Noble, & LaBranche, 2000)
- Bogs can be found in western Maryland, and also in the coastal plain. The coastal plain bogs are rare and threatened in the state. The few remaining bogs provide habitat for many rare or endangered species in Maryland. Anne Arundel County contains the highest number of bogs in the state (MDNR, 2015ae).
- Chesapeake Bay, the largest estuary in the country, has diverse estuarine habitats. The Chesapeake Bay NERR is comprised of three sites (nearly 6,300 acres total) in Maryland: Monie Bay (salt marsh), Otter Point Creek (tidal freshwater marsh), and Jug Bay (tidal riverine system) (NERRA, 2016). Monie Bay contains saltwater marshes, along with shallow open water and tidal creeks, and upland pine forests; all of which provide habitat for many species. Otter Point Creek contains one of the last tidal freshwater marshes in upper Chesapeake Bay that is relatively undisturbed and in a natural condition. Jug Bay contains shallow, tidal freshwater marsh, along with fringe marsh and streams, and adjacent upland (Friends of Jug Bay, 2014).

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 storm water discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 7.2.5-1, 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 of activities that could have other direct effects to wetlands in Maryland 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 storm water 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 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 (which are high quality wetlands in Maryland).
- *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:[160] change in function(s)[161] 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 could divert 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 Maryland 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 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.

[160] 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

[161] 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 species habitat, biodiversity, recreational/social value.

- *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 7.2.5-1, 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 663,000 acres of wetlands in Maryland 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 where high quality wetlands occur, 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.

7.2.5.4. 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 would 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, 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 launched 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 POPs 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 to 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 could 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 a “wetlands of special concern”, a 100-foot buffer would be needed to avoid 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 about 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 partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, 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 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 ROW. 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 further avoid or minimize potential impacts.

7.2.5.5. 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 partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, 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 rights-of-way 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.

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 7.1.5, Wetlands.

7.2.6. Biological Resources

7.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Maryland associated with construction/deployment and operation of the Proposed Action and its alternatives. Chapter 17 identifies BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.6.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 7.2.6-1. As described in Section 3.2, *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 terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 7.1.6.3, 7.1.6.4, and 7.1.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 7.1.6.6 for impact assessment methodology and significance criteria associated with threatened and endangered species in Maryland.

Table 7.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	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: 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 Maryland 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 Maryland 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	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**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
	Geographic Extent	Regional or site specific effects observed within Maryland 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

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
	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.
	Geographic Extent	Regional effects observed within Maryland 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

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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.
	Geographic Extent	Regional effects observed within Maryland 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

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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 Maryland.		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

7.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Maryland 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 7.2.6-1, potentially significant direct injury or mortality impacts are associated with population-level or sub-population effects if they are observed for at least one species depending on the distribution and the management of the subject species. This includes large scale mortality or injury events that may impact sensitive endemic species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, FirstNet deployment events are expected to be relatively small in scale. The implementation of standard BMPs 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. Areas near Baltimore and along the Chesapeake Bay and north of Washington D.C. have experienced extensive land use changes from urbanization and agriculture. However, the western portion of the state near West Virginia and Pennsylvania is forested and remains relatively unfragmented.

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, if proposed sites with sensitive or rare regional vegetative communities are unavoidable, BMPs and mitigation measures 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[b1]). 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 and mitigation measures 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. Maryland has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select plant and animal invasive species. The Maryland Invasive Species Council maintains lists of invasive species and invasive species of concern, including those regulated under state and/or federal law. The list does not have regulatory or legal status; however, is designed to provide on-the-ground management and regulatory guidance and support for invasive species.

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. Maryland is assessing 30 invasive plants for possible listing in the state. Two of these species, Cogongrass and Japanese bloodgrass, are on the Federal Noxious Weed List. Most of the proposed state-listed invasive species are terrestrial (MDA, 2014b). 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 and mitigation measures would 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 operational activities.

Deployment Impacts

As described in Section 2.1.2, 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[162], 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 expected 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

[162] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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 biological resources.

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:

- 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 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 or 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.

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 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 to terrestrial vegetation 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 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 are expected 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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 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 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 7.1.6.3, Terrestrial Vegetation.

7.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Maryland and the 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 7.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of 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.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Maryland. 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, 2015j). 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 or minimize disturbance to bats.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from likely FirstNet deployment activities.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

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, J., Kerlinger, P. and A. 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 resting 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 populations of bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of Maryland 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 would be further 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 Maryland's amphibian and reptile species are widely distributed throughout the state. 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.

Five species of marine turtles – three of which are listed as threatened or endangered under the ESA in Maryland – occur in Maryland's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Maryland 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 Maryland that have experienced extensive land use changes from urbanization and agriculture. However, the western portions of the state that are forested 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 Maryland's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Maryland 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, as appropriate.

Marine Mammals

A number of seal species may occur in the offshore areas of Maryland. Harbor seals tend to be non-migratory; they can be found in open waters and also using rocks, beaches or other coastal habitats as haulouts and pupping sites in Maryland, particularly off the coast of Assateague Island and the eastern coastline. Seals could be temporarily excluded from a resource or abandon their haulout locations due to the presence of humans, noise, or vessel traffic during deployment activities. For example, the seals would need to find a new haulout, likely at a less favorable location. Effects on seals from exclusion from resources would be low magnitude and temporary in duration.

Further, whales may be temporarily excluded from a resource if they avoid it due to the increased presence of boats, humans, and associated noise. Depending on the duration of response activities, minke whales could be excluded from their environment temporarily or could abandon the habitat entirely.

The degree to which habitat exclusion affects minke whales depends on many factors. Minke whales are mobile and are found in open water habitat in both coastal inshore and offshore oceanic environments; therefore, it is expected that activities would have only a minor and temporary effect on the ability of minke whales to access important resources. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures, as appropriate.

Loss of habitat or exclusions from these areas for seals and whales could be avoided or minimized by BMPs and mitigation measures, as appropriate (see Chapter 17).

Birds

The direct removal of most bird nests is prohibited under the MBTA. The USFWS and MDNR 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 to passerine[163] 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 and mitigation measures, including nest avoidance during construction-related activities, would help to further minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Maryland's amphibians and reptiles 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) could be implemented, as appropriate, to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 7.2.4, *Water Resources*) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Maryland's amphibian and reptile populations, though BMPs and mitigation measures, as appropriate, would help to avoid or minimize the potential impacts.[164]

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 7.2.6.6, Threatened and Endangered Species and Species of Concern.

[163]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.
[164] See Section 3.2.5, Wetlands, for a discussion of BMPs for wetlands.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would 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. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Marine Mammals

Repeated disturbance (e.g., from vessel traffic), especially near haulouts, can cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not expected to be located offshore or in the oceanic environment, less than significant impacts to no impacts would be anticipated for marine mammals.

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, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term, 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 Maryland's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below.

<u>Terrestrial Mammals</u>

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. 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.

<u>Marine Mammals</u>

Noise associated with the installation of cables in the near/offshore waters of coastal Maryland could impact marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds[165]. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

<u>Birds</u>

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 Maryland undertake some of the longest-distance migrations of all animals. Maryland is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. Maryland has 43 IBAs spread throughout the state that serve as important stopover areas for migratory birds (MD-DC Audubon Society, 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.

[165] Level A: 190 dB re 1µPa (rms) for seals and 180 dB re 1µPa (rms) for whales, dolphins, and porpoises. It is the minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss. Level B: 160 dB re 1µPa (rms). It is defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing. (Southall et al., 2007)

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in Maryland. 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, Brevin and 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 (Berven & Grudzien, 1990). 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 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 Maryland’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 breeding grounds for large mammals, such as bears, has the potential to negatively affect body condition and reproductive success of mammals in Maryland.

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.

Marine Mammals

Restricted access to important calving grounds has the potential to negatively affect body condition and reproductive success of marine mammals in Maryland. For example, the displacement of female seals from preferred pupping habitats due to deployment and operations may reduce fitness and survival of pups potentially affecting overall productivity, though impacts are expected to be less than significant since activities are likely to be small-scale in nature. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Disturbance to hauled out seals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

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 the 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 and mitigation measures 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; therefore, 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 Maryland, Eurasian boars (*Sus scrofa*) adversely impact several native large and small mammals, including bear (*Ursus americanus*), turkey (*Meleagris gallopavo*), waterfowl and deer. FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary. Invasive species effects to terrestrial mammals could be minimized following BMPs and mitigation measures in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

Marine Mammals

Invasive species displace native fauna and flora communities and/or radically change the nature of the habitats they invade. They also compete for the same natural resources and life requirements (i.e., food, space, and shelter) as native species and degrade local ecologies by disrupting the food chain, thereby causing the extinction of native species. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native marine mammal species would not occur.

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 Maryland, 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, et al. 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 Maryland; although non-native reptiles and amphibians are known to occur in the state. 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. 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 Maryland and are known to cause irreversible damage to native forests. The Maryland Invasive Species Council maintains lists of invasive species and invasive species of concern, including those regulated under state and/or federal law. Although the list does not have regulatory or legal status, the Emerald ash borer and Brown marmorated stink bug (*Halymorpha halys)* are known invasive species in Maryland. 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 and mitigation measures 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 construction/deployment and operational 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.

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 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. These types of infrastructure deployment activities are anticipated to be less than significant to wildlife resources:

- 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 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 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 or inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife, marine mammals in particular (see Section 7.2.4, 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 if RF hazards are negligible. 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 direct injury/mortalities to wildlife on roadways from vehicular movement. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. 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 wildlife by direct or indirect injury/mortality from collision, entanglement, 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.

Deployment Impacts

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.

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 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 7.1.6.4, Terrestrial Wildlife.

7.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Maryland and the 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, 2012d).

Based on the impact significance criteria presented in Table 7.2.6-1, 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 (although 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, as defined in Chapter 17, could be implemented as appropriate and feasible, to help to avoid or further 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 and 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, any 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 and quantity 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 7.2.4, 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. FirstNet deployment impacts are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. Impacts to migration or migratory patterns are expected to be less than significant. BMPs and mitigation measures, as feasible and appropriate, 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 construction/deployment and operational 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.

- 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 environment.

Activities with the Potential to Have Impacts

Potential construction/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 development scenarios or 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 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 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 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 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. 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 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 7.1.6.5, Fisheries and Aquatic Habitats.

7.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Maryland and Maryland's offshore environment associated with construction/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 7.2.6-2. 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.

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 7.2.6-2, 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, fish, invertebrates, and plants with known occurrence in Maryland are described below. There are no listed amphibians in Maryland, therefore they will not be discussed in this section.

Table 7.2.6-2: 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.	

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
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.
	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.	

Terrestrial Mammals

Direct mortality or injury to the federally listed Northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. The northern long-eared bat (*Myotis septentrionalis*) occurs throughout the state (USFWS, 2015ao). 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 these species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (NYSDEC, 2015b). 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

Two federally listed birds are known to occur within coastal and estuarine areas of Maryland. The piping plover (*Charadrius melodus*) is found on open, sandy beaches along the Maryland coast, while the red knot (*Calidris canutus rufa*) is found within sandy estuaries and tidal mudflats primarily during migration seasons (USFWS, 2015e). 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.

Fish

One endangered fish species is federally listed and known to occur in Maryland. The endemic Maryland darter (*Etheostoma sellare*) has a limited range in northern creeks of the state (USFWS, 2015e). As a result, direct mortality or injury is unlikely as the majority of 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.

Reptiles and Amphibians

No federally listed amphibians would be affected by the Proposed Action in Maryland.

The federally listed threatened bog turtle (*Clemmys muhlenbergii*) occurs within wetland and floodplain areas in northern Maryland (USFWS, 2015e). 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 are also known to occur in the coastal area and offshore environment of Maryland. None of these turtles nest in Maryland (USFWS, 2015e). Direct mortality or injury is unlikely as the majority of 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.

Invertebrates

Two endangered and two threatened invertebrate species are federally listed and known to occur in Maryland. The two threatened tiger beetles, the Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) and the Puritan Tiger Beetle (*Cicindela puritan)* are primarily found along sandy Maryland coastlines. The federally listed mollusk, the Dwarf Wedgemussel (*Alasmidonta heterodon)* is found in rivers around the upper Chesapeake Bay. The endemic Hay's Spring Amphipod (*Stygobromus hayi*) is only known to occur in five springs in Rock Creek in Maryland and Washington, D.C., including one in Montgomery County, Maryland[166] (Pavek, 2002). Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur near their known habitats. Distribution of these species is limited to the sandy coastline region, habitat near the upper Chesapeake Bay, and specific spring habitat in Rock Creek in Maryland. 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

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. 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, marine mammals, birds, terrestrial reptiles and marine reptiles, fish, invertebrates, and plants with known occurrence in Maryland are described below.

[166] The exact locations of each of these species is not provided in USFWS species literature; uncertain if the species are found in the same springs or different springs.

Terrestrial Mammals

Reproductive effects to the federally listed Northern long-eared bat could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present (USFWS, 2015h) (USFWS, 2015j). Noise, light, and other human disturbances associated with the Proposed Action could adversely affect this federally listed terrestrial mammal 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 and red knot (*Calidris canutus rufa*) are the only federally listed bird species that are known to nest in Maryland on sandy beaches (piping plover) or marshes (red knot) (USFWS, 2005) (USFWS, 2015t). The majority of FirstNet deployment activities would not occur on beaches or saltmarshes; therefore, impacts to these bird species are not anticipated. Noise, light, or human disturbance within nesting areas could cause piping plovers 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.

Reptiles and Amphibians

The federally listed bog turtle occurs within wetland and floodplain areas in northern Maryland (USFWS, 2015k). Changes in water quality, especially during the breeding seasons, can 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 for this 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.

The three federally listed sea turtles found in the offshore areas of Maryland are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Fish

Deployment activities have the potential to impact the Maryland Darter (*Etheostoma sellare*) in the upstream portions of the Chesapeake Bay watershed, specifically the upstream portions of the Potomac and Susquehanna rivers resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality and quantity can cause stress resulting in lower productivity (see Section 7.2.4, Water Resources, for a discussion of potential impacts to water resources). 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.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for the federally listed Dwarf Wedgemussel (*Alasmidonta heterodon)* known to occur in the rivers around the upper Chesapeake Bay in Maryland. 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 and Puritan Tiger beetle, as well as the federally listed amphipod species. 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 listed 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, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Maryland 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, 2015ao). 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

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.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the Maryland darter. Behavioral changes are unlikely as the majority of 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.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mussels resulting in lower productivity. Disturbances to the amphipod species in Rock Creek could impact survival. Deployment activities are not expected to cause changes to water quality that could result in impacts. 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 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 impacts 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.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Maryland. 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.

Birds

No critical habitat has been designated for piping plover or red knot populations that are known to occur in Maryland; 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.

Reptiles and Amphibians

No designated critical habitat occurs for reptiles or amphibians in Maryland. 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.

Fish

Critical habitat occurs for the Maryland darter, a small endangered freshwater fish species in Maryland. Small segments of Deer Creek and Gashey's Run located in the northern upstream portions of the Chesapeake Bay contain Maryland Darter critical habitat. 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.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in Maryland. 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 Maryland. 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 construction/deployment and operational 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, the following are expected to have no impacts 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 development scenarios or 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 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 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 7.2.4, 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. 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.

- 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, blimps, or piloted aircraft 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 to 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 operation impacts are not likely to adversely effect, 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 routine operations, management, and monitoring are not likely to adversely affect threatened and endangered species and their associated habitats. 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 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

7.2.7. Land Use, Recreation, and Airspace

7.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Maryland associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.7.2. 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 7.2.7-1. As described in Section 7.2, 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 land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 7.2.7-1: 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

7.2.7.3. 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 aboveground 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 7.2.7-1, 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 aboveground 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 ROWs 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 ROW, 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 7.2.7-1, 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 ROWs 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 7.2.7-1, 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 7.2.7-1, 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 tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 7.2.7-1, 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 likely not impact airspace resources.

7.2.7.4. 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 ROWs.
    - 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 7.1.7 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 7.1.7 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 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 or 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 7.1.7 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 7.1.7 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 AGL or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 7.1.7 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 construction/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 ROWs 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 or 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 (see Section 7.1.7 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 tower is located in proximity to one of Maryland'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 Maryland airports (See obstruction criteria in Section 7.1.7 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 any potential impacts or 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. Potential impacts to land uses associated with deployment 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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 7.2.8, 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.

7.2.7.5. 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 would likely 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 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 land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 7.1.7, Land Use, Recreation, and Airspace.

7.2.8. Visual Resources

7.2.8.1. Introduction

This section describes potential impacts to visual resources in Maryland associated with construction/deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 7.2.8-1. As described in Section 7.2, 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 visual resources addressed in this section are presented as a range of possible impacts.

Table 7.2.8-1: 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

NA = not applicable

7.2.8.3. 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 Maryland, residents and visitors travel to many national and state parks, such as Assateague Island National Seashore to view its sandy beaches and wild horses. 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. Maryland does not have regulations related to construction permits, protection of natural resources, or historic preservation; rather local jurisdictions control actions through local regulations and preservation ordinances. 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 7.2.8-1, 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.

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 7.2.8-1, 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 the night skies.

7.2.8.4. 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, 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. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment 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 construction/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 POPs, 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 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. 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 and 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 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 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. 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.

7.2.8.5. 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. 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 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 7.1.8, Visual Resources.

7.2.9. Socioeconomics

7.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Maryland associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 7.2.9-1. As described in Section 7.2, 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 socioeconomics addressed in this section are presented as a range of possible impacts.

Table 7.2.9-1: Impact Significance Rating Criteria for Socioeconomics

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
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 to 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

7.2.9.3. 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 Spending, Income, Industries, and Public Revenues;
- 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 likely 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 Maryland. Median values of owner-occupied housing units in the 2009–2013 period ranged from nearly $350,000 in the greater Washington area, to under $120,000 in the Cumberland area in western Maryland. 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 telecommunication 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 Spending, 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 $7B 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 partner(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) 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 Maryland. The average unemployment rate in 2014 was 5.8 percent, lower than the national rate of 6.2 percent. Counties with unemployment rates below the national average (that is, better employment performance) were generally in the central area of the state. An exception was Baltimore City, which had an unemployment rate greater than 8.6 percent. Other counties with unemployment rates above the national average were located in the Chesapeake Bay Eastern Shore region and the western portion of the state.

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 7.2.9-1 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.

7.2.9.4. 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.

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 socioeconomics, 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 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 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.

7.2.9.5. 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 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 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.

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 7.1.9, Socioeconomics.

7.2.10. Environmental Justice

7.2.10.1. Introduction

This section describes potential impacts to environmental justice in Maryland associated with construction/deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 7.2.10-1. As described in Section 7.2, 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 environmental justice addressed in this section are presented as a range of possible impacts.

7.2.10.3. 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.

Table 7.2.10-1: 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

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 PEIS. The areas shown in the environmental justice screening map of Existing Environment (Section 7.1.10) as having Moderate Potential or High Potential for environmental justice populations would particularly warrant further screening. As discussed in Section 7.1.10, Maryland’s population has higher percentages of minorities than the region or the nation, and lower rates of poverty than the region or nation. The largest concentrations of areas with High Potential for environmental justice populations are in central Maryland, in the Baltimore, Washington metro, and Waldorf areas. The distribution of areas with Moderate Potential for environmental justice populations is fairly even across the state. Further analysis using the data developed for the screening analysis in Section 7.1.10 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, 2014d) (USEPA, 2015ah).

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.

7.2.10.4. 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 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 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 development scenarios or 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.

7.2.10.5. 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 temporarily generated, 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 7.1.10, Environmental Justice.

7.2.11. Cultural Resources

7.2.11.1. Introduction

This section describes potential impacts to cultural resources in Maryland associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 7.2.11-1. As described in Section 7.2, 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 cultural resources addressed in this section are presented as a range of possible impacts.

Table 7.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level: Adverse effect	Impact Level: Mitigated adverse effect[1]	Impact Level: Effect, but not adverse	Impact Level: 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 area of potential effect (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
	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

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	Mitigated adverse effect[1]	Effect, but not adverse	No effect
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 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 Officer 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 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.

7.2.11.3. 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 7.2.11-1, 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 that archaeological sites and historic properties are present throughout Maryland, some deployment activities may be in these same 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.

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 by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

7.2.11.4. 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, attaching equipment to satellites launched for other purposes, 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 development scenarios or 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, including historic post-WWII structures in suburban areas of Maryland outside Washington, D.C. and Baltimore.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Although lighting up of dark fiber would have no impacts to cultural resources as mentioned above, installation of new associated huts or equipment, if required, could 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, as coastal areas of Maryland have the potential to contain prehistoric archaeological sites, as well as sites associated with the state’s significant maritime history since European colonization, such as shipwrecks. 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 and historical sites, such as wharves and seawalls (archaeological deposits tend to be located in association with bodies of water, and Maryland, for example, has numerous maritime and riverine archaeological sites

associated with its 18th and 19th century commercial expansion), and the associated network 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 impacts to archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Baltimore that have larger numbers of historic 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 site. 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 effects 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 effect, 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.

7.2.11.5. 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 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 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 site 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. 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 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 7.1.11, Cultural Resources.

7.2.12. Air Quality

7.2.12.1. Introduction

This section describes potential impacts to Maryland’s air quality from construction/deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Maryland’s air quality were evaluated using the significance criteria presented in Table 7.2.12-1. As described in Section 7.2, 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 Maryland’s air quality addressed in this section are presented as a range of possible impacts.

7.2.12.3. 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 Maryland that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone and $PM_{2.5}$ are state-wide issues (see Section 7.1.12, Air Quality, and Figure 7.1.12-1). The majority of the counties in Maryland are designated as maintenance areas for one or more of the following pollutants: CO_2, PM, and ozone (Table 7.1.12-4); counties located in the central portion of the state are designated nonattainment or maintenance for two to three NAAQS pollutants (Figure 7.1.12-1).

Table 7.2.12-1: Impact Significance Rating Criteria for Maryland

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

Based on the significance criteria presented in Table 7.2.12-1, air emission 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 Maryland; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout Maryland (Figure 7.1.12-1), 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.

7.2.12.4. 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, 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-term emissions to air quality.

- 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 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 POPs, 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, POPs, 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 and 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. 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.

7.2.12.5. 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, 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. 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 to 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.

7.2.13. Noise

7.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in Maryland. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 7.2.13-1. As described in Section 7.2, 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 noise impacts to Maryland addressed in this section are presented as a range of possible impacts.

Table 7.2.13-1: 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

NA = not applicable

7.2.13.3. 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 7.2.13-1, 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. 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 construction 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.

7.2.13.4. 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 and 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, 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 PoPs, 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 short-term/temporary 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 noise increases 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 temporary increases in 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 and 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) 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. 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.

7.2.13.5. 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 to 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.

7.2.14. Climate Change

7.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Maryland associated with deployment and operation of the Proposed Action and alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.14.2. 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 7.2.14-1. As described in Section 7.2, 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, 2015am), 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 significat.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**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

Table 7.2.14-1: Impact Significance Rating Criteria for Climate Change

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.

7.2.14.3. 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 would also impact precipitation events, sea level rise, and ocean water acidity (USGCRP, 2014a).

Air Temperature

Figure 7.2.14-1 and Figure 7.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Maryland from a 1969 to1971 baseline.

(Cfa) – Figure 7.2.14-1 shows that by mid-century (2040 to 2059) under a low emissions scenario temperatures in the entire state of Maryland will increase by approximately 4 °F. By the end of the century (2080 to 2099) under a high emissions scenario temperatures in the western most portion of the state will increase by approximately 6 °F, and the temperatures in the remainder of the state will increase by approximately 8 °F (USGCRP, 2009).

Figure 7.2.14-2 shows that by mid-century (2040 to 2059) temperatures in the southern portion of Maryland under a high emissions scenario will increase by approximately 4 °F, and in the remainder of the state temperatures will increase by approximately 5 °F. By the end of the century (2080 to 2099) under a high emissions scenario temperatures in the eastern and southern tip of Maryland will increase by approximately 8 °F, and the temperature in the remainder of the state will increase by approximately 9 °F (USGCRP, 2009).

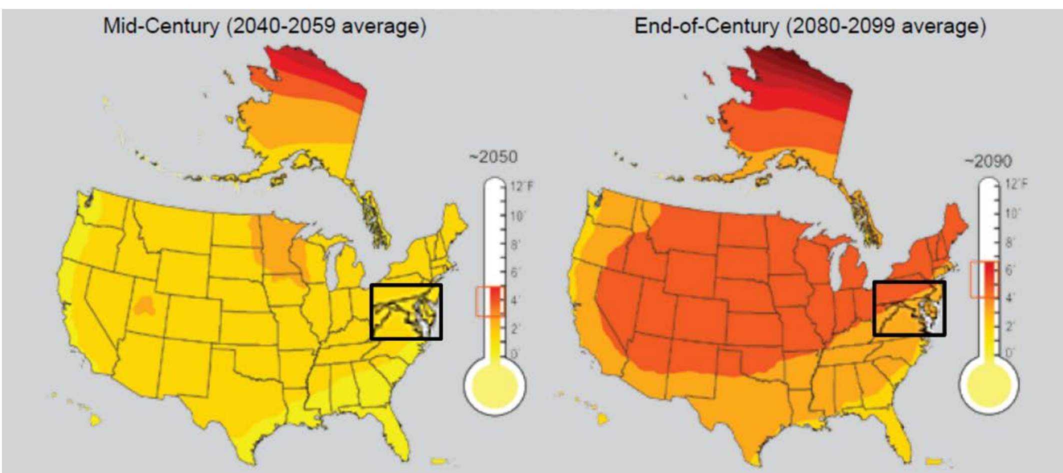


Figure 7.2.14-1: Maryland Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

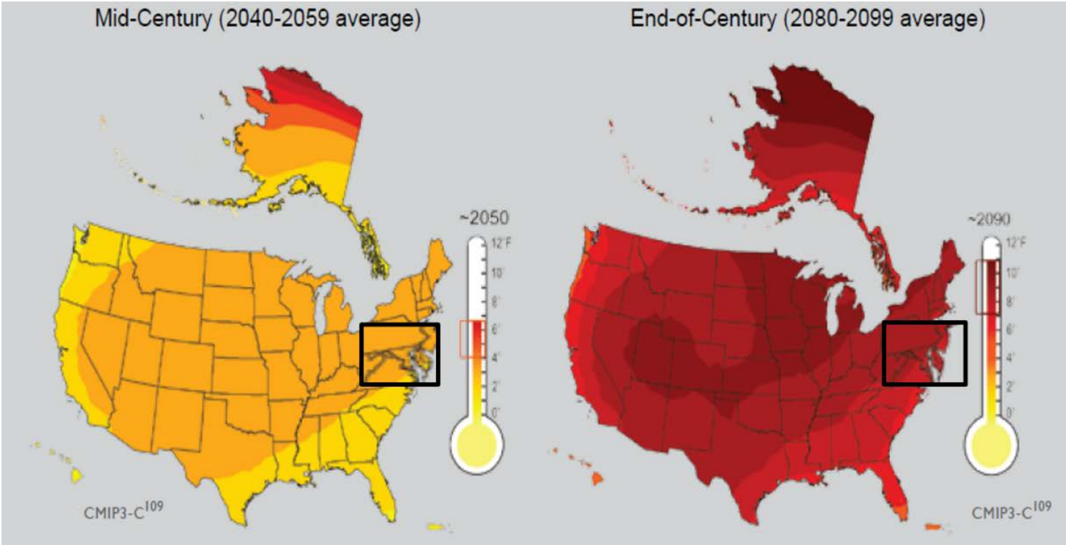


Figure 7.2.14-2: Maryland High Emission Scenario Projected Temperature Change

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 7.2.14-3 and Figure 7.2.14-4 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 7.2.14-3 show 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 7.2.14-4 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 7.2.14-3 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 and spring for the entire state of Maryland. In summer, under a rapid emissions reduction scenario, precipitation will increase by 10 percent in the majority of the state, however, there are no expected increases in precipitation in the eastern most portion of the state. There are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014b).

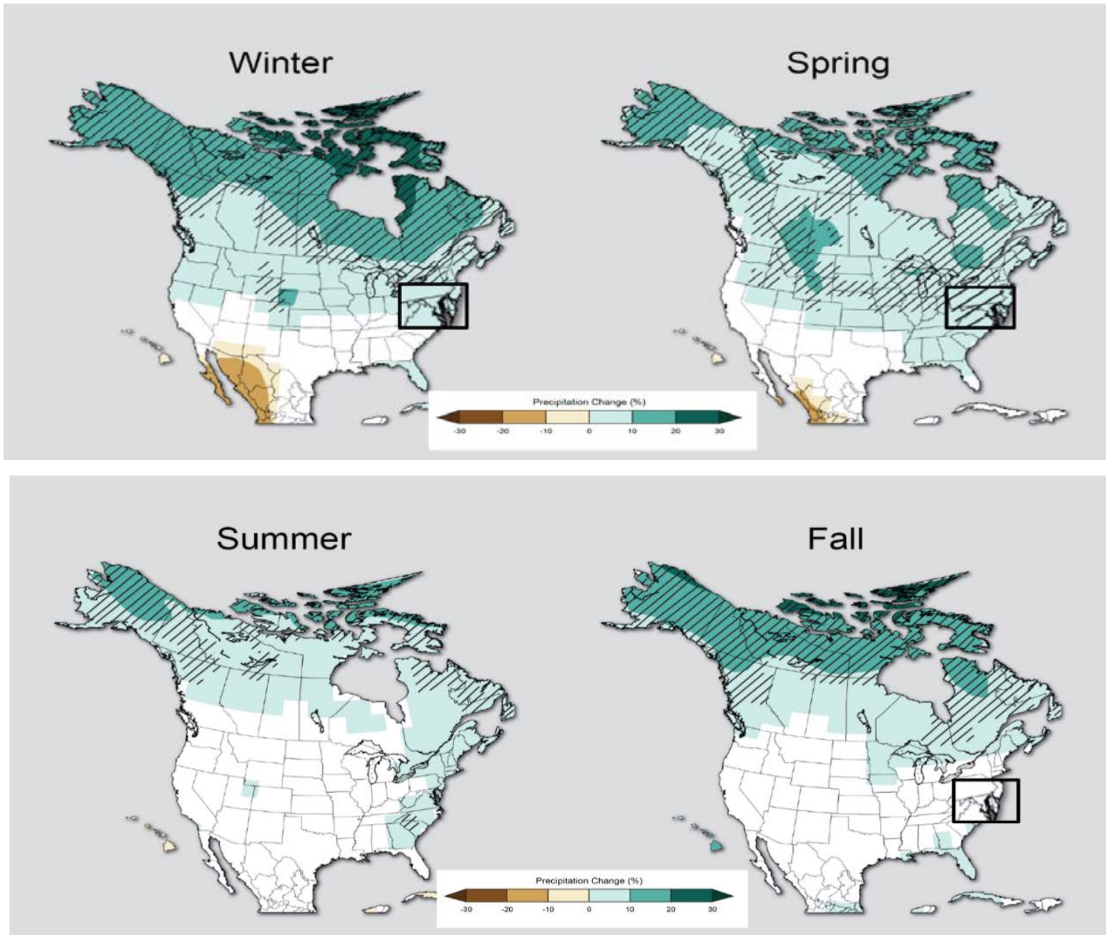


Figure 7.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

Figure 7.2.14-4 shows that if emissions continue to increase, winter and summer precipitation could increase as much as 20 percent over the period 2071 to 2099. In spring, precipitation in this scenario could increase as much as 10 percent. No significant change fall rainfall is anticipated over the same period (USGCRP, 2014b).

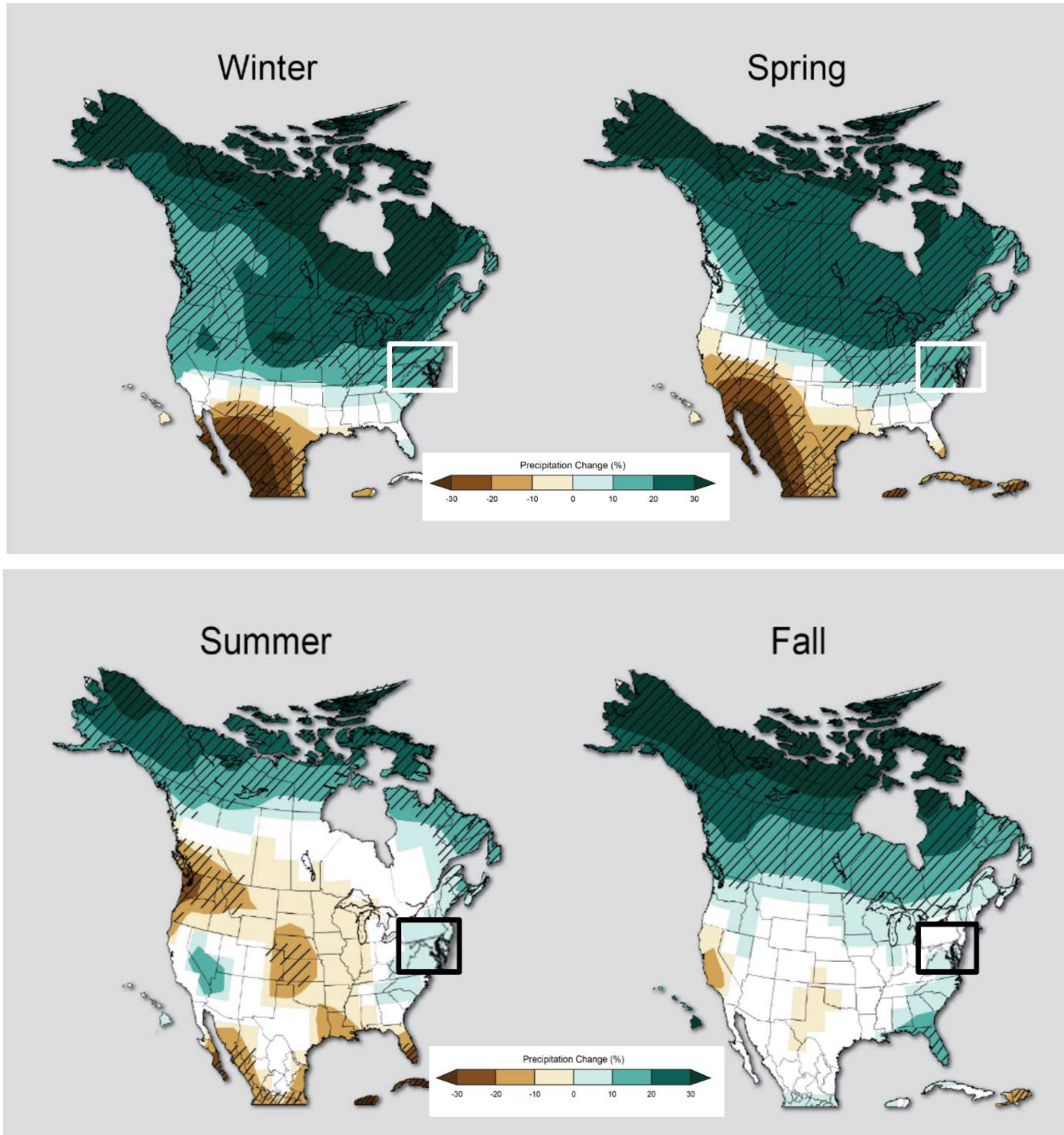


Figure 7.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors would 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" (MDNR, 2015e). 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." (MDNR, 2015e). Sea level and currents can be influenced by the amount of heat stored in the ocean (MDNR, 2015e).

The amount of sea level rise would vary in the future along different stretches of the U.S. coastline and under different absolute global sea level 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, 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, and USACE. Figure 7.2.14-5 and Figure 7.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 7.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 7.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

Cfa – Figure 7.2.14-5 presents an 8 inch global average sea level rise above 1992 levels resulting in a .7 to 1.3 foot sea level rise in 2050 on the coast of Maryland. Figure 7.2.14-6 indicates that a 1.24 foot sea level rise above 1992 level would result in a 1.7 to 2.3 foot sea level rise in 2050 along the coast of Maryland.

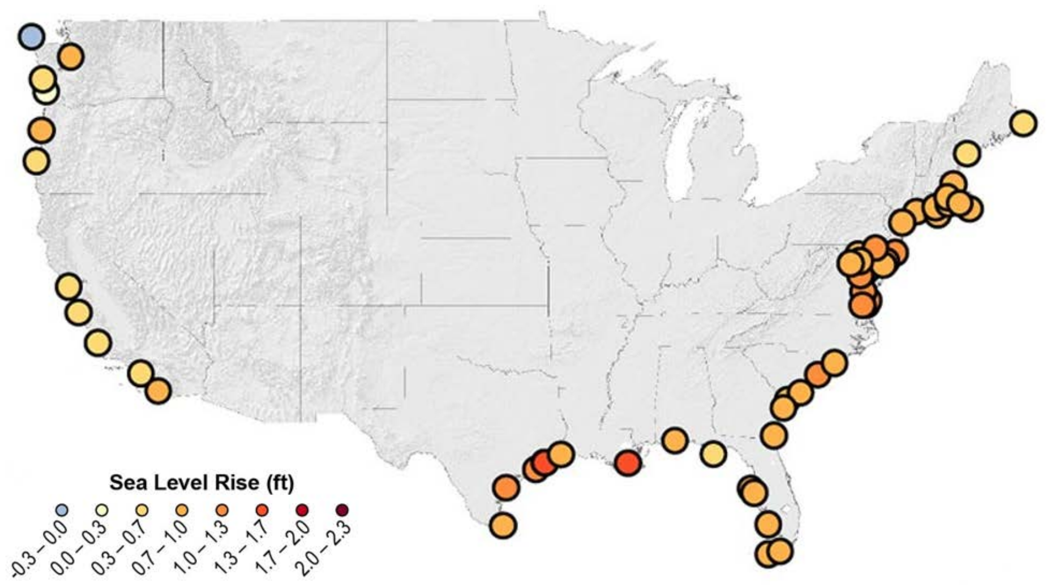


Figure 7.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

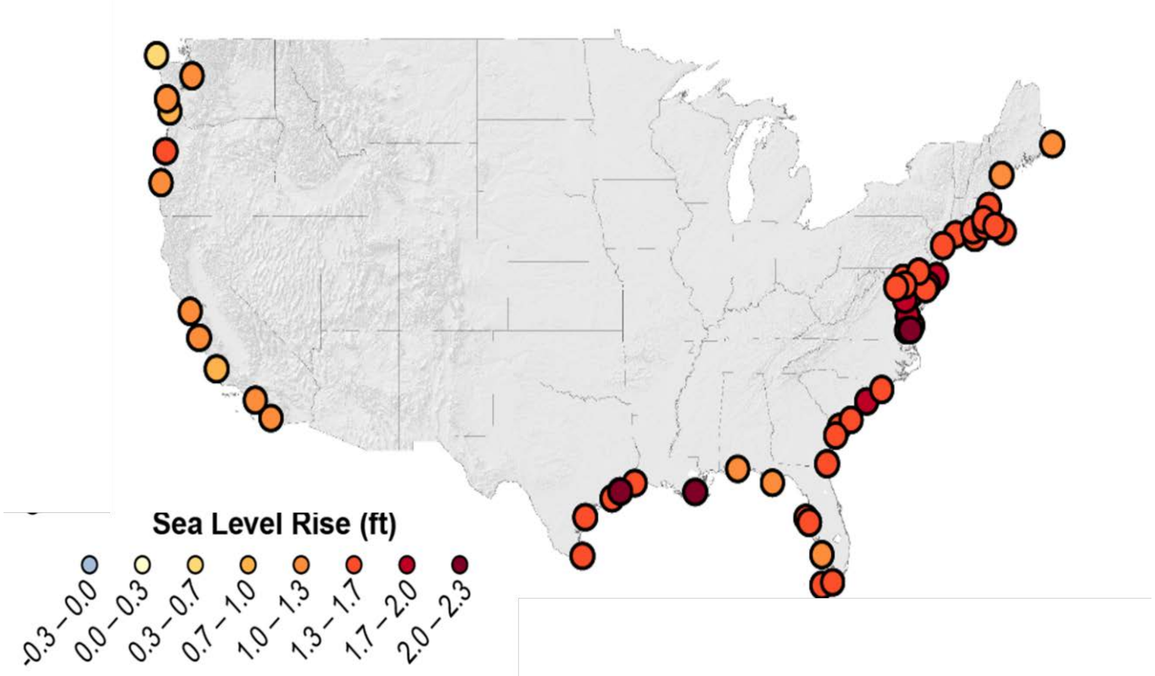


Figure 7.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

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 provide greater certainty (USGCRP, 2009).

7.2.14.4. 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 7.2.14-1, 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 on-site 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, 2015a). 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. 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 (Vereecken, et al., 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 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 19, Cumulative Impacts. No BMPs will be described in this chapter for this aspect of the resource.

Sea level along the Maryland coast is projected to rise between 2.7 to 3.4 feet over the next century, and due to the Chesapeake Bay region's geography and geology, Maryland is considered the third-most vulnerable state to sea level rise, behind Florida and Louisiana (State of Maryland, 2015c) with significant impacts on both the natural and built environment. For natural ecosystems, this will inundate wetlands and other important coastal habitat, including the Chesapeake Bay, with negative consequences for populations of oysters and other important species (NOAA, 2015g). Climate change is also expected to increase the frequency and intensity of heavy downpours as the 21st century progresses (USGCRP, 2014e). 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 (particularly the Chesapeake Bay), and negative impacts on both flora and fauna (State of Maryland, 2015c). For the built environment, particularly critical infrastructure in low-lying areas as well shoreside communities, the impacts of repeated inundation are anticipated to be negative (USGCRP, 2014f). Climate change is also anticipated to negatively impact human health with longer and more intense heat waves, particularly in urban areas with a significant heat island such as Baltimore where harmful air pollutants such as ground-level ozone also tend to accumulate (State of Maryland, 2015c).

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. Rising sea levels in Maryland combined with increased heavy downpours and increased intensity of hurricanes could have negative impacts on FirstNet installations and infrastructure located on or near the coast, as well as in floodplains and other vulnerable areas (USGCRP, 2014e). Increasing temperature and periods of extreme summer heat will increase the demand for air-conditioning, which may place stress on the electric grid (DOE, 2015), and also potentially overwhelm the capacity of on-site equipment needed to keep microwave and other transmitters cool.

7.2.14.5. 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 Maryland, 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, 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 right-of-ways 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.

  - 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, and 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. The coastal areas of Maryland 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, 2014a). Stronger storms may also increase the potential for damage from high winds and wind-borne debris. For inland areas at risk of flooding, climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash floods (USGCRP, 2014a). 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 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 from the project, while adaptation 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. 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.

7.2.14.6. 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.

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. 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.

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. These activities are expected to be less than significant due the limited duration of deployment activities.

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.

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. 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 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 7.1.14, Climate Change.

7.2.15. Human Health and Safety

7.2.15.1. Introduction

This section describes potential impacts to human health and safety in Maryland associated with deployment of the Proposed Action and alternatives. Chapter 17 identifies BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

7.2.15.2. 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 7.2.15-1. As described in Section 7.2, 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 human health and safety addressed in this section are presented as a range of possible impacts.

Table 7.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

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
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 Manmade 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

7.2.15.3. *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 7.2.15-1, 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, 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 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, the 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, 2015b).

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, 2015b). 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, 2015b). 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 Maryland Department of Labor, Licensing and Regulation, Division of Labor and Industry (MDDLI) is authorized by OSHA to administer the state program which oversees employee safety in all state and local government and private sector 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. MDDLI is not authorized by OSHA to administer the state’s private sector program for occupational safety or federal employers. Therefore, MDDLI defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands 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. Mines may cause unstable surface and subsurface conditions as a result of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 7.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of the Interior's (DOI) Abandoned Mine Lands inventory, through MDE, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination, mining activities, 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 or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) 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. In the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under OSHA, RCRA, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), etc. 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 MDE 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. Telecommunications, including public safety communications, can be knocked out (temporarily or permanently) during disaster events.

Based on the impact significance criteria presented in Table 7.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters (e.g., coastal regions or areas located within the floodplain). 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.

7.2.15.4. 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 development 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 construction/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 development scenarios or 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 PoPs, 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 would 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 and 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 working over water, weather exposure, the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential for 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.
  - 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.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance in land-based deployables occur in 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. 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.

7.2.15.5. 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 7.2.15, Human Health and Safety.

MD Appendix A – Water Resources

Table A-1. Characteristics of Maryland's Watersheds, as Defined by MDE

Watershed/Size Land Area within MD (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Coastal Bays (631)	Isle of Wight Bay Chincoteague Bay	• Excess nitrogen • Excess phosphorous
Lower Eastern Shore (2,884)	Pokomoke River Wicomico River Nanticoke River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens
Choptank (1,358)	Choptank River	• Excess nitrogen • Excess phosphorous • Turbidity • Pathogens
Upper Eastern Shore (1,922)	Chester River Sassafras River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens • PBCs
Upper Western Shore (1,640)	Susquehanna River	• Excess nitrogen • Excess phosphorous • Turbidity
Lower Potomac (1,841)	Potomac River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens • PBCs
Middle Potomac (1,055)	Potomac River Anacostia River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens • PCBs
Patuxent (1,579)	Patuxent River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens • Methyl Mercury
Lower Western Shore (505)	Severn River South River Magothy River West River	• Excess nitrogen • Excess phosphorous • Pathogens • PCBs

Watershed/Size Land Area within MD (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Patapsco/Back (1,138)	Patapsco River Back River	• Turbidity • Excess nitrogen • Excess phosphorous • Pathogens • PCBs
Upper Potomac (3,459)	Potomac River Monocacy River Savage River	• Aluminum • Pathogens • Turbidity • Iron
Youghiogheny (702)	Youghiogheny River Cassleman River	• Turbidity • Pathogens • Methyl Mercury • Excess phosphorous

Source: (USEPA, 2016d)

MD APPENDIX B – AIR QUALITY

Table B-1: National Ambient Air Quality Standards (NAAQS)

Pollutant	Averaging Time	Primary Standard[a]		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
CO	8-hour	10,000	9	-	-	Standard is not to be exceeded more than once per year
	1-hour	40,000	35	-	-	
Lead	3-month	0.15[b]	-	Same as Primary		Rolling average. Not to be exceeded
NO_X	1-hour	188	0.100	-	-	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Annual	100	0.053	Same as Primary		Annual Mean
PM_{10}	24-hour	150	-	-	-	Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$	Annual	12	-	15	-	Annual mean, averaged over 3 years
	24-hour	35	-	Same as Primary		98th percentile, averaged over 3 years
O_3	8-hour	147	0.075[c]	Same as Primary		Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
SO_X	1-hour	196	0.075[d]	-	-	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-hour	-	-	1,300	0.5	Not to be exceeded more than once per year

Source: (USEPA, 2016e)

[a] The standard may be expressed both sets of units. A bank cell, containing a dash, indicates that there is no primary or secondary standard for the specific pollutant and averaging time.
[b] "Final Rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[c] Final Rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, USEPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.
[d] Final Rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved."

Table B-2: Federally Regulated Hazardous Air Pollutants (HAPs)

POLLUTANT[a]	CAS#[b]
Acetaldehyde	75070
Acetamide	60355
Acetonitrile	75058
Acetophenone	98862
2-Acetylaminofluorene	53963
Acrolein	107028
Acrylamide	79061
Acrylic acid	79107
Acrylonitrile	107131
Allyl chloride	107051
4-Aminobiphenyl	92671
Aniline	62533
o-Anisidine	90040
Asbestos	1332214
Benzene (including benzene from gasoline)	71432
Benzidine	92875
Benzotrichloride	98077
Benzyl chloride	100447
Biphenyl	92524
Bis(2-ethylhexyl)phthalate (DEHP)	117817
Bis(chloromethyl)ether	542881
Bromoform	75252
1,3-Butadiene	106990
Calcium cyanamide	156627
Caprolactam	105602
Captan	133062
Carbaryl	63252
Carbon disulfide	75150
Carbon tetrachloride	56235
Carbonyl sulfide	463581
Catechol	120809
Chloramben	133904
Chlordane	57749
Chlorine	7782505
Chloroacetic acid	79118
2-Chloroacetophenone	532274
Chlorobenzene	108907
Chlorobenzilate	510156
Chloroform	67663

POLLUTANT[a]	CAS#[b]
Chloromethyl methyl ether	107302
Chloroprene	126998
Cresols/Cresylic acid (isomers and mixture)	1319773
o-Cresol	95487
m-Cresol	108394
p-Cresol	106445
Cumene	98828
2,4-D, salts and esters	94757
Dichlorodiphenyldichloroethylene (DDE)	3547044
Diazomethane	334883
Dibenzofurans	132649
1,2-Dibromo-3-chloropropane	96128
Dibutylphthalate	84742
1,4-Dichlorobenzene(p)	106467
3,3-Dichlorobenzidene	91941
Dichloroethyl ether (Bis(2-chloroethyl)ether)	111444
1,3-Dichloropropene	542756
Dichlorvos	62737
Diethanolamine	111422
N,N-Diethyl aniline (N,N-Dimethylaniline)	121697
Diethyl sulfate	64675
3,3-Dimethoxybenzidine	119904
Dimethyl aminoazobenzene	60117
3,3'-Dimethyl benzidine	119937
Dimethyl carbamoyl chloride	79447
Dimethyl formamide	68122
1,1-Dimethyl hydrazine	57147
Dimethyl phthalate	131113
Dimethyl sulfate	77781
4,6-Dinitro-o-cresol, and salts	534521
2,4-Dinitrophenol	51285
2,4-Dinitrotoluene	121142
1,4-Dioxane (1,4-Diethyleneoxide)	123911
1,2-Diphenylhydrazine	122667
Epichlorohydrin (l-Chloro-2,3-epoxypropane)	106898
1,2-Epoxybutane	106887
Ethyl acrylate	140885
Ethyl benzene	100414
Ethyl carbamate (Urethane)	51796
Ethyl chloride (Chloroethane)	75003

POLLUTANT[a]	CAS#[b]
Ethylene dibromide (Dibromoethane)	106934
Ethylene dichloride (1,2-Dichloroethane)	107062
Ethylene glycol	107211
Ethylene imine (Aziridine)	151564
Ethylene oxide	75218
Ethylene thiourea	96457
Ethylidene dichloride (1,1-Dichloroethane)	75343
Formaldehyde	50000
Heptachlor	76448
Hexachlorobenzene	118741
Hexachlorobutadiene	87683
Hexachlorocyclopentadiene	77474
Hexachloroethane	67721
Hexamethylene-1,6-diisocyanate	822060
Hexamethylphosphoramide	680319
Hexane	110543
Hydrazine	302012
Hydrochloric acid	7647010
Hydrogen fluoride (Hydrofluoric acid)	7664393
Hydrogen sulfide	7783064
Hydroquinone	123319
Isophorone	78591
Lindane (all isomers)	58899
Maleic anhydride	108316
Methanol	67561
Methoxychlor	72435
Methyl bromide (Bromomethane)	74839
Methyl chloride (Chloromethane)	74873
Methyl chloroform (1,1,1-Trichloroethane)	71556
Methyl ethyl ketone (2-Butanone)	78933
Methyl hydrazine	60344
Methyl iodide (Iodomethane)	74884
Methyl isobutyl ketone (Hexone)	108101
Methyl isocyanate	624839
Methyl methacrylate	80626
Methyl tert butyl ether	1634044
4,4-Methylene bis(2-chloroaniline)	101144
Methylene chloride (Dichloromethane)	75092
Methylene diphenyl diisocyanate (MDI)	101688
4,4'¬-Methylenedianiline	101779

POLLUTANT[a]	CAS#[b]
Naphthalene	91203
Nitrobenzene	98953
4-Nitrobiphenyl	92933
4-Nitrophenol	100027
2-Nitropropane	79469
N-Nitroso-N-methylurea	684935
N-Nitrosodimethylamine	62759
N-Nitrosomorpholine	59892
Parathion	56382
Pentachloronitrobenzene (Quintobenzene)	82688
Pentachlorophenol	87865
Phenol	108952
p-Phenylenediamine	106503
Phosgene	75445
Phosphine	7803512
Phosphorus	7723140
Phthalic anhydride	85449
Polychlorinated biphenyls (Aroclors)	1336363
1,3-Propane sultone	1120714
beta-Propiolactone	57578
Propionaldehyde	123386
Propoxur (Baygon)	114261
Propylene dichloride (1,2-Dichloropropane)	78875
Propylene oxide	75569
1,2-Propylenimine (2-Methyl aziridine)	75558
Quinoline	91225
Quinone	106514
Styrene	100425
Styrene oxide	96093
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746016
1,1,2,2-Tetrachloroethane	79345
Tetrachloroethylene (Perchloroethylene)	127184
Titanium tetrachloride	7550450
Toluene	108883
2,4-Toluene diamine	95807
2,4-Toluene diisocyanate	584849
o-Toluidine	95534
Toxaphene (chlorinated camphene)	8001352
1,2,4-Trichlorobenzene	120821
1,1,2-Trichloroethane	79005

POLLUTANT[a]	CAS#[b]
Trichloroethylene	79016
2,4,5-Trichlorophenol	95954
2,4,6-Trichlorophenol	88062
Triethylamine	121448
Trifluralin	1582098
2,2,4-Trimethylpentane	540841
Vinyl acetate	108054
Vinyl bromide	593602
Vinyl chloride	75014
Vinylidene chloride (1,1-Dichloroethylene)	75354
Xylenes (isomers and mixture)	1330207
o-Xylenes	95476
m-Xylenes	108383
p-Xylenes	106423
Antimony Compounds	-
Arsenic Compounds (inorganic including arsine)	-
Beryllium Compounds	-
Cadmium Compounds	-
Chromium Compounds	-
Cobalt Compounds	-
Coke Oven Emissions	-
Cyanide Compounds[c]	-
Glycol ethers[d]	-
Lead Compounds	-
Manganese Compounds	-
Mercury Compounds	-
Fine mineral fibers[e]	-
Nickel Compounds	-
Polycylic Organic Matter[f]	-
Radionuclides (including radon)[g]	-
Selenium Compounds	-

Source: (USEPA, 2015ae)[a] For all listings above which contain the word "compounds" and for glycol ethers, the following applies: Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc.) as part of that chemical's infrastructure.

[b] Chemical Abstract Service (CAS) Registry Numbers are universally used to provide a unique, unmistakable identifier for chemical substances.

[c] X'CN where X = H' or any other group where a formal dissociation may occur. For example, potassium cyanide (KCN) or Ca(CN)2.

[d] Includes mono- and di- ethers of ethylene glycol, diethylene glycol, and triethylene glycol R-(OCH2CH2)n-OR' where:

n = 1, 2, or 3;
R = alkyl C7 or less; or
R = phenyl or alkyl substituted phenyl;
R’= H or alkyl C7 or less; or

OR’ consists of carboxylic acid ester, sulfate, phosphate, nitrate, or sulfonate.
[e] Includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.
[f] Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100 º C.
[g] A type of atom which spontaneously undergoes radioactive decay.

ACRONYMS

Acroynm	Definition
A.D.	Anno Domini
AAF	Army Airfield
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AGL	Above Ground Level
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
AUVSI	Association for Unmanned Vehicle System International
B&O	Baltimore & Ohio
B.C.	Before Christ
BGE	Baltimore Gas and Electric
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BTOP	Broadband Technology Opportunities Program
BWI	Baltimore – Washington International Airport
C&O	Chesapeake & Ohio
CAA	Clean Air Act
CAS	Chemical Abstract Service
CCMP	Comprehensive Conservation and Management Plan
CEJSC	Commission on Environmental Justice and Sustainable Communities
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Controlled Firing Area
CFOI	Census of Fatal Occupational Injuries
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	Methane
CHS	Controlled Hazardous Substance
CIMC	Cleanups In My Community
CMARC	Central Maryland Area Regional Communications
CO	Carbon Monoxide

Acroynm	Definition
CO_2	Carbon Dioxide
COLT	Cell on Light Truck
COMAR	Code of Maryland Regulations
COW	Cell on Wheels
CRS	Community Rating System
CWA	Clean Water Act
D.C.	District of Columbia
DCA	Washington National Airport
DDE	Dichlorodiphenyldichloroethylene
DE	Delaware
DEHP	Bis(2-ethylhexyl)phthalate
DNR	Department of Natural Resources
DOC	Department of Commerce
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
DPS	Distinct Population Segments
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FL	Florida
FLM	Federal Land Manager
FR	Federal Register
FSDO	Flight Standards District Office
FSS	Flight Service Station
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
GOHS	Governor's Office of Homeland Security
GWP	Global Warming Potential
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plans

Acroynm	Definition
HGR	Henson Field
HHRA	Human Health Risk Assessment
HSEMA	Homeland Security and Emergency Management Agency
IAD	Washington Dulles International Airport
IBA	Important Bird Area
IFR	Instrument Flight Rules
IL	Illinois
IPAC	Invasive Plant Advisory Committee
IPCC	Intergovernmental Panel on Climate Change
KCN	Potassium Cyanide
LBS	Locations-Based Services
LLC	Limited Liability Company
LRR	Land Resource Regions
LTE	Long Term Evolution
MAA	Maryland Aviation Administration
MALPF	Maryland Agricultural Land Preservation Foundation
MARC	Maryland Area Regional Commuter
MBTA	Migratory Bird Treaty Act
MD	Maryland
MDDLI	Maryland Division of Labor and Industry
MDE	Maryland Department of Environment
MDHMH	Maryland Department of Health and Mental Hygiene
MDI	Methylene Diphenyl Diisocyanate
MDNR	Maryland Department of Natural Resources
MDOT	Maryland Department of Transportation
MDP	Maryland Department of Planning
MESIN	Maryland Eastern Shore Interoperability Network
MGS	Maryland Geologic Survey
MHI	Median Household Income
MHT	Maryland Historical Trust
MHz	Megahertz
MIHP	Maryland Inventory of Historic Properties
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tonnes
MOA	Military Operation Area
MOSH	Maryland Occupational Safety and Health
MPA	Maryland Port Administration
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSHA	Mine Safety and Health Administration
MSL	Mean Sea Level

Acroynm	Definition
MT	Metric Ton
MTA	Maryland Transit Administration
MWAA	Metropolitan Washington Airports Authority
MYA	Million Years Ago
N_2O	Nitrous Oxide
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NCR	National Capital Region
NCRHSP	National Capital Region Homeland Security Program
NECWA	New England Coastal Wildlife Alliance
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act
NIH	National Institute of Healh
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices to Airmen
NO_X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NST	National Scenic Trail
NTFI	National Task Force on Interoperability
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWS	National Weather Service

Acroynm	Definition
NY	New York
NYSDEC	New York State Department of Environmental Conservation
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OSHA	Occupational Safety and Health Administration
OSMRE	Office of Surface Mining Reclamation and Enforcement
PA	Pennsylvania
PEIS	Programmatic Environmental Impact Statement
PFBC	Pennsylvania Fish and Boat Commission
PGA	Peak Ground Acceleration
PHL	Philadelphia International Airport
PM	Particulate Matter
POP	Point of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
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
SBY	Salisbury-Ocean City Wicomico Regional Airport
SCEC	State Climate Extremes Committee
SCIP	Statewide Communications Interoperability Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIEC	Statewide Interoperability Executive Committee
SIP	State Implementation Plan
SMIEC	Southern Maryland Interoperable Emergency Communications
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedure
SOW	Site on Wheels
SO_X	Sulfur Oxides
SPL	Sound Pressure Level

Acroynm	Definition
SSA	Sole Source Aquifer
STATSGO2	State Soil Geographic
SUA	Special Use Airspace
SWA	Solid Waste Acceptance
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
U.S.	United States
U.S.C.	U.S. Code
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
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
VA	Virginia
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compound
VoIP	Voice over Internet Protocol
VT	Vermont
WCS	Wetlands Classification Standard
WHS	Wildlife & Heritage Service
WIP	Watershed Implementation Plan
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Wetlands of Special State Concern
WV	West Virginia
WWI	World War I
WWII	World War II
WWPP	Wastewater Permit Program
YOY	Young of the Year

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