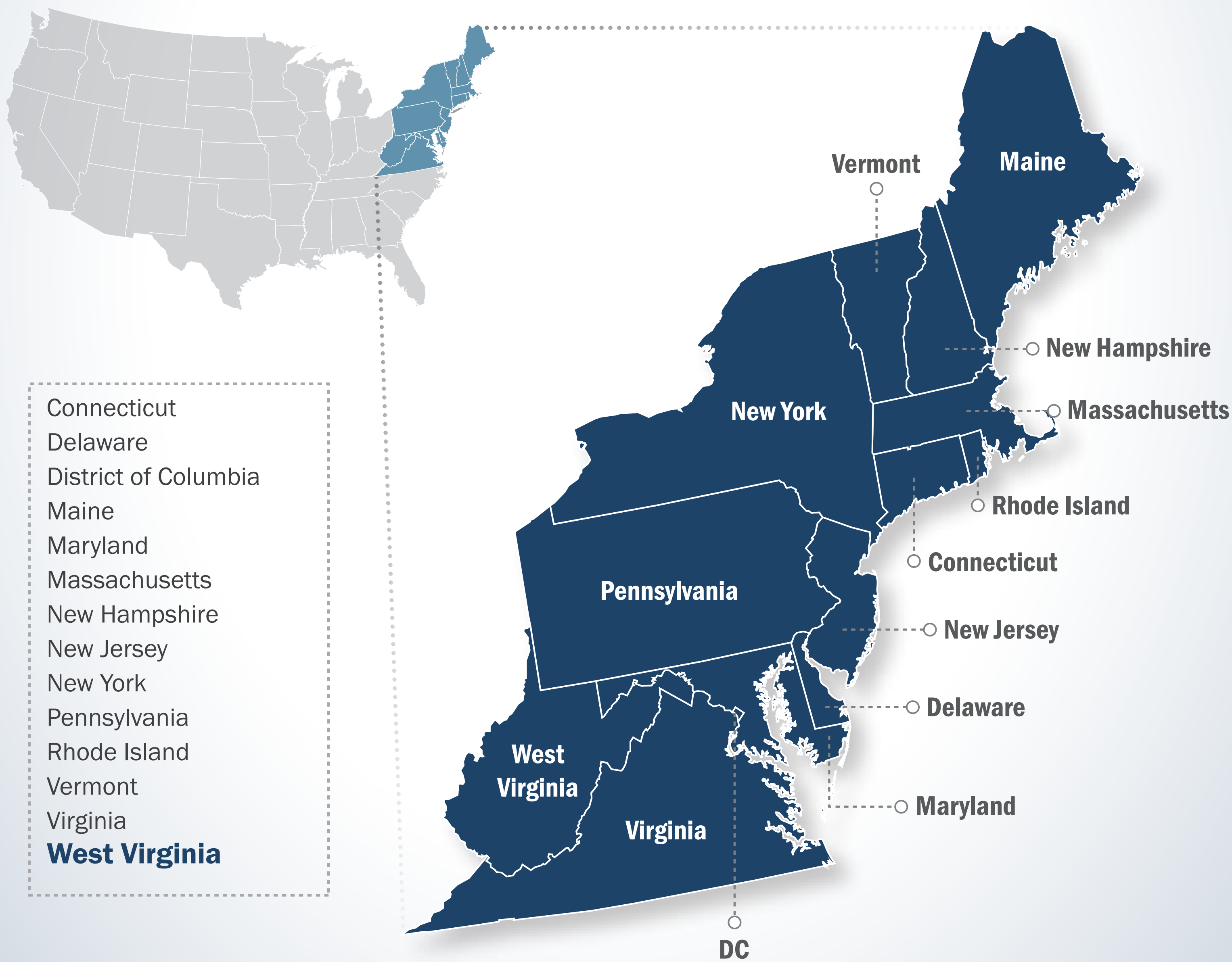
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 14 - CHAPTER 16



Connecticut
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Virginia
West Virginia

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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 14 - CHAPTER 16

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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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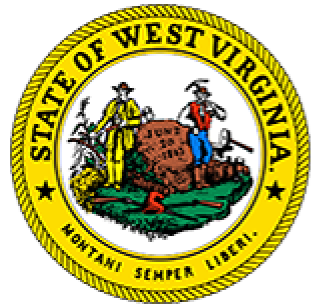
16. WEST VIRGINIA



West Virginia became a state in 1863 during the Civil War, when several counties in northwestern Virginia separated from the state and sided with the Union rather than the Confederacy (West Virginia Division of Culture and History, 2015a). West Virginia is bordered by Pennsylvania and Maryland to the north, Ohio and Kentucky to the west, and Virginia to the east and south. This chapter provides details about the existing environment of West Virginia as it relates to the Proposed Action. General facts about West Virginia are provided below.

- **State Nickname**: The Mountain State
- **Area:** 24,259 square miles; **U.S. Rank**: 41 (USGS, 2012a) (Census Bureau, 2010a)
- **Capital:** Charleston
- **Counties:** 55 (Census Bureau, 2015a)
- **Estimated Population:** Over 1.8 million people; **U.S. Rank:** 37 (Census Bureau, 2015b)
- **Most Populated Cites:** Charleston and Huntington (Census Bureau, 2015a)
- **Main Rivers:** Potomac River, Ohio River, Coal River, Greenbrier River, Big Sandy River, Guyandotte River, Elk River, Kanawha River, and Cheat River
- **Bordering Waterbodies:** Ohio River and Big Sandy River
- **Mountain Ranges:** Allegheny Mountains and a portion of the Appalachian Mountains
- **Highest Point:** Spruce Knob (4,863 feet) (USGS, 2015a)

16.1. AFFECTED ENVIRONMENT

16.1.1. Infrastructure

16.1.1.1. Definition of the Resource

This section provides information on West Virginia 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 man-made 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 16.1.1.3 provides an overview of West Virginia's traffic and transportation infrastructure, including road and rail networks and waterway facilities. West Virginia's public safety infrastructure could include any infrastructure utilized by a public safety entity 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 West Virginia are presented in more detail in Section 16.1.1.4. Section 16.1.1.5 describes West Virginia's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of West Virginia utilities, such as power, water, and sewer, is presented in Section 16.1.1.6.

16.1.1.2. Specific Regulatory Considerations

Multiple West Virginia laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 16.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 16.1.1-1: Relevant West Virginia Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Code: Chapter 5D Public Energy Authority Act	West Virginia Public Energy Authority; Public Service Commission; Oil and Gas Conservation Commission	Fosters and promotes the mineral development industry; acquires and finances electric power, natural gas transmission, or other energy projects and facilities; prescribes and enforces safety standards for pipeline facilities; establishes rules and regulations for energy utilities.

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Code: Chapter 15 Public Safety; West Virginia Code of Rules: Title 55 State Emergency Response Commission, Title 81 Public Safety	Department of Public Safety; State Police; Division of Homeland Security and Emergency Management (DHSEM); Office of Emergency Services	Enforces criminal and traffic laws state wide; maintains safety; designates emergency planning districts in order to facilitate preparation and implementation of emergency plans.
West Virginia Code: Chapter 24 Public Service Commission; West Virginia Code of Rules: Title 150 Public Service Commission	Public Service Commission; Oil and Gas Conservation Commission	Makes and enforces rules and orders to prevent waste from water and energy sources; transmission of messages by telephone, telegraph, or radio; generation and transmission of electrical energy; the supply of water, gas, or electricity, and sewer systems; controls flow of solid waste; establishes, develops, and maintains an emergency telephone system.
West Virginia Code: Chapter 17 Roads and Highways; Chapter 17a Motor Vehicle Administration; West Virginia Code of Rules: Title 91 Motor Vehicles; Title 150 Intrastate Rail Transportation; Title 157 Highways	Division of Highways; Division of Public Transit; Public Port Authority; Division of Motor Vehicles	Supervises the construction, reconstruction, repair, and maintenance of state roads and highways; establishes, develops, improves, and manages public transportation facilities, services, equipment, techniques, and methods; oversees railroad property, safety, and sanitation; establishes, defines, and regulates state road systems and motor vehicles.

Source: (West Virginia Legislature, 2016)

16.1.1.3. Transportation

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

The West Virginia Department of Transportation (WVDOT) has jurisdiction over freeways and major roads, airports, railroads, and ports in the state; local counties have jurisdiction for local streets and roads. The mission of the WVDOT is to “create and maintain for the people of West Virginia, the United States and the world a multi-modal and inter-modal transportation system that supports the safe, effective and efficient movement of people, information and goods that enhances the opportunity for people and communities to enjoy environmentally sensitive and economically sound development” (West Virginia Division of Culture and History, 2015a).

West Virginia has an extensive and complex transportation system across the entire state. The State’s transportation network is comprised of

- 38,759 miles of public roads and 6,958 bridges (WVDEP, 2015a);
- 2,297 miles of rail network that includes passenger rail and freight (WVDEP, 2013a);
- 123 aviation facilities, including airstrips and heliports (FAA, 2015a); and
- 1 major port.

Road Networks

As identified in Figure 16.1.1-1, the major urban centers of the state are Charleston-Huntington in the southwest, Morgantown-Wheeling in the north, and Martinsburg in the east (USFS, 2015a). West Virginia 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. Table 16.1.1-2 lists the interstates and their start/end points in West Virginia. 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 (USDOT, 2015a).

Table 16.1.1-2: West Virginia Interstates

Interstate	Southern Or Western Terminus In WV	Northern Or Eastern Terminus In WV
I-64	KY line at Huntington	VA line at White Sulphur Springs
I-68	I-79 at Morgantown	MD line at Bruceton Mills
I-70	OH line at Wheeling	PA line at Valley Grove
I-77	VA line at Hardy	OH line at Williamstown
I-79	I-77 in Charleston	PA line at Morgantown
I-81	VA line at Shenandoah	MD line at Potomac

In addition to the Interstate System, West Virginia 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 16.1.1-1 illustrates the major transportation networks, including roadways, in West Virginia. Section 16.1.8, Visual Resources, describes the National and Scenic Byways found in West Virginia from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the U.S. Department of Transportation's (DOT) Federal Highway Administration (FHWA) designates and manages the byways. West Virginia has six National Scenic Byways:

- Coal Heritage Trail: 97.6 miles in the south-central portion of the state from Bluefield to Hico (USDOT, 2015b);
- Highland Scenic Highway: 43 miles in the Monongahela National Forest (USDOT, 2015c);
- Historic National Road: 824.2 miles across six states with the West Virginia portion in the northern panhandle of the state (USDOT, 2015d);
- Midland Trail: 116.8 miles through the central section of the state from Charleston to White Sulphur Springs (USDOT, 2015e);
- Staunton-Parkersburg Turnpike: 180 miles through central West Virginia from Parkersburg to Bartow (USDOT, 2015f); and
- Washington Heritage Trail: 136 miles through the eastern panhandle from Paw Paw to Harpers Ferry (USDOT, 2015g).

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by WVDOT. West Virginia has 10 State Scenic Byways that crisscross the entire state (WVDOC, 2015):

- Cheat River Byway
- Coal Heritage Trail Byway
- Farm Heritage Road Byway
- Little Kanawha Creek Road Byway
- Lower Greenbrier River Byway
- Old Route 7 Byway
- Midland Trail Byway
- Mountain Parkway Byway
- Northwestern Turnpike Byway
- Paint Creek Byway

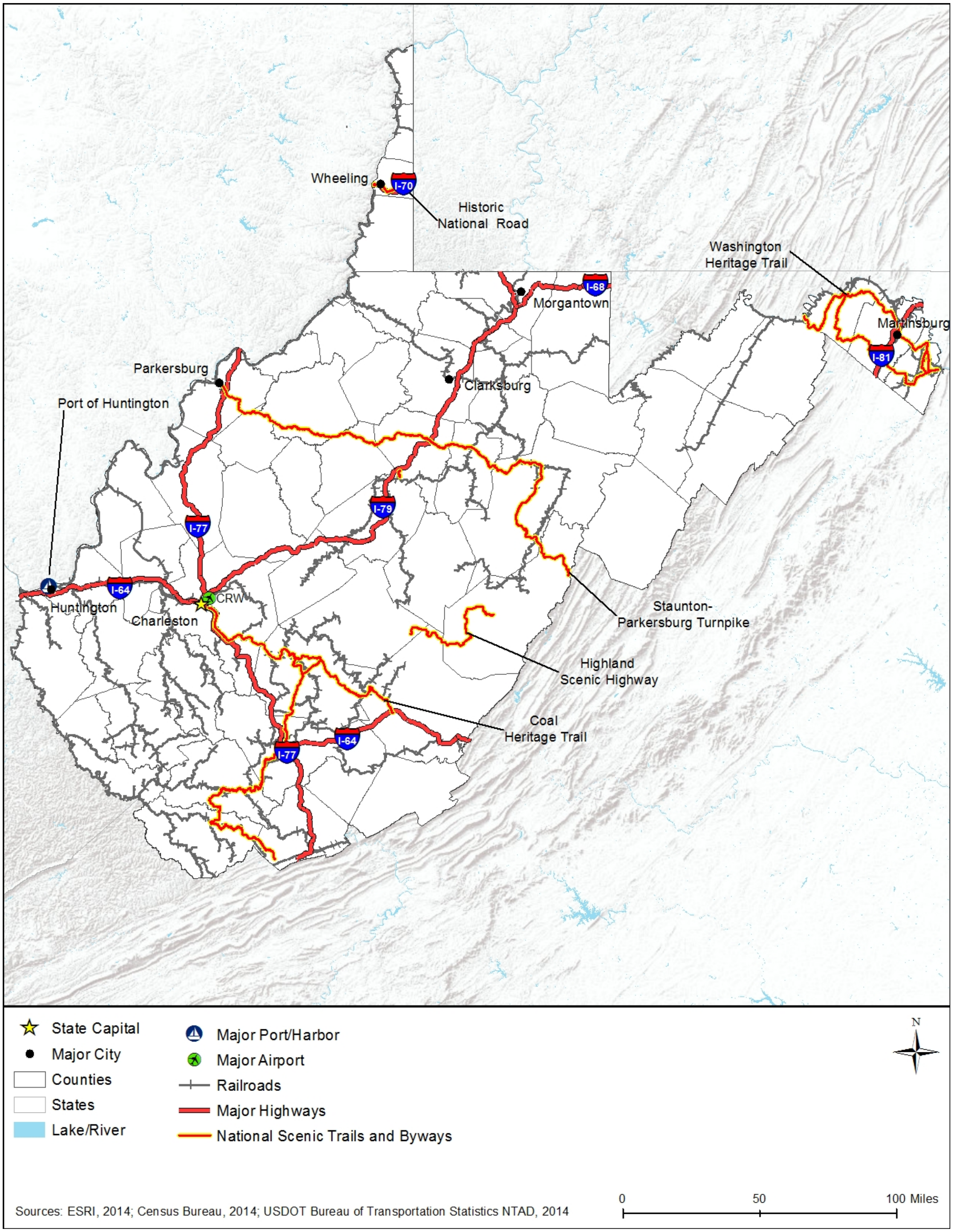


Figure 16.1.1-1: West Virginia Transportation Networks

Source: (USDOT, 2014)

Airports

Air service to the state is provided by several small, regional airports, the largest of which is Yeager Airport (CRW) outside Charleston. The Central West Virginia Regional Airport Authority consists of 13 board members from the surrounding counties and the City of Charleston (Yeager Airport, 2015). The Airport Authority owns and operates Yeager Airport. Figure 16.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 16.1.7, Land Use, Airspace, and Recreation, provides detail on airports and airspace in West Virginia.

Rail Networks

West Virginia is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Freight railroad companies own all 2,297 miles of track in the state; the passenger rail lines and public transportation lines operate on the tracks owned by freight rail (WVDEP, 2013a). Figure 16.1.1-1 illustrates the major transportation networks, including rail lines, in West Virginia.

Amtrak runs two lines through West Virginia. The Capitol Limited makes one round trip per day between Washington, DC and Chicago, IL. The Cardinal runs three round trips per week between New York, NY and Chicago, IL. In 2012, Amtrak served 55,000 passengers at West Virginia train stations (WVDEP, 2013a). Table 16.1.1-3 provides a complete list of Amtrak lines that run through West Virginia.

Table 16.1.1-3: Amtrak Train Routes Serving West Virginia

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in West Virginia
Capitol Limited	Washington, DC	Chicago, IL	18 hours	Harper's Ferry, Martinsburg
Cardinal/Hoosier State	New York, NY	Chicago, IL	26 hours 30 minutes	Charleston, Harper's Ferry

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

The Maryland Transit Administration, a division of the Maryland DOT, operates the Maryland Area Regional Commuter (MARC). It provides service between Union Station in Washington, D.C. and stations in West Virginia and Maryland along three lines: the Penn, Camden, and Brunswick Lines. The Brunswick Line terminates in West Virginia; it makes stops in Harper's Ferry, Duffields, and Martinsburg. MARC trains make three round trips per day between Martinsburg and Washington, DC. In fiscal year 2012, the Brunswick Line served 1,910,900 passengers in West Virginia (WVDEP, 2013a).

Freight rail remains an important mode of transport in West Virginia. On average, over 115 million tons of freight travel on freight rail in the state, which is almost 1.1 million rail cars of freight (WVDEP, 2013a). The largest commodity traveling via freight rail is coal at 88 percent of the total carloads (WVDEP, 2013a).

Harbors

West Virginia is landlocked in the eastern part of the United States, and as such has no territorial boundaries touching an ocean. However, the state does have several rivers crisscrossing its interior, which provide locations for a number of harbors that assist with inland shipping. Though these facilities tend to be small, many of them are seeing expansion efforts courtesy of the West Virginia Port Authority (WVDOT, 2015a). Aside from the smaller river harbors, West Virginia is home to the Port of Huntington, the largest inland shipping port in the U.S. (Huntington Waterways, 2015).

The Port of Huntington is located at the juncture of the Ohio and Big Sandy Rivers, in western West Virginia. It can be reached overland by I-64, shown in Figure 16.1.1-1. Expansion of the port's territory in 2000 gave it jurisdiction over a total of "14 miles of the Ohio River in the vicinity of Huntington" and "100 miles of the Ohio River from the mouth of the Scioto River near Portsmouth, stretching upstream to the northern boundary of Gallia County; 9 miles of the Big Sandy and 90 miles of the Kanawha." The port moves over 80 million tons of cargo through inland rivers each year, with an estimated value of $5.3 billion. This cargo include such goods as coal, steel, and petroleum. (Huntington Waterways, 2015)

Of the less busy harbors in West Virginia, what is now the Cabell/Wayne Port District in Prichard is being considered as the location of a new inland port (WVDOT, 2015a). Prichard is south of Port of Huntington, along the Big Sandy River. Another proposal would seat a public port in Charleston, the state capitol. Charleston's position on the Kanawha River could help it become an important area for shipping vessels moving along the state's rivers (WVDOT, 2015a).

16.1.1.4. Public Safety Services

West Virginia 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 16.1.1-4 presents West Virginia's important demographics including estimated population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 16.1.9, Socioeconomics.

Table 16.1.1-4: Important West Virginia Indicators

West Virginia Indicators	
Estimated Population (2014)	1,850,326
Land Area (square miles) (2010)	24,259
Population Density (persons per sq. mile) (2010)	77.1
Municipal Governments (2013)	232

Sources: (USGS, 2012a) (Census Bureau, 2015c) (National League of Cities, 2007)

Table 16.1.1-5 presents West Virginia's public safety infrastructure, including fire and police stations.

Table 16.1.1-5: Public Safety Infrastructure in West Virginia by Type

Fire and Rescue	
Infrastructure Type	**Number**
Fire and Rescue Stations	934
Law Enforcement Agencies	214
Fire Departments	523

Source: (National Fire Department Census, 2015)

Table 16.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 16.1.1-6: First Responder Personnel in West Virginia by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	920
Fire and Rescue Personnel	10,696
Law Enforcement Personnel	6,859
Emergency Medical Technicians and Paramedics	2,510

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

16.1.1.5. Telecommunications Resources

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

In general, the deployment of telecommunications resources in Connecticut is widespread and similar to other states in the U.S. 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 16.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio (LMR) network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including an long-term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

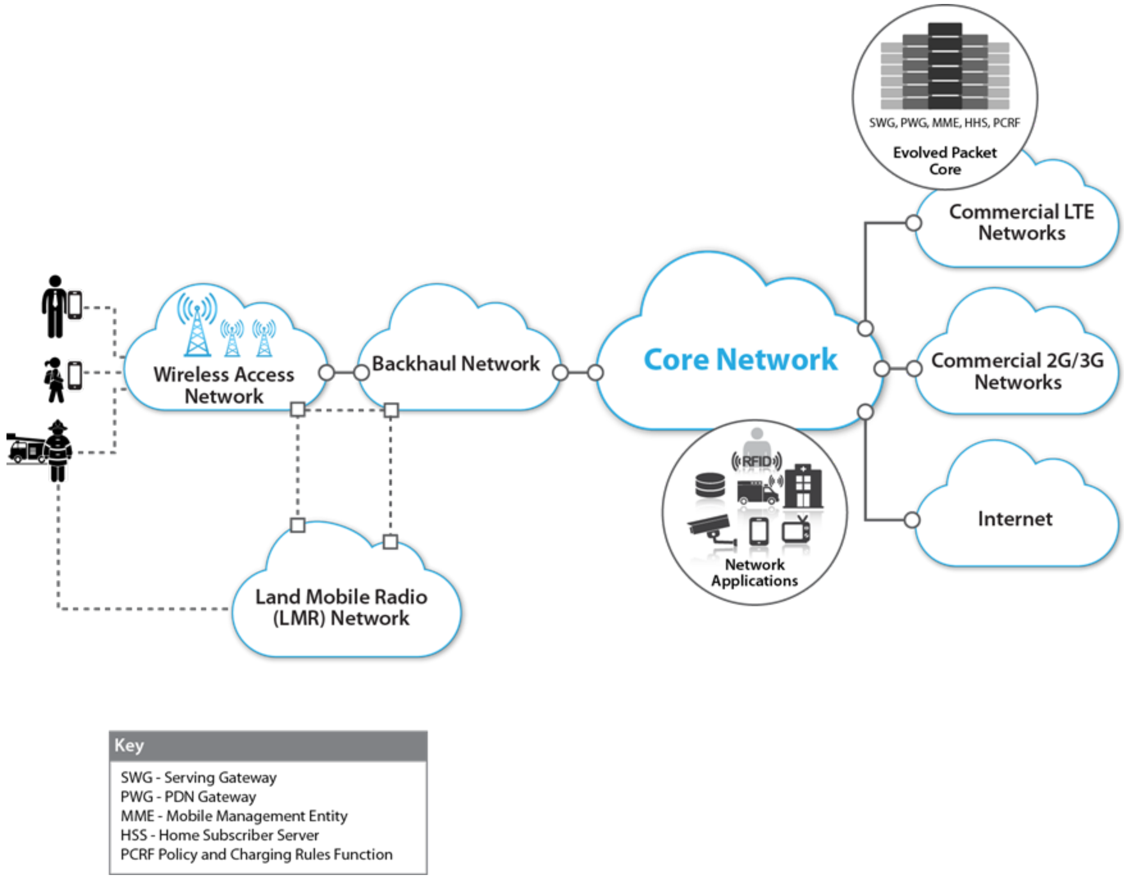


Figure 16.1.1-2: Wireless Network Configuration

Prepared by: Booz Allen Hamilton

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 scale, which is national (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 West Virginia. 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 LMR networks into a nationwide public safety LTE broadband network, the U.S. Department of Commerce (DOC) Public Safety Communications Research (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 West Virginia are comprised of a statewide Ultra High Frequency (UHF) digital Project-25 (P-25) wireless communications network, Statewide Interoperability Radio Network (SIRN), as well as a combination of legacy Very High Frequency (VHF)[1] and UHF[2] networks serving a broad range of public safety user groups.

In 2009, the Executive Office of West Virginia was awarded a National Telecommunications Information (NTIA) Broadband Technology Opportunities Program (BTOP) infrastructure grant for fiber optic, microwave equipment, and wireless towers. The microwave and wireless tower site portion of the BTOP grant resulted in increased capacity and coverage for public safety users and 863 public safety locations are benefiting from improved connectivity due to the project (Executive Office of the State of West Virginia 2013a). The BTOP project expanded the number of SIRN tower sites from 84 to 96 through the addition of 12 new towers (Executive Office of the State of West Virginia, 2013b). The West Virginia SIRN covers 87 percent of the state (Eyre 2012). The coverage could be greater – however, the presence of the National Radio Astronomy Observatory in Green Bank, West Virginia, requires wireless restrictions in large adjacent areas (West Virginia Legislature, 2015a). Regarding this "Quiet Zone" near the Observatory, the West Virginia 2015 Statewide Communications Interoperability Plan (SCIP) summarizes this situation as follows,

> *Another key factor affecting radio interoperability in West Virginia is the National Radio Quiet Zone, which encloses a land area of approximately 13,000 square miles near the border of Virginia, and was designated to minimize harmful interference to the National Radio Astronomy Observatory in Green Bank, West Virginia. Power density thresholds in the radio spectrum that exceed the levels that are harmful to observations in Green Bank are not permitted without power reduction, antenna modification, relocating the antenna, or selecting different frequencies where the power density limits are different.*

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

> *Due to these limitations, the State chose to establish the 450 MHz UHF digital trunked radio spectrum as the State's official radio system*. (State of West Virginia 2015)

The responsibility for the West Virginia SIRN resides with the West Virginia Statewide Interoperable Executive Committee (SIEC) whose duties span operational, oversight, policy, and technical standard selection. The SIRN Frequently Asked Questions explains:

> *By Executive Order of the Governor of WV, the SIRN is administered by the WV SIEC. The SIEC advises the Governor, the state Homeland Security Advisor, and the Statewide Interoperable Coordinator on statewide priorities related to interoperable communications, provides day-to-day governance of the SIRN, serves as the primary mechanism for updating policies, procedures, and guidelines, identifies new and developing technologies and standards, and enhances the coordination of all available resources for public safety interoperable communications in WV.* (SIRN 2015)

Statewide Public Safety Networks

West Virginia elected to implement its statewide public safety and state agency system on the Phase 1 Project-25 (P-25) FDMA[3] standard that provides digital communication capabilities and enhances interoperability for public safety users (P25.org, 2015). In its 2015 SCIP, West Virginia highlighted the ability via the P-25 network to communicate with adjacent states, its overall improved interoperability, and the benefits of standardization in adopting its P-25 system for statewide communications. "The SIRN enables Federal, State, and local agencies to communicate with one another and provides interoperable communications for all public safety agencies in West Virginia on a shared radio network, as well as provides interoperable connectivity to its bordering States." (State of West Virginia 2015)

The SCIP also calls attention to the wireless communications challenges inherent in a mountainous state such as West Virginia supporting its use of the low VHF frequency to provide better propagation in the State. "The geography of West Virginia constitutes the largest communications challenge within the State. The Appalachian Mountains hinder using higher frequency ranges because more towers tend to be required when operating at higher frequencies. Thus, West Virginia uses the 450 MHz range UHF, P-25 trunking system[4] as the standard communication system throughout the State due to its line of sight considerations." (State of West Virginia 2015)

The State Police, local and county police, fire, and EMS public safety agencies use the SIRN UHF P-25 system. In addition, it supports West Virginia non-public safety agencies including the State Environmental Protection Agency, Department of Corrections, and the DOT.

A major user of the P-25 SIRN system is the West Virginia State Police, which is organized into eight Troops with regional territory deployments, plus a State Police Headquarters in Charleston, the state capital. The SIRN is used for patrol operations as well as to provide interoperability to

[3] Frequency Division Multiplexing.

[4] "Trunked single-site or multisite systems can be shared among a mix of users, with each type of user having an appropriate set of talk groups and priorities." (NTIA 2015)

support mutual aid and cross-jurisdictional incident response needs. VHF frequencies are also used by the State Police for car-to-car and other tactical communications needs (RadioReference.com, 2015a).

In addition to the statewide P-25 UHF network, law enforcement mutual aid in West Virginia can be provided via two lo-band VHF networks operational in West Virginia. The first VHF network is an intercounty mutual aid network and the second a Sherriff's network. (RadioReference.com, 2015b)

Statewide EMS are provided communications via the SIRN on UHF as well as on VHF over regionalized medical networks in West Virginia, Medcom (managed out of Charleston), and Medbase (managed out of Morgantown) (RadioReference.com, 2015c).

City and County Public Safety Networks

West Virginia's local city/town and county public safety first responders rely on a diverse set of older networks and frequencies. In West Virginia, local and countywide networks are a combination of low-VHF, VHF, and UHF systems (RadioReference.com, 2015d). For example in Hampshire County, in the northeastern portion of West Virginia, local police and sheriff communications are on lo-VHF for police and fire dispatch; VHF frequencies for tactical communications; and both VHF and UHF for fire tactical communications (RadioReference.com, 2015d).

In Kanawha County in Southwestern West Virginia (where the State Capital, Charleston, is located), there is a high dependency on the SIRN system by the County law enforcement agencies and County fire and EMS. However, each of these organizations also uses older VHF networks for dispatch and tactical communications highlighting the diversity within wireless networks used by local and county public safety organizations in West Virginia (RadioReference.com, 2015e).

Public Safety Answering Points (PSAPs)

According to the Federal Communications Commission (FCC)'s Master PSAP registry, there are 22 PSAPs supporting West Virginia 9-1-1 emergency service across the state (FCC, 2015b).

Commercial Telecommunications Infrastructure

West Virginia's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC, 2015b) (FCC, 2014a). The following sub-sections present information on West Virginia'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

West Virginia's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems. Table 16.1.1-7 presents the number of providers of switched access[5] lines, Internet access[6], and mobile wireless services including coverage.

Table 16.1.1-7: Telecommunications Access Providers and Coverage, as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	104	97% of households
Internet access	41	57% of households
Mobile Wireless	7	83% of population

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

Table 16.1.1-8 shows the wireless providers in West Virginia along with their geographic coverage. The following four maps, Figure 16.1.1-3, Figure 16.1.1-4, Figure 16.1.1-5 and Figure 16.1.1-6, show: i) the combined coverage for the top two providers AT&T and Verizon Wireless; ii) U.S. Cellular's and Sprint's coverage; iii) NTELOS' and Micrologic, Inc.'s coverage; and iv) the coverage of all other providers with less than 5% coverage area, respectively.

Table 16.1.1-8: Wireless Telecommunications Coverage by Providers

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	91.35%
Verizon Wireless	37.87%
U.S. Cellular	34.44%
Sprint	18.48%
NTELOS	14.62%
Micrologic, Inc.	13.09%
Other[a]	11.74%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5% coverage area. Providers include WVVA.NET, NTELOS, Shentel, StratusWave Communications, T-Mobile, NTELOS, and Cricket Wireless.

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

6 Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

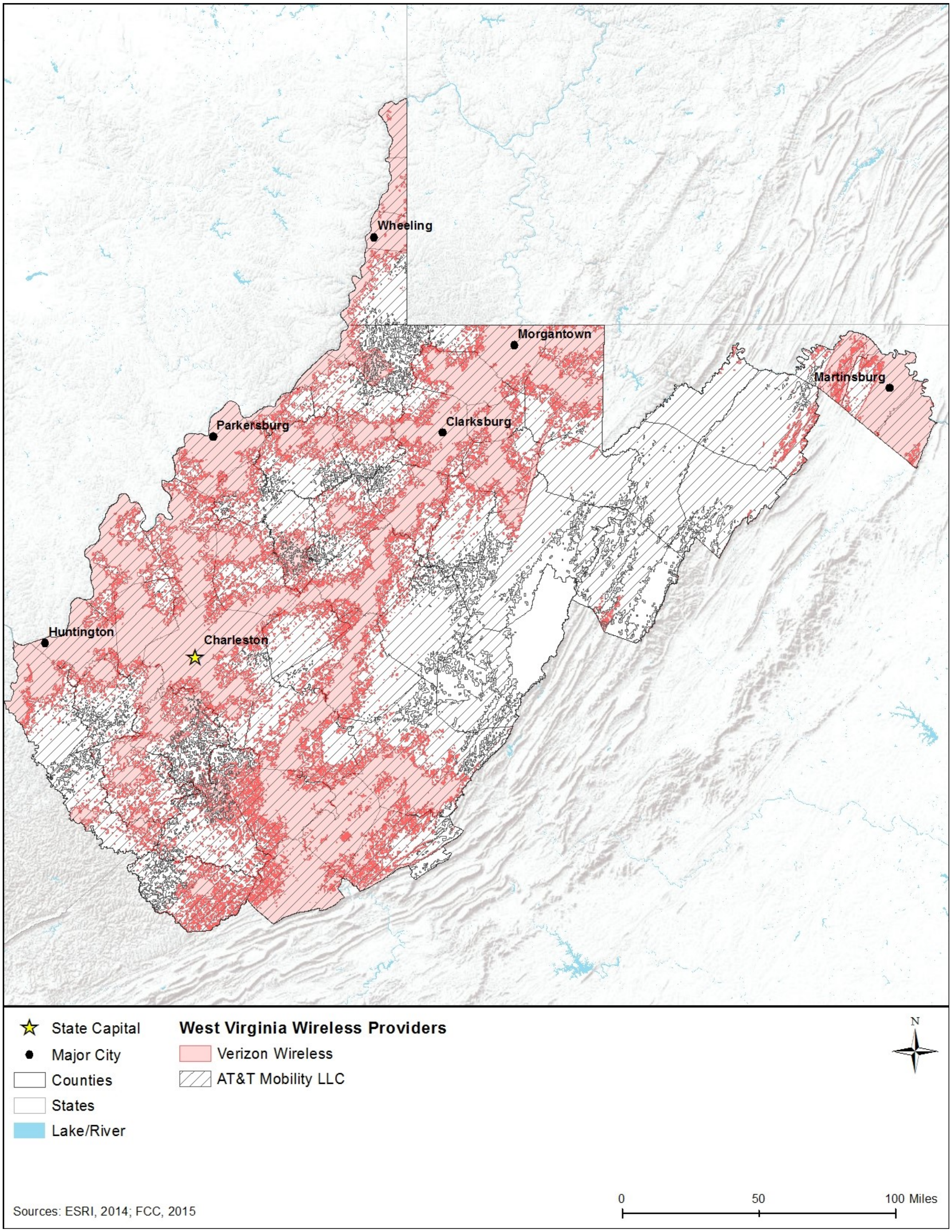


Figure 16.1.1-3: AT&T and Verizon Wireless Availability in West Virginia

Source: (NTIA, 2014)

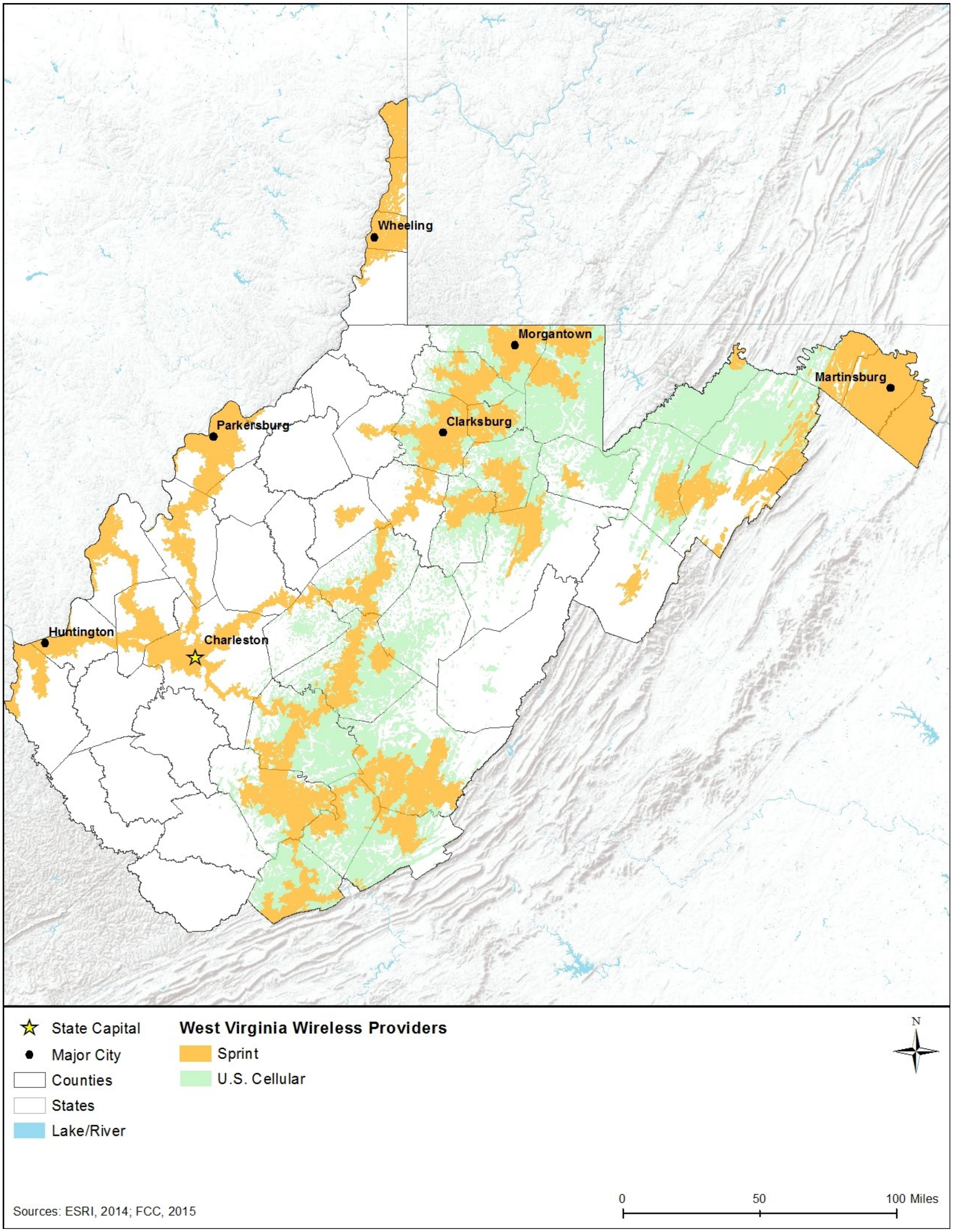


Figure 16.1.1-4: U.S. Cellular and Sprint Wireless Availability in West Virginia

Source: (NTIA, 2014)

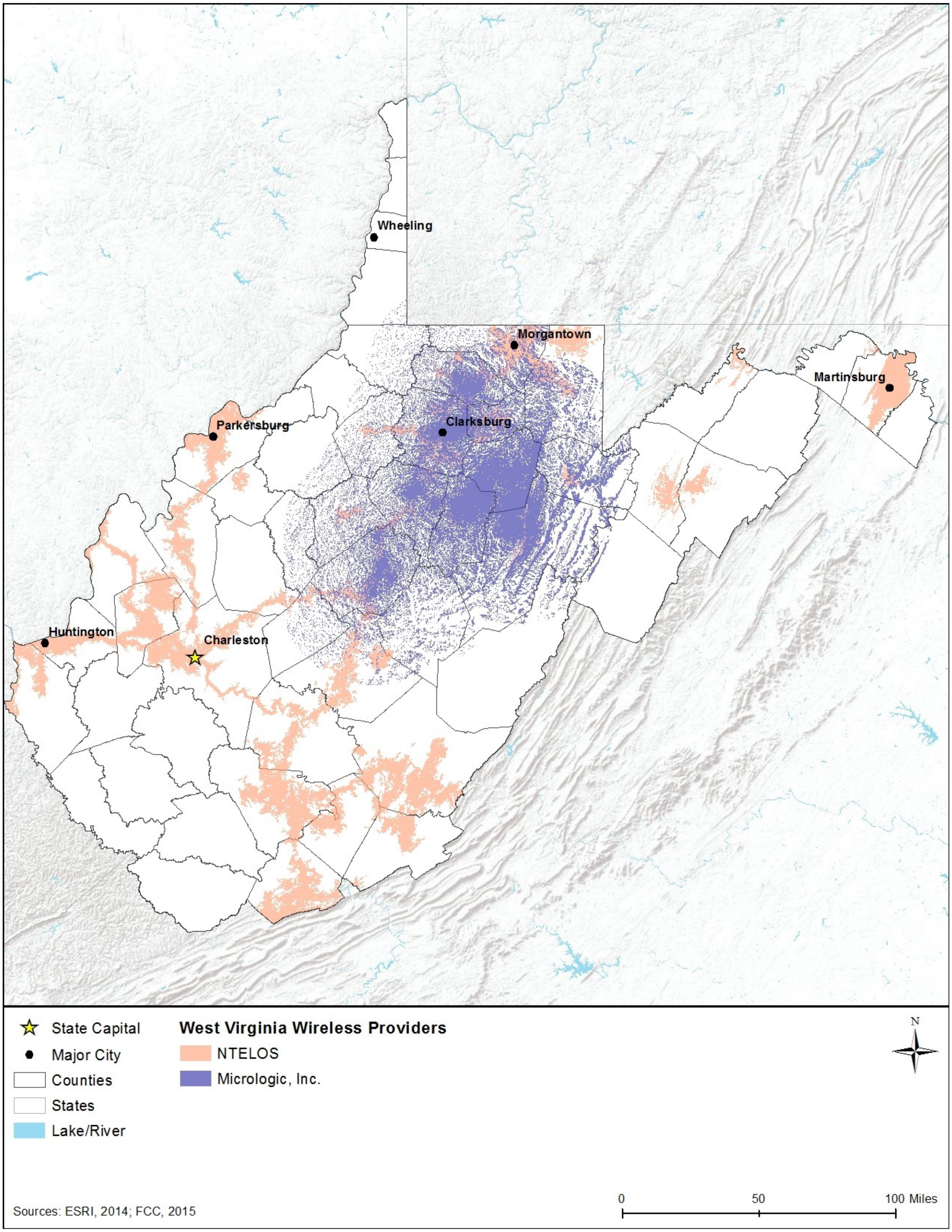


Figure 16.1.1-5: NTELOS and Micrologic Wireless Availability in West Virginia

Source: (NTIA, 2014)

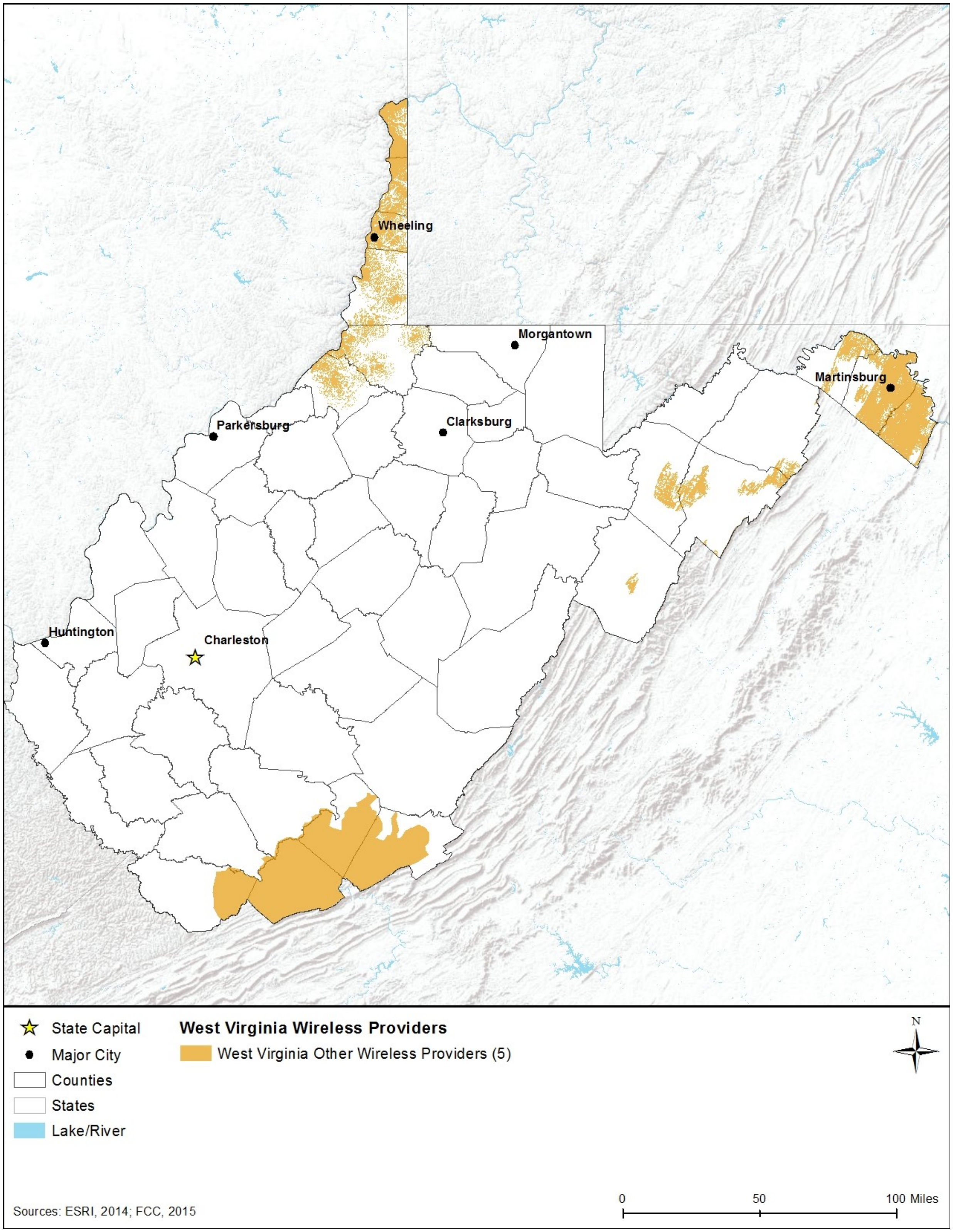


Figure 16.1.1-6: Wireless Availability in West Virginia for All Other Coverage Providers

Source: (NTIA, 2014)

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 16.1.1-7 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 16.1.1-7: Types of Towers

Telecommunications tower infrastructure can be found throughout West Virginia State, 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).[7] Table 16.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in the state of West Virginia. Figure 16.1.1-8 shows the location of those 1,225 structures, as of June 2015.

[7] 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 16.1.1-9: Number of Commercial Towers in West Virginia by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	116	100ft and over	0
75ft – 100ft	453	75ft – 100ft	0
50ft – 75ft	336	50ft – 75ft	12
25ft – 50ft	146	25ft – 50ft	3
25ft and below	18	25ft and below	0
Subtotal	**1,069**	**Subtotal**	**15**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	6	100ft and over	0
75ft – 100ft	13	75ft – 100ft	0
50ft – 75ft	2	50ft – 75ft	1
25ft – 50ft	2	25ft – 50ft	0
25ft and below	0	25ft and below	1
Subtotal	**23**	**Subtotal**	**2**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	9	100ft and over	4
75ft – 100ft	58	75ft – 100ft	0
50ft – 75ft	30	50ft – 75ft	2
25ft – 50ft	12	25ft – 50ft	0
25ft and below	1	25ft and below	0
Subtotal	**110**	**Subtotal**	**6**
Constructed Tanks[d]			
Tanks	0		
Subtotal	**0**		
Total All Tower Structures		**1,225**	

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)

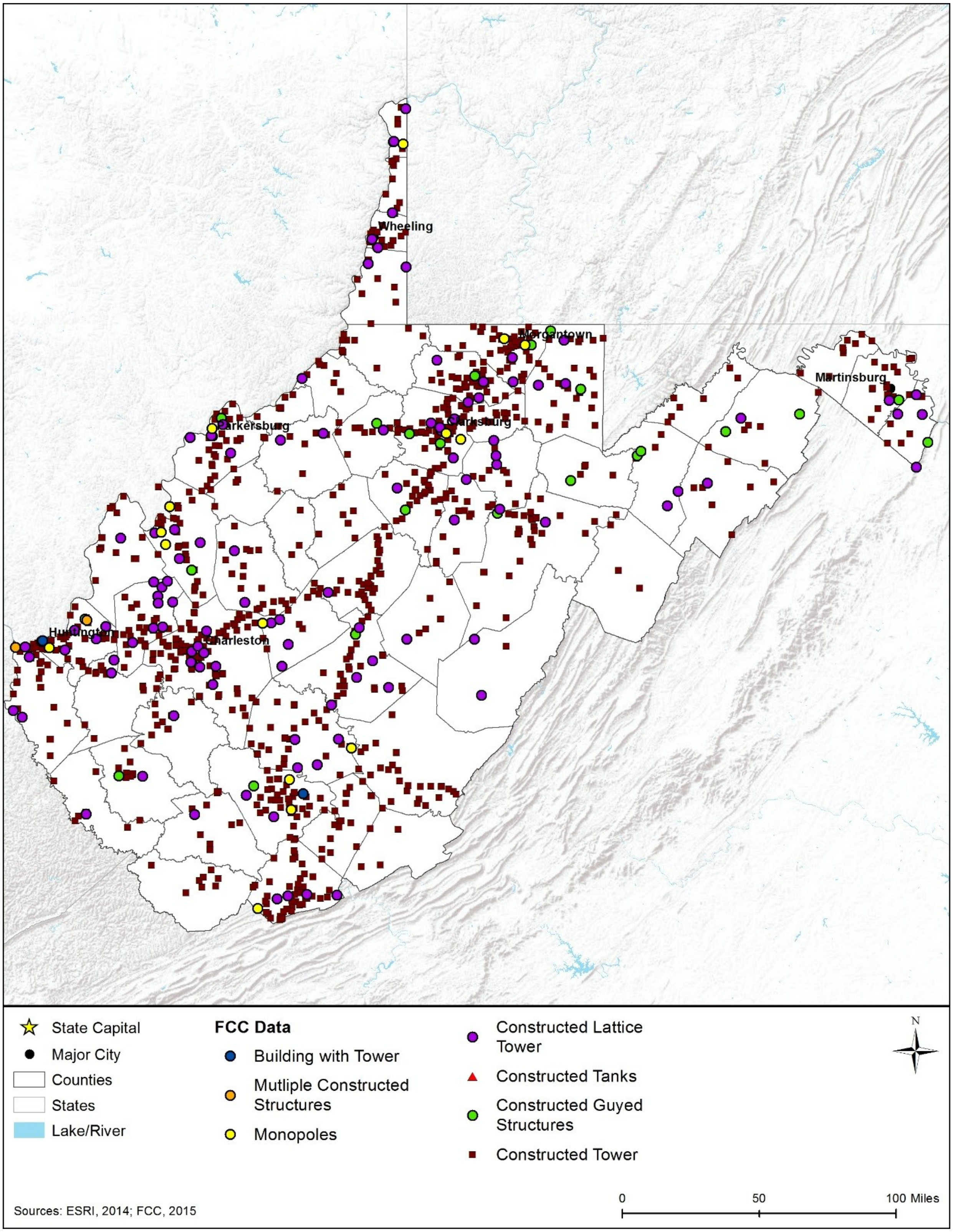


Figure 16.1.1-8: FCC Tower Structure Locations in West Virginia

Source: (FCC, 2015c)

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 16.1.1-9. 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).

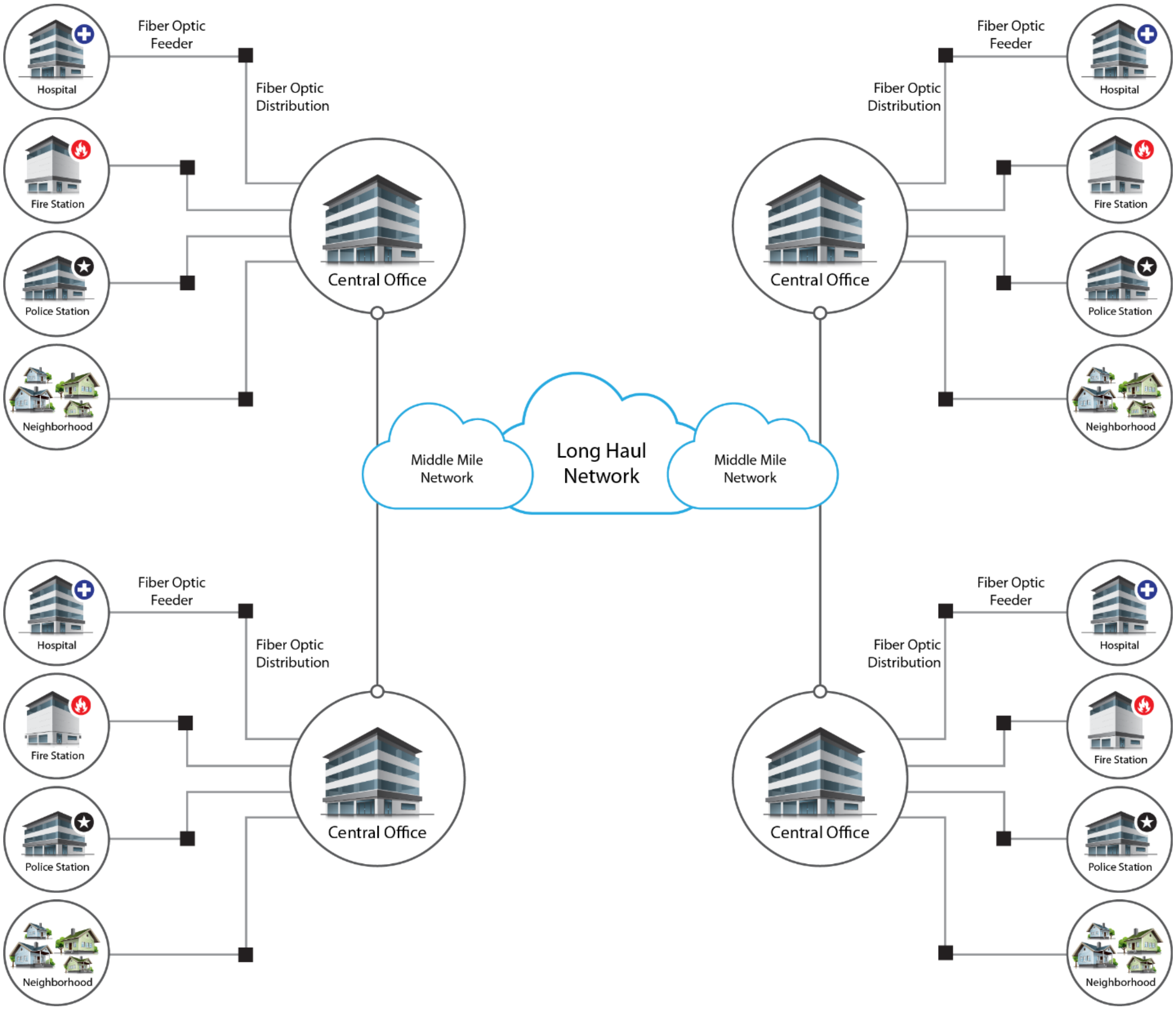


Figure 16.1.1-9: Typical Fiber Optic Network in West Virginia

Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In West Virginia, fiber access networks are concentrated in the highest population centers as shown in the figures below. There are 22 fiber providers that offer service in the state, as listed in Table 16.1.1-10. Figure 16.1.1-10 and Figure 16.1.1-11 show: i) the combined coverage for the top three providers, and ii) the coverage of all other providers.

Table 16.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Frontier West Virginia, Inc.	25.86%
Frontier Communications of West Virginia	12.42%
Other[a]	11.61%
Suddenlink Communications	8.29%

Source: (NTIA, 2014)

[a]*Other: Provider with less than 5% coverage area. Providers include: Comcast, Shentel, Comcast, Armstrong Telephone Company - Northern Division, Suddenlink Communications, Community Antenna Service, Inc., HardyNet, Armstrong Utilities, Inc., Time Warner Cable, Lumos Networks LLC, Spruce Knob Seneca Rocks Telephone, Inc., West Side Telecommunications, Armstrong Telephone Company-WV, Pine Tree Networks, City of Philippi, Inter-Mountain Cable Inc., Mikrotec CATV, LLC, Lumos Networks of West Virginia Inc., and Blue Devil*

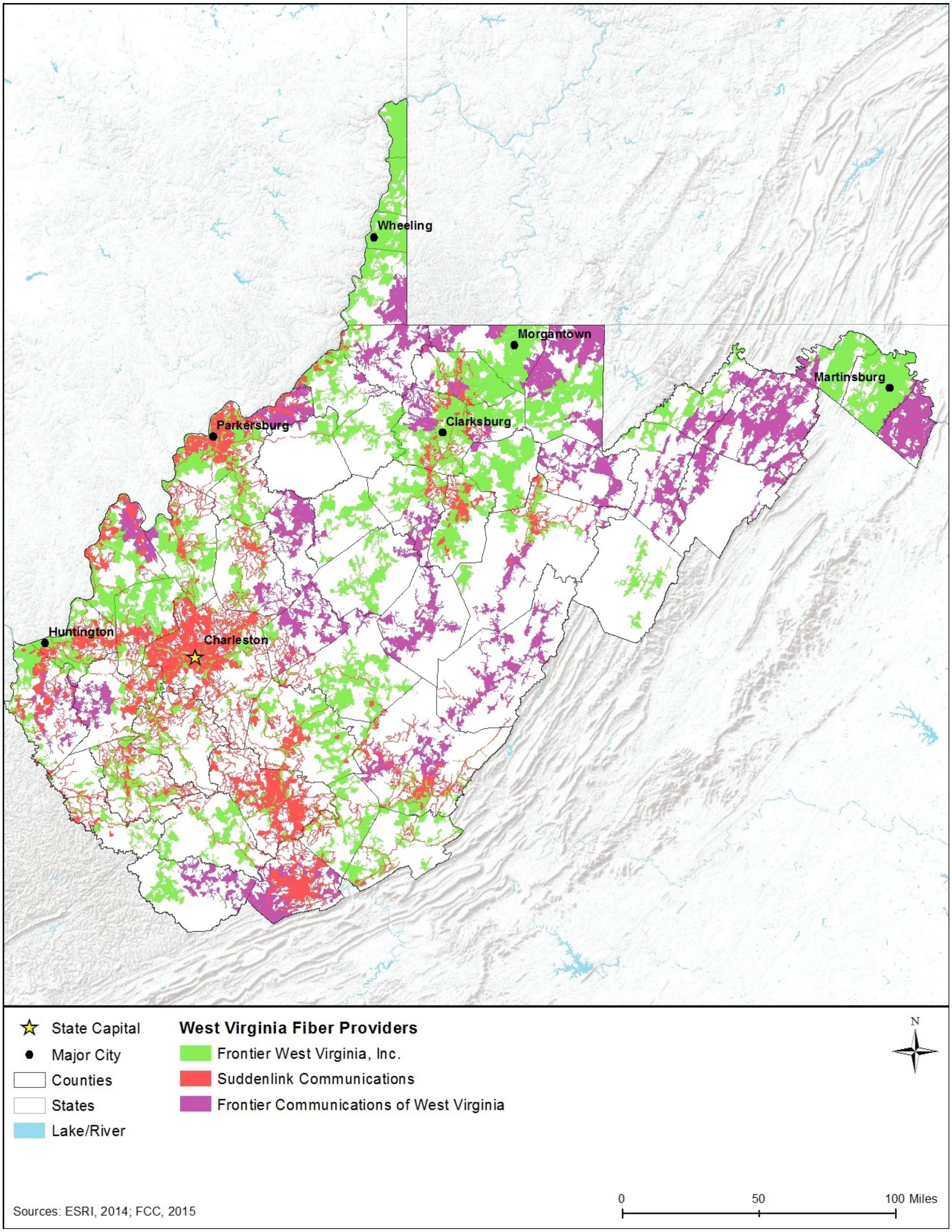


Figure 16.1.1-10: Top Fiber Providers Availability in West Virginia

Source: (NTIA, 2014)

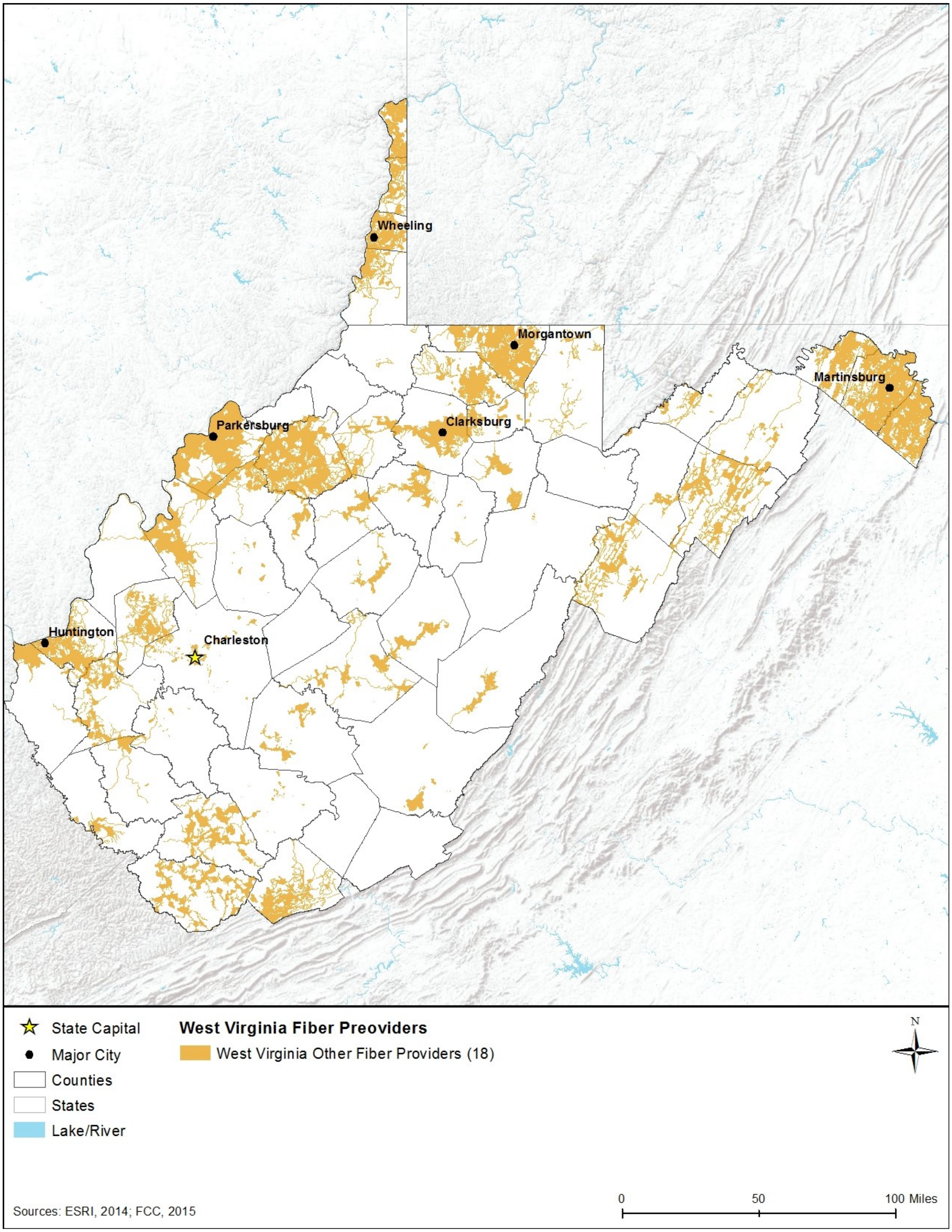


Figure 16.1.1-11: Fiber Availability in West Virginia for All Other Coverage Providers

Source: (NTIA, 2014)

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among, 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).

16.1.1.6. Utilities

Utilities are the systems that are essential to support daily operations in a community and cover a broad array of public services, such as electricity, wastewater, and sewage. Section 16.1.4, Water Resources, describes the potable water sources in the state.

Electricity

West Virginia is home to a number of electric companies that supply energy to the state's residents. Ten of these have their rates regulated by the West Virginia Public Service Commission, including the publically owned municipal power plants in the towns of New Martinsville and Philippi. Four of the utilities are based in other states, including Pennsylvania, Ohio, and Virginia (Public Service Commission, 2015a). Along with these ten companies, twenty privately owned wholesale electricity generators supply power in the state. These are not regulated by the PSC, and fifteen of them are based outside of the state (Public Service Commission, 2015b).

The companies that fall under the jurisdiction of the PSC accounted for approximately 32,700,000-megawatt hours (MWh) of power in 2013.[8] The bulk of this, nearly 61%, came from the Appalachian Power Company. A further 28 percent was produced by the Monongahela Power Company (Public Service Commission, 2015b). In total, the state of West Virginia produced 81,162,000 MWh of electricity in 2013, approximately 95 percent of which came from coal. The next largest sources of power were hydroelectric and wind power, accounting for just over 1 million MWh each. Petroleum and natural gas produced a negligible amount (EIA, 2015a). In 2013, 77 percent of the coal mined in West Virginia was shipped elsewhere. Foreign countries received 33 percent of it, and other U.S. states received 44 percent. Just the previous year, West Virginia produced the second largest amount of coal of all U.S. states, at 12 percent of the U.S. total (EIA, 2015b).

Water

The state of West Virginia has 334 water utilities that are overseen by the Public Service Commission of West Virginia. These utilities are organized by type, of which there are four:

[8] A Megawatt hour (MWh) is defined as "One thousand kilowatt-hours or 1 million watt-hours." Where one watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2015c)

publicly owned water districts, publicly owned utilities, privately owned companies, and water associations. The water districts and publicly owned utilities comprise the bulk of this number (Public Service Commission, 2015b). The publically owned water utilities served 249,405 customers in 2013, while the water districts served 189,838. Water associations provided service to 12,306 customers and privately owned utilities served 200,945 (Public Service Commission, 2015b).

The state's drinking water quality is overseen by the Environmental Engineering Division (EED), which contains both the Source Water Assessment Program and Wellhead Protection Program. The EED issues permits for construction of new water systems and the renovation of existing systems. The state's citizens rely on the EED to ensure both the safety of their drinking water and the expertise of people working in the field (WVDHHR, 2015a). The Source Water Assessment Program helps identify possible sources of water contamination that should be monitored, as well as the risk of contamination in drinking water sources such as groundwater (WVDHHR, 2015b). The Wellhead Protection Program has similar responsibilities, including identifying potential contamination sources. It is also tasked with identifying areas "…from which water could flow to the source within a five-year time of travel. Area is determined using groundwater models, available technical data, and geological setting." (WVDHHR, 2015c) Information on water source susceptibility and quality can be found on the Source Water and Wellhead Protection Program at https://www.wvdhhr.org/oehs/eed/swap/. These reports also detail potential contamination sources and the water treatment process (WVDHHR, 2015d).

Wastewater

West Virginia has 304 separate wastewater entities. This number includes 94 public sewer districts, 164 public sewer utilities, 42 privately owned sewer utilities, and 4 associations or authorities. The largest group of these, the public sewer utilities, served nearly 300,000 people in 2013 (Public Service Commission, 2015b). Due to the existence of numerous cross-connections (areas where a physical connection between potable and non-potable waters, such as wastewater, have the potential to mix), programs have been put in place to avoid contamination. Another potential problem is the existence of backflows, which are areas where water may flow backwards through piping systems. Some of West Virginia's public water systems have required backflow prevention systems to be installed in potential problem areas (WVDHHR, 2015e).

The West Virginia Department of Environmental Protection (WVDEP) issues permits for the operation of wastewater treatment facilities. These include industrial facilities and industrial pretreatment facilities, which are locations where industrial wastewater is treated to remove chemicals or industrial pollutants before it is sent to municipal or other sewer systems. WVDEP also permits municipal wastewater facilities. (WVDEP, 2015a)

Solid Waste Management

In West Virginia, solid waste management is a local responsibility. The state has 55 counties and 50 Solid Waste Authorities (SWA). Forty-eight of the counties have their own SWA, and the other seven counties share one of two regional SWAs. These local SWAs own or operate seven landfills and five transfer stations, as well as participating in more than 40 recycling programs (SWMB, 2015a). The Solid Waste Management Board (SWMB) provides some oversight and other services for local solid waste authorities. These services include "…assisting in maintaining the financial stability of publically owned landfills, assisting in solid waste planning on the local level, planning for special waste management needs…" and "…monitoring publically owned waste management facilities, assisting the West Virginia Legislature with research and other things that benefit both public and private sector waste management in West Virginia." (SWMB, 2015b) Permitting for solid waste facilities in the state is handled by the WVDEP. WVDEP issues permits for non-residential composting, industrial landfills, tire processing facilities, and renewal of any existing facility permit (SWMB, 2015c).

West Virginia is home to 38 waste management facilities, of which 18 are functional landfills, three are tire disposal companies and 17 are transfer stations (SWMB, 2015d). Additionally, there are 33 landfills that have been closed or are otherwise non-operational (SWMB, 2015e). Of the state's 18 landfills, eight are public and ten are privately owned facilities. The public facilities accept approximately 6,384 tons of waste each month (SWMB, 2015a). The private facilities handle over double this amount, accepting an average of 13,379 tons of waste monthly. Permits for some facilities allow them to accept up to 30,000 tons each month. Kentucky, Ohio, and Pennsylvania accept the bulk of West Virginia's waste that does not stay in state. Ohio accepts the largest amount of this waste, at 221,760 tons in 2013 (SWMB, 2015a).

West Virginia currently lacks a recycling reporting requirement, which makes it difficult for the state to monitor recycling rates and plan for the future. Additionally, the low population density of many areas in the state make it difficult for recycling centers to make income. This leads to an increase in collection costs at existing facilities to cover the difference. Many other states rely on curbside pickup programs in municipalities, which is not an effective strategy in largely rural West Virginia. In 2013, the most collected recyclable materials collected by solid waste authorities were yard waste, compost, and paper. That year, 9,178 tons of yard waste or compost were collected, together with 7,768 tons of mixed paper. The highest revenue makers were cardboard and paper, at $508,850 and $443,596 respectively (SWMB, 2015a).

16.1.2. Soils

16.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

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

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

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

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

16.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Appendix C presents applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981. A list of applicable state laws and regulations is included in Table 16.1.2-1 below.

Table 16.1.2-1: Relevant West Virginia Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Erosion and Sediment Control Act	WVDEP	Erosion and Sediment Control Plan: Disturbance over three acres, excluding pipelines and roads, must have an Erosion and Sediment Control Plan be certified by registered engineer.

Source: (WVDEP, 2015b)

16.1.2.3. Environmental Setting

West Virginia is composed of two Land Resource Regions (LRRs),[9] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- East and Central Farming and Forest Region
- Northern Atlantic Slope Diversified Farming Region

Within and among West Virginia's two LRRs are seven Major Land Resource Areas (MLRA),[10] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of West Virginia's MLRAs are presented in Figure 16.1.2-1 and Table 16.1.2-2 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

[9]Land Resource Region: "A geographical area made up of an aggregation of MLRAs with similar characteristics." (NRCS, 2006)

[10]MLRA: "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)

relatively short distances, reflecting differences in parent material, elevation and position on the landscape, biota[11] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[12] 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[13] (discussed further in the subsections below).

Table 16.1.2-2: Characteristics of Major Land Resource Areas in West Virginia

MLRA Name	Region of State	Soil Characteristics
Central Allegheny Plateau	Northwestern West Virginia	Alfisols[14], Ultisols[15], and Inceptisols[16] are the dominant soils orders in this MLRA. They range from shallow to very deep and excessively drained to somewhat poorly drained. The soils in this MLRA are generally skeletal[17] to clayey.
Cumberland Plateau and Mountains	Southwestern West Virginia	Ultisols and Inceptisols are the most common soil orders in this MLRA. Depth of soils and drainage conditions vary widely with the topography, which ranges from undulating to rolling areas to steep slopes.
Eastern Allegheny Plateau and Mountains	North and South Central West Virginia	Dominant soil orders in this MLRA include Ultisols and Inceptisols, and the soils are generally moderately deep to very deep, excessively drained to somewhat poorly drained, and are loamy[18].
Northern Appalachian Ridges and Valleys	Eastern and Northeastern West Virginia	Inceptisols, Ultisols, and Alfisols are the dominant soil orders. These loamy or clayey soils range from shallow to very deep, and are generally excessively drained to moderately well drained.
Northern Blue Ridge	Northeastern West Virginia	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.
Southern Appalachian Ridges and Valleys	Southern West Virginia	The dominant soil orders are Ultisols and Inceptisols. These soils vary from shallow to very deep, and are generally well drained.
Western Allegheny Plateau	Northern tip bordering Ohio and Western West Virginia bordering Kentucky	Ultisols and Inceptisols are the dominant soil orders. These loamy soils range from moderately deep to very deep, excessively drained to somewhat poorly drained.

Source: (NRCS, 2006)

[11]The flora and fauna of a region.
[12]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)
[13]Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength. (USFS, 2009b)
[14] 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)
[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] Skeletal: "Containing significant amounts of coarse fragments such as gravels, cobbles and stones." (University of Arizona, 2016)
[18] Loam: "A soil with 20% clay, 40% silt and 40% sand." (Colorado State University Extension, 2016)

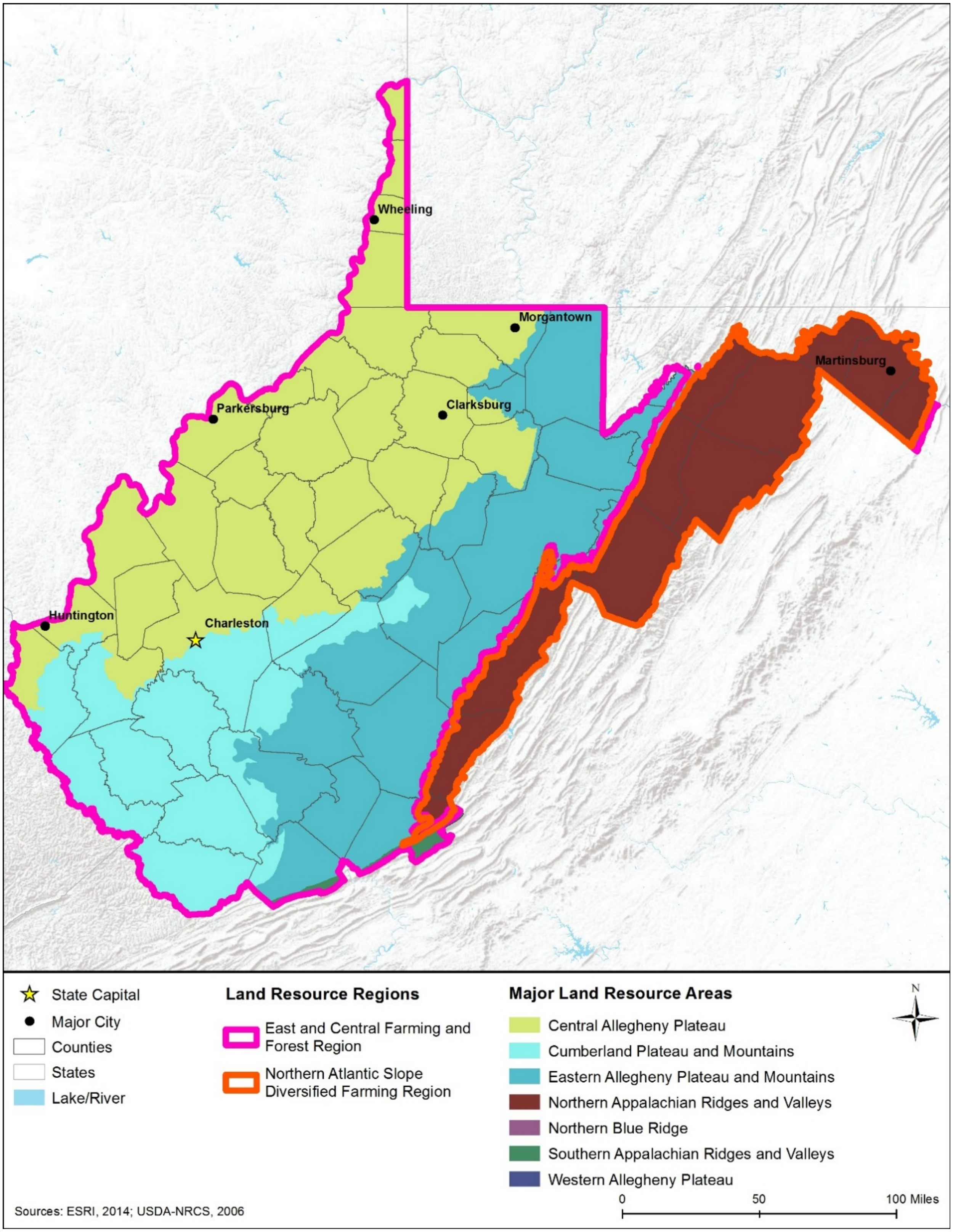


Figure 16.1.2-1: Locations of Major Land Resource Areas in West Virginia

Soil Suborders

Soil suborders are part of the soil taxonomy[19] (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 properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015b). The State Soil Geographic (STATSGO2) soil database[20] identifies nine different soil suborders in West Virginia (NRCS, 2015d). Figure 16.1.2-2 depicts the distribution of the soil suborders, and Table 16.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential[21]. Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 16.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in West Virginia.

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). Fluvents, Psamments, Udepts, and Udults fall into this category in West Virginia.

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

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

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,

[19] Taxonomy: “A formal representation of relationships between items in a hierarchical structure,” (USEPA, 2015a)
[20] STATSGO2 soil database: 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)

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). Aquepts, Udalfs, Udepts, and Udults fall into this category in West Virginia.

Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 16.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in West Virginia. Soils with the highest erosion potential in West Virginia include those in the Aqualfs, Aquepts, Orthents, Udalfs, Udepts, Udolls, and Udults suborders, which are found throughout most of the state (Figure 16.1.2-2).

Soil Compaction and Rutting

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

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 16.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in West Virginia. Soils with the highest potential for compaction and rutting in West Virginia include those in the Aquepts suborder, which are found in southeastern areas of the state (Figure 16.1.2-2).

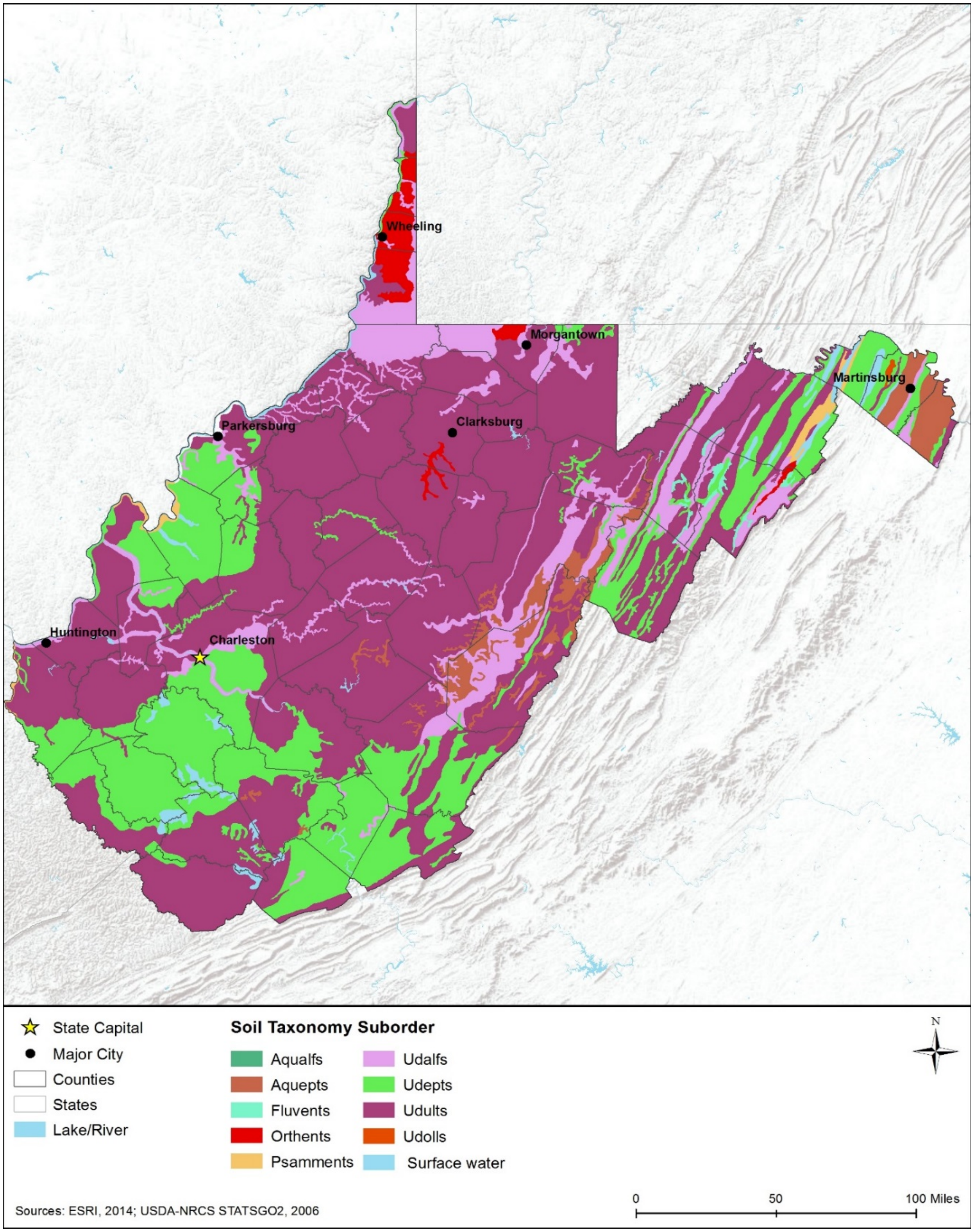


Figure 16.1.2-2: West Virginia Soil Taxonomy Suborders

Table 16.1.2-3: Major Characteristics of Soil Suborders[23] Found in West Virginia, as depicted in Figure 16.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[24]	Hydrologic Group	Runoff Potential	Permeability[25]	Erosion Potential	Compaction and Rutting Potential
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Silt loam	0-3	Somewhat poorly drained	No	C	Medium	Low	Medium	Low
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.	Loam, silt loam, silty clay loam, very channery loam	0-15	Very poorly drained to somewhat poorly drained	No, Yes	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.	Cobbly loam	0-3	Somewhat excessively drained	No	A	Low	High	Low	Low
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Silt loam, loamy sand	0-70	Excessively drained to well drained	No	B, C	Medium	Moderate to Low	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.	Loamy fine sand, loamy sand	2-35	Excessively drained to well drained	No	A	Low	High	Low	Low
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Channery[26] clay, channery silt loam, channery silty clay loam, clay, clay loam, fine sandy loam, flaggy loam, loam, sandy clay loam, silt loam, silty clay, silty clay loam, stratified sandy loam to silty clay loam, stratified fine sandy loam to silty clay loam, unweathered bedrock, weathered bedrock	0-70	Moderately well drained to well drained	No	B, C, D	Medium to High	Moderate to Very Low	Medium to High, depending on slope	Low

[23] Suborder: Level of soil classification based on “genetic similarity; moisture regime, organic matter composition, [and] parent material effects.” (NCSU, 2016)
[24] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part." (NRCS, 2015e)
[25] Based on Runoff Potential, described in Section 16.1.2.3.
[26] Channery: an accumulation of thin, flat, coarse fragments of sandstone, limestone, or schist.

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[24]	Hydrologic Group	Runoff Potential	Permeability[25]	Erosion Potential	Compaction and Rutting Potential
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Channery loam, channery sandy loam, channery silt loam, cobbly fine sandy loam, extremely channery silt loam, fine sandy loam, gravelly loam, loam, sandy loam, silt loam, stratified gravelly sandy loam to silty clay loam, unweathered bedrock, very channery sandy loam, weathered bedrock	0-80	Moderately well drained to somewhat excessively drained	No	A, B, C, D	Low to High	High to Very Low	Low to High, depending on slope	Low
Mollisols	Udolls	Udolls are found in humid climates. They are more or less freely drained, and have historically supported tall grass prairie. They are used as pasture or rangeland, and as cropland in areas with little slope.	Silty clay loam, silt loam	0-18	Well drained	No	B, D	Medium to High	Moderate to Very Low	Medium to High, depending on slope	Low
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have an udic moisture regime. Most of these soils currently support or formerly supported mixed forest vegetation, and many have been cleared and used as cropland (mostly with the use of soil amendments).	Channery clay loam, channery loam, channery sandy clay loam, channery silt loam, cobbly fine sandy loam, extremely channery silt loam, gravelly loam, gravelly silt loam, loam, sandy clay loam, sandy loam, silt loam, silty clay loam, unweathered bedrock, very channery silt loam, very channery silty clay loam, very flaggy loam	0-70	Moderately well drained to well drained	No	A, B, C, D	Low to High	High to Very Low	Low to High, depending on slope	Low

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

16.1.3. Geology

16.1.3.1. 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 PEIS, including groundwater (Section 16.1.4), human health (Section 16.1.15), and climate change (Section 16.1.14).

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

- Section 16.1.3.3, Major Physiographic Regions and Provinces[27] [28]
- Section 16.1.3.5, Surface Geology
- Section 16.1.3.6, Bedrock Geology[29]
- Section 16.1.3.7, Paleontological Resources[30]
- Section 16.1.3.8, Fossil Fuel and Mineral Resources
- Section 16.1.3.9, Potential Geologic Hazards[31]

16.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act (NHPA) and the Clean Water Act (CWA), are detailed in Section 1.8. A list of applicable state laws and regulations is included in Table 16.1.3-1 below.

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[27] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology. (Fenneman, 1916).
[28] Physiographic provinces: Subsets within physiographic regions. (Fenneman, 1916)
[29] Bedrock: Solid rock beneath the soil and superficial rock. (USGS, 2015b)
[30] Paleontology: "Study of life in past geologic time based on fossil plants and animals." (USGS, 2015c)
[31] 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)

Table 16.1.3-1: Relevant West Virginia Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Building Codes	County and Municipal Governments	Guidelines for seismic design in construction. (West Virginia DHSEM, 2013)
Bridge Design Manual (2014)	WVDOT	Bridges must be designed with consideration of seismic motion. (WVDEP, 2014a)
West Virginia Code §20-7A-5	West Virginia Division of Natural Resources (WVDNR)	Excavation, removal, destruction, injury, or defacing any historic or prehistoric ruins, burial grounds, archaeological or paleontological site including saltpeter workings, relics or inscriptions, fossilized footprints, bones or any other such features which may be found in any cave is prohibited. A permit must be obtained from WVDNR to remove or excavate fossils. (WVDEP, 2015b)

16.1.3.3. Environmental Setting: Physiographic Regions and Provinces

Geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation) created the concept of physiographic regions in 1916. 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-divided into physiographic provinces based on differences observed on a more local scale. (Fenneman, 1916)

West Virginia is entirely within the Appalachian Highlands Physiographic Region (Figure 16.1.3-1); in West Virginia, this region can be subdivided into three physiographic provinces: Blue Ridge, Valley and Ridge, and Appalachian Plateaus (USGS, 2003a).

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 million years ago (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, 2003a)

As reported above, the Appalachian Highlands Region within West Virginia is composed of three physiographic provinces: Blue Ridge, Valley and Ridge, and Appalachian Plateaus (USGS, 2003a).

[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 ASL. (NPS, 2004)

Blue Ridge Province – The Blue Ridge Province is limited to extreme eastern portions of West Virginia. The Blue Ridge is composed of metamorphic[34] Precambrian (older than 542 MYA) and Cambrian (542 to 488 MYA) rocks that have been intruded by younger igneous[35] rocks (WVGES, 2015). These are the oldest rocks in the state (WVGES, 2004).

Valley and Ridge Province – The Valley and Ridge Province extends from its western border with the Appalachian Plateau to its eastern border with the Blue Ridge. The Valley and Ridge is dominated by northeast-southwest-trending parallel valleys and ridges. "The valleys are primarily composed of less-resistant shale and siltstone, while the mountain ridges are mainly resistant sandstone[36] and limestone[37]." West Virginia's Valley and Ridge Province is comprised of folded and faulted rocks from the late Precambrian (1,000 to 542 MYA) Era through the early Mississippian (359 to 345 MYA) Period. (WVGES, 2015)

The boundary between the Appalachian Plateau and the Valley and Ridge is the Allegheny Structural Front. This topographic feature trends southwestward across eastern West Virginia for the length of the state through Monroe County. The Allegheny Structural Front is marked by an "abrupt change in the topography, stratigraphy, and structure" (WVGES, 2004).

Appalachian Plateaus Province – The Appalachian Plateaus Province includes the western two-thirds of West Virginia. The Appalachian Plateau Province is underlain by flat-lying sedimentary rocks, which dip slightly to the west at an angle of 2 to 3 degrees (WVGES, 1969). Local relief is generally a few hundred feet between hilltops and valleys. (WVGES, 2015).

The oldest rocks in the Appalachian Plateau are in the eastern portion of the Province, and range in age from late Ordovician (461 to 444 MYA) to Mississippian (359 MYA to 318 MYA). The majority of the Appalachian Plateau is comprised of Pennsylvanian (318 MYA to 299 MYA) and Permian (299 MYA to 251 MYA) rocks, which contain most of West Virginia's coal. Upwards of 95 percent of West Virginia's natural gas and the entirety of its oil is extracted from the Appalachian Plateaus Province (see Section 16.1.3.8, Fossil Fuels and Mineral Resources). (WVGES, 2004)

[34] Metamorphic Rocks: "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, 2015d)
[35] Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)." (USGS, 2015d)
[36] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (USGS, 2015d)
[37] 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, 2015d)

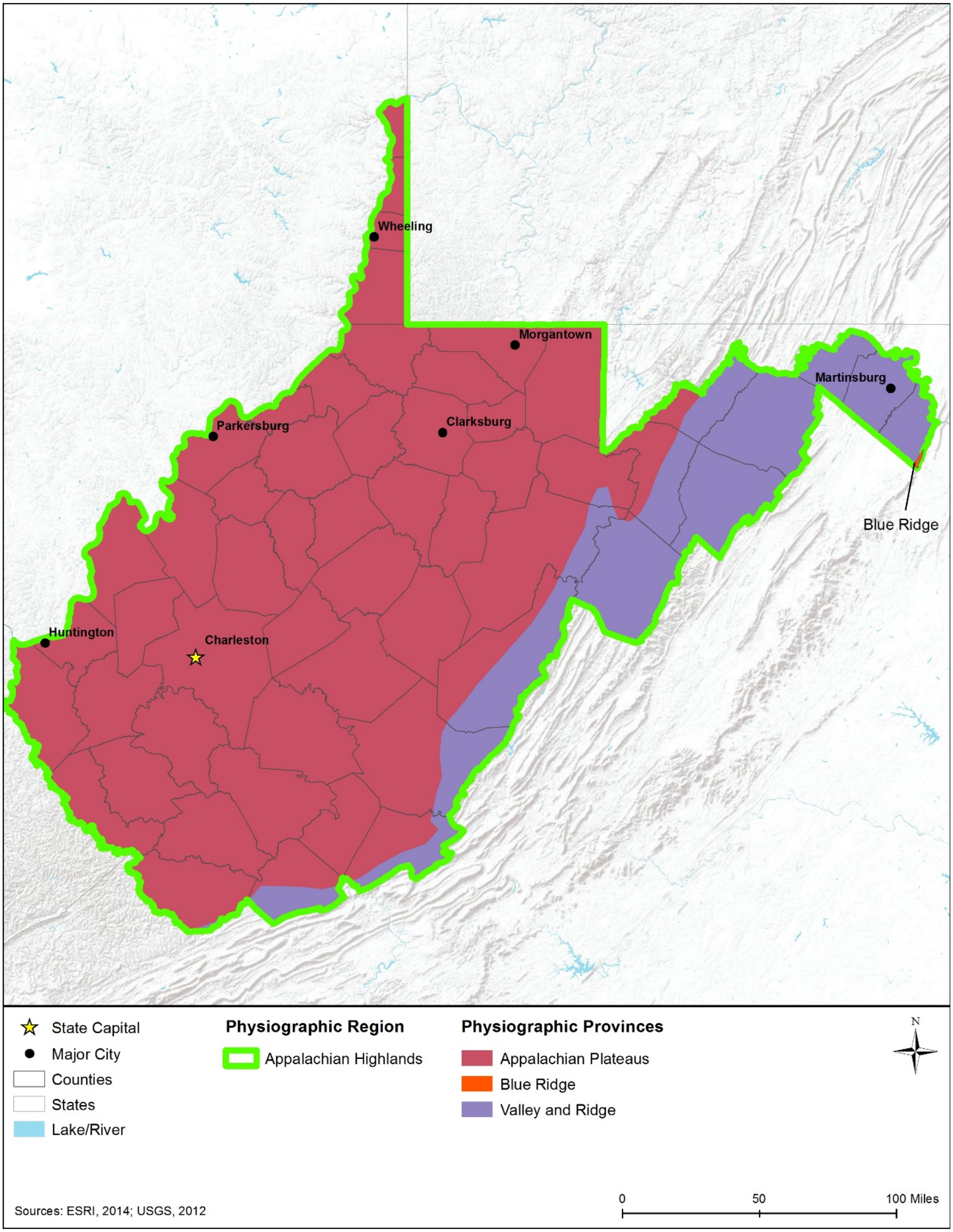

Figure 16.1.3-1: Physiographic Regions and Provinces of West Virginia

16.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[38] 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,[39] subsidence,[40] and erosion. (Thompson, 2015)

West Virginia was not affected by North America's most recent ice ages. However, two lakes formed in the present-day Monongahela and Teays valleys due to ice dams, resulting in lake and alluvial deposits near the Ohio River. These are West Virginia's only Cenozoic Era (younger than 70 MYA) sedimentary deposits (WVGES, 1969).

[38] 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)

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

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

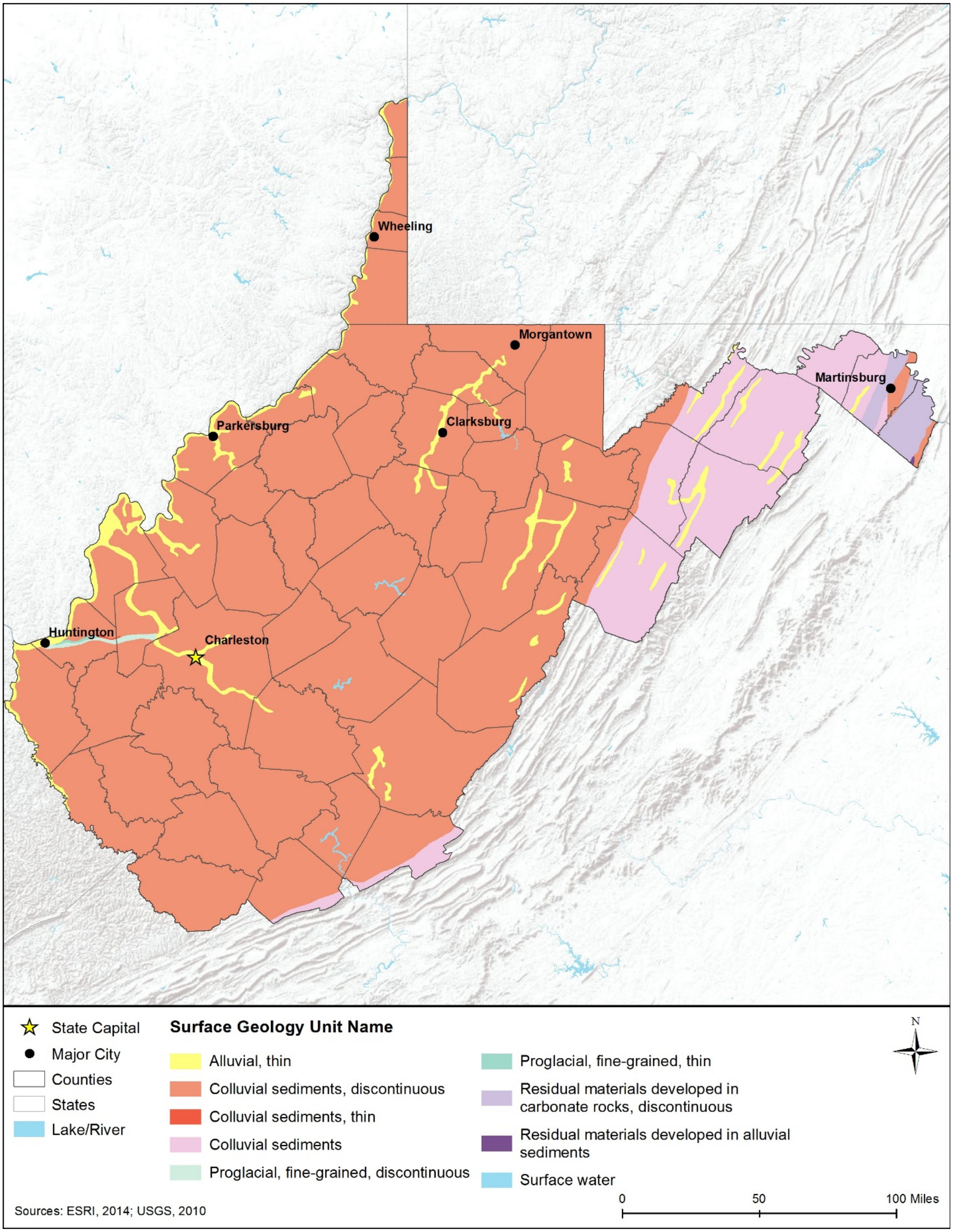

Figure 16.1.3-2: Generalized Surface Geology for West Virginia

16.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015e) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[41] rock composition, and regional tectonism[42]. 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).

Most of West Virginia's rocks are Paleozoic sedimentary rocks, deposited between 600 MYA and 230 MYA. During the Cambrian (542 MYA to 488 MYA) and Ordovician Periods (488 MYA to 423 MYA), marine sedimentary rocks including limestone, shale,[43] siltstones,[44] and sandstones were deposited. Subsequent movements of the Earth's tectonic plates[45] have caused orogenies[46] followed by erosion. West Virginia's sedimentary rocks were produced and deposited by the erosion of mountains, which were formed during the Taconic (ended 440 MYA), Acadian (ended 325 MYA), and Alleghenian orogenies (ended 260 MYA). There are no sedimentary rocks in West Virginia between the ages of 230 MYA and 70 MYA. (WVGES, 1969)

Figure 16.1.3-3 displays the bedrock geology for West Virginia. For more site-specific information, other sources such as regulated mine information from the West Virginia Geological and Economic Survey (WVGES), county soil surveys, and USGS topographical maps should be consulted. Additionally, more detailed studies may be available for specific areas from the USGS, county soil and water conservation districts, and local academic institutions.

[41] 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)
[42] Tectonism: “Structure forces affecting the deformation, uplift, and movement of the earth’s crust.” (USGS, 2015d)
[43] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks." (USGS, 2015d)
[44] Siltstone: "A sedimentary rock made mostly of silt-sized grains." (USGS, 2015d)
[45] Tectonic Plates: "A slab of rigid lithosphere (crust and uppermost mantle) that moves over the asthenosphere." (USGS, 2015d)
[46] Orogeny: "An episode of mountain building and/or intense rock deformation." (USGS, 2015d)

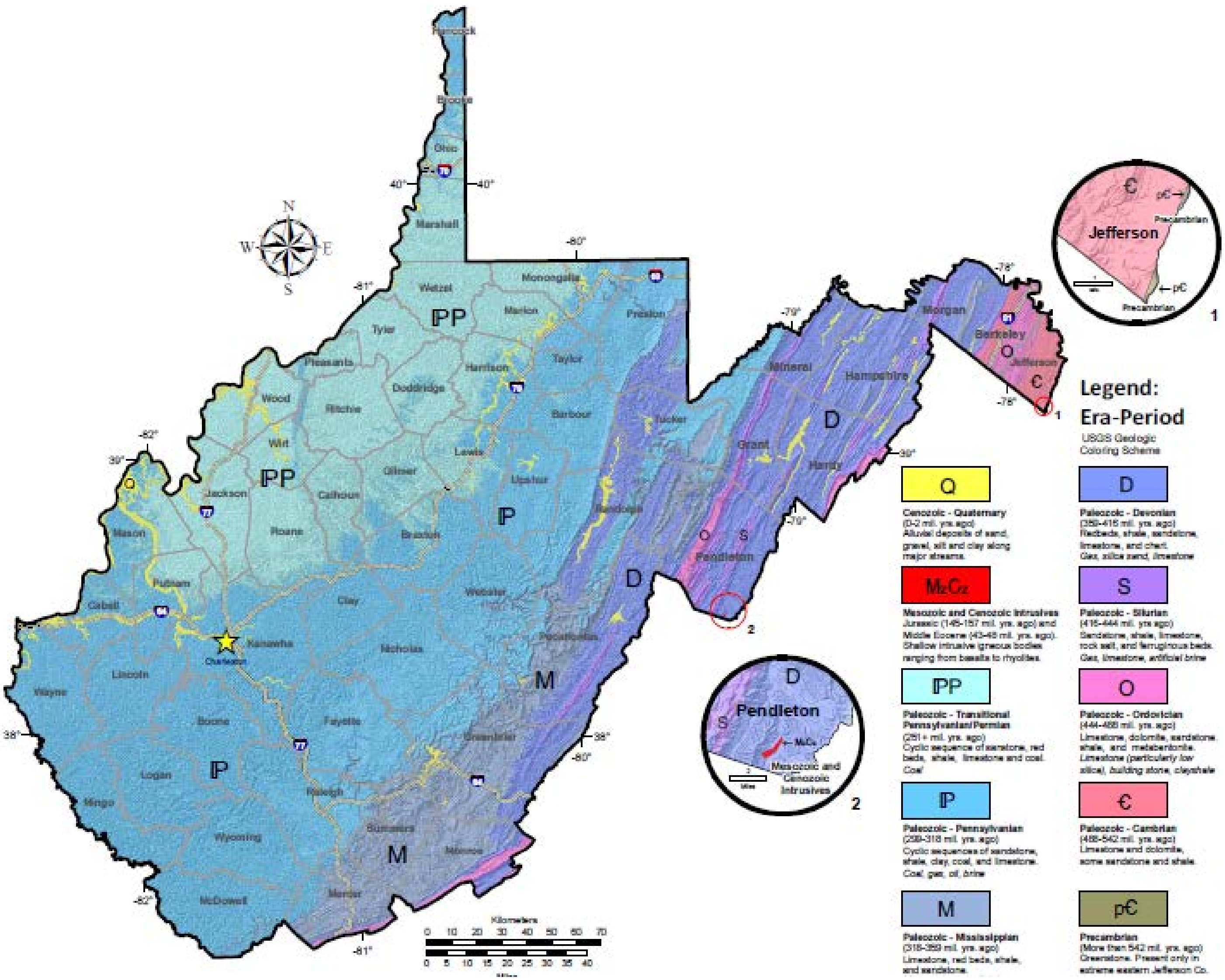

Figure 16.1.3-3: Generalized Bedrock Geology for West Virginia

Source: (WVGES, 2014)

16.1.3.6. *Paleontological Resources*

Early Paleozoic Era fossils from the Cambrian (542 to 488 MYA) and Ordovician (488 to 444 MYA) Periods in West Virginia include those from marine environments, such as trilobites[47], marine worms, stromatolites[48], and graptolites[49] (Paleontology Portal, 2015). Ordovician fossils also include brachiopods[50] and bryozoans[51], which are especially abundant in limestones and shales in the northeastern part of the state (WVGES, 2011a). By the Silurian (444 to 416 MYA) Period shallow marine and tidal environments resulted in the preservation of nautiloids[52] and ostracodes[53] in the eastern part of West Virginia (Paleontology Portal, 2015). Devonian Period fossils found in eastern West Virginia include trilobites, brachiopods, gastropods, and glass sponges[54] (WVGES, 2011a). Deposits from the Mississippian (359 to 318) Period through the Permian (299 to 251 MYA) Period contain numerous records of dinosaur ancestors, in the form of four-legged reptiles and amphibians (WVGES, 2011b). Mississippian Period fossil records also include blastoids[55], crinoid stems[56], and amphibians, while Pennsylvanian (318 to 299 MYA) records include gastropods, impressions of fern leaves, and teeth from early sharks, and fossils of root systems of plants that lived in swamp forests have also been found. Potential fossil-bearing rocks from this period are found throughout most of the state (Paleontology Portal, 2015). Permian fossils include reptile skulls, as well as trackways[57] of amphibians (WVGES, 2011a). The most recent fossils to be found in West Virginia date from the Pleistocene (2.6 MYA to 11,700 years ago), and include the flat headed peccary[58], and teeth from the mastodon and wooly mammoth. These fossils have been found in western and southeastern areas of the state (WVGES, 2011a). The Pleistocene-age Jefferson Ground Sloth (*Megalonyx jeffersonii*) is the state fossil of West Virginia. (WVGES, 2012)

West Virginia State Fossil
Megalonyx jeffersonii

Source: (WVGES, 2012)

[47] Trilobites: "a fossil group of extinct marine arthropods."
[48] Stromatolites: "layered bio-chemical accretionary structures formed in shallow water by the trapping, binding and cementation of sedimentary grains by biofilms (microbial mats) of microorganisms."
[49] Graptolites: "fossil colonial animals known chiefly from the Upper Cambrian through the Lower Carboniferous (Mississippian)."
[50] Brachiopods: "marine animals that have hard "valves" (shells) on the upper and lower surfaces."
[51] Bryozoans: "commonly known as moss animals, they are a phylum of aquatic invertebrate animals."
[52] Nautiloids: "a large and diverse group of marine cephalopods (Mollusca) belonging to the subclass Nautiloidea"
[53] Ostracodes: "a class of the Crustacea sometimes known as seed shrimp."
[54] Glass Sponges: "or Hexactinellid sponges have a skeleton made of four- and/or six-pointed siliceous spicules."
[55] Blastoids: "often called sea buds, are an extinct type of stemmed echinoderm."
[56] Crinoids: "marine animals that make up the class Crinoidea of the echinoderms."
[57] Trackways: "fossilized imprint of an ancient route of travel."
[58] Peccary: "also known as a javelina, is a medium-sized hoofed mammal."

16.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

West Virginia's field production of crude oil was at 9.8M barrels in 2014; in April 2015, the state produced more than 1.1M barrels accounting for 0.4 percent of nationwide production for that period. As of 2013, West Virginia had 28 rotary rigs[59] in operation (1.6 percent of the nationwide total). (EIA, 2015d)

Since 2007, West Virginia's natural gas production has tripled due to extraction from the Marcellus Shale Formation. As of 2013, there were 53,318 natural gas producing wells in the state (nearly 11 percent of the nationwide total), and with 18 trillion cubic feet coming from shale gas; conventional natural gas fields and coalbed methane (CH_4) in coal fields also contribute to West Virginia's natural gas production as well. Figure 16.1.3-4 shows the distribution of oil and gas wells throughout the state. (EIA, 2015d)

Minerals

As of 2014, West Virginia's nonfuel mineral production was valued at $395M, ranking 37th nationwide in terms of dollar value. West Virginia's leading nonfuel mineral commodity by value is crushed stone, which totals nearly 51 percent of the state's production in terms of dollar value. The balance of West Virginia's mineral production is primarily Portland cement, lime, and industrial sand and gravel, with minimal production of masonry cement (USGS, 2015f). West Virginia has also historically produced peat (USGS, 2001a).

West Virginia is also a well-known producer of coal, which is found in Pennsylvanian Period (318 to 299 MYA) shale and sandstone layers (WVDHHR, 2006). In 2013, West Virginia produced 112,786 short tons of coal in 218 coalmines (11.5 percent of total nationwide production). West Virginia is ranked second behind Wyoming in total coal production. (EIA, 2015d)

[59] Rotary rig: “a machine that creates holes in the earth’s sub-surface.”

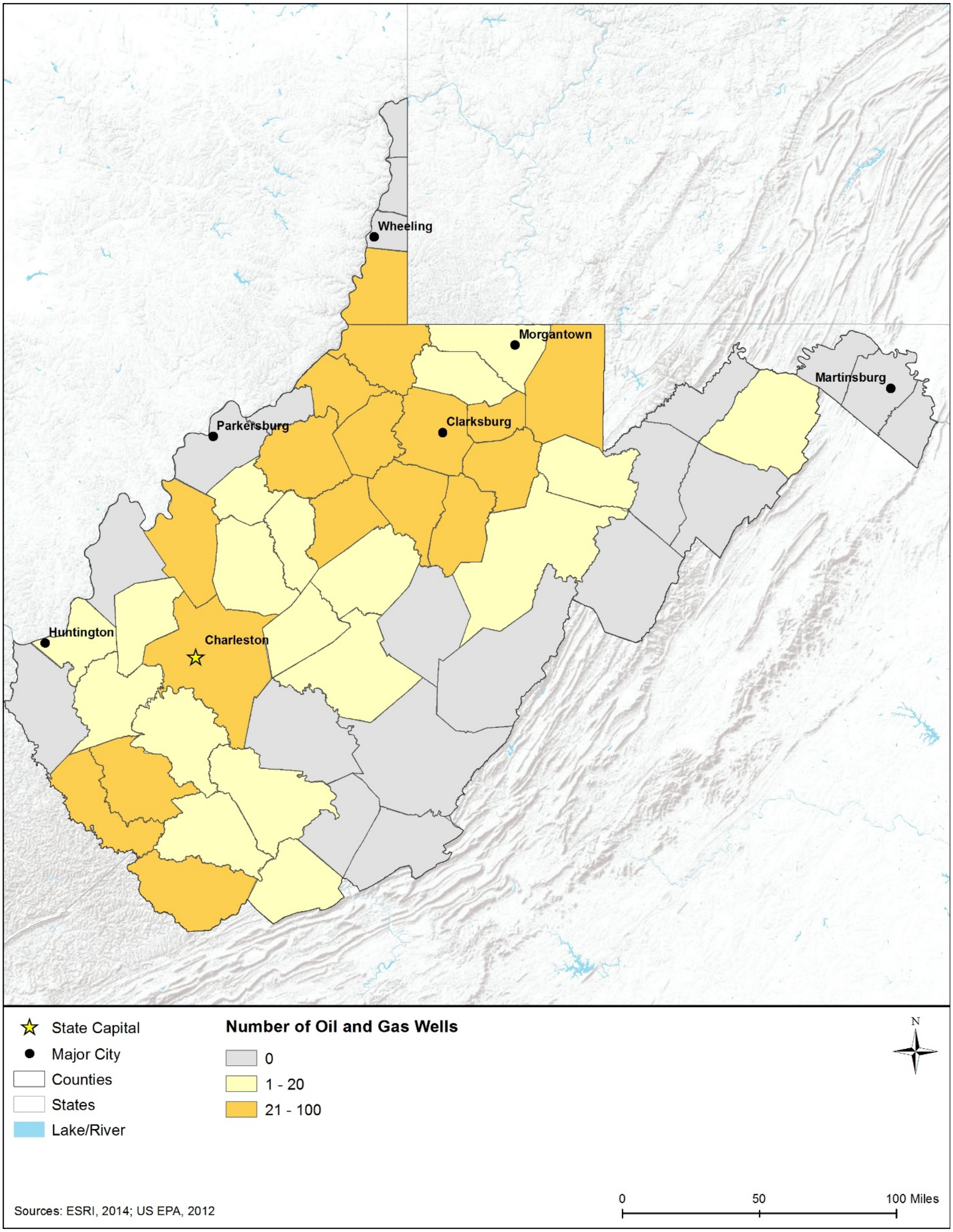

Figure 16.1.3-4: Oil and Gas Wells in West Virginia

16.1.3.8. Geologic Hazards

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

Earthquakes

Between 1973 and March 2012, there was one earthquake of a magnitude-3.5 (on the Richter scale[60]) or greater in West Virginia, though several earthquakes of a similar magnitude occurred in nearby areas of southwestern Virginia (USGS, 2014b). 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, 2012b).

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." 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)

Figure 16.1.3-5 depicts the seismic risk throughout West Virginia. 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). If the acceleration due to gravity exceeds 10%, most pre-1965 buildings are likely to experience damage.[61] (USGS, 2015h)

Areas of greatest seismicity in West Virginia are concentrated in the southernmost portions of the state stemming from the New Madrid Fault several hundred miles to the southwest. The largest earthquake ever recorded in West Virginia was a magnitude-4.5 quake that occurred in 1969 in the southern part of the state. Impacts were felt in parts of eight other states. (USGS, 2012c)

[60] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude. (USGS, 2014c)

[61] Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (USGS, 2015h)

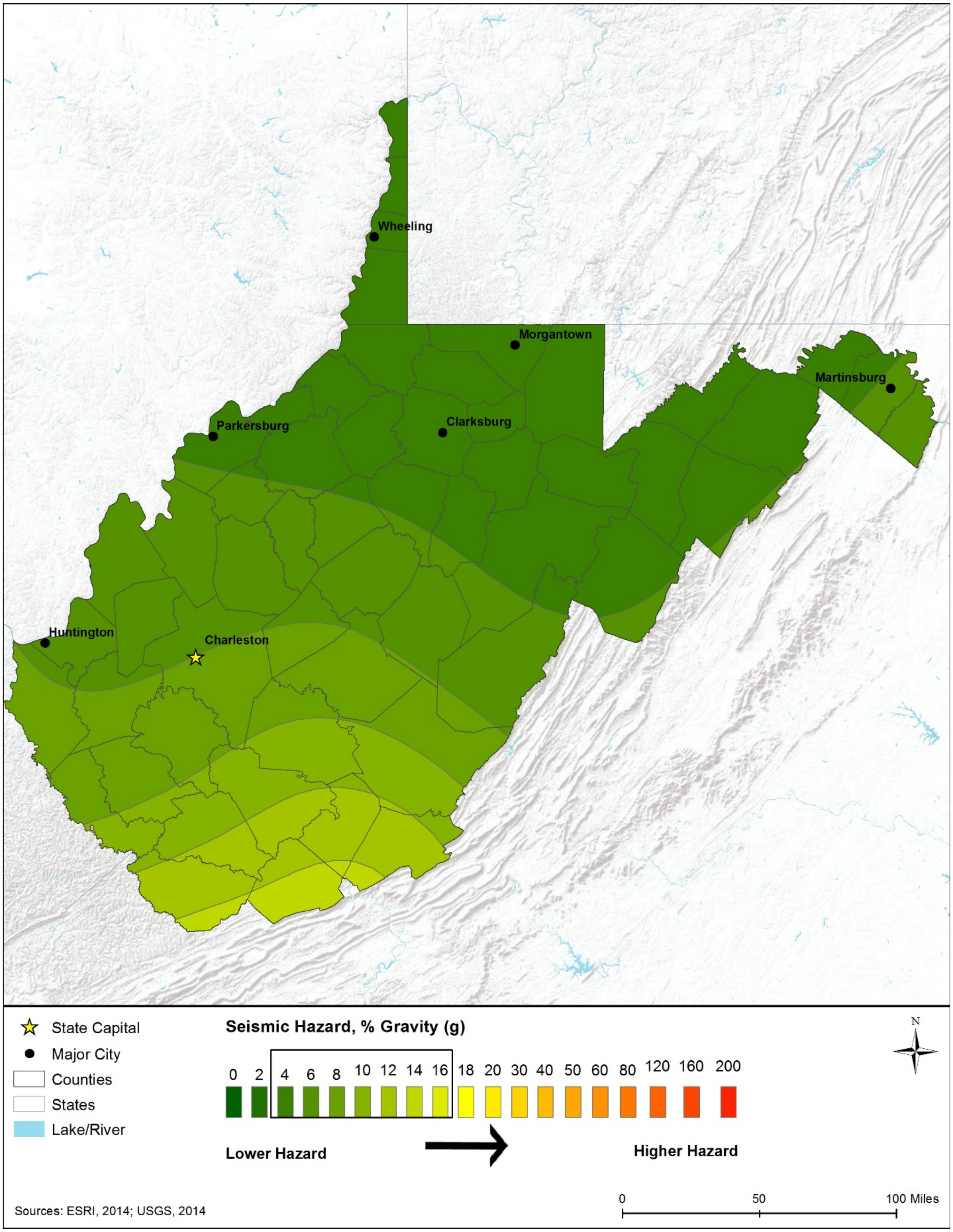

Figure 16.1.3-5: West Virginia 2014 Seismic Hazard Map

Landslides

West Virginia's Appalachian Plateaus Province is one of the most landslide-prone areas for landslides in the Eastern United States (Radbruch-Hall, et al., 1982). "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, 2003b). 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, 2003b).

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, 2003b)

In West Virginia's Appalachian Plateaus, earth flows, debris flows, and debris avalanches, are pervasive in areas with weathered bedrock and unconsolidated surface sediments. More than 75 percent of slopes between Pittsburgh (PA) and Chattanooga (TN), including much of western West Virginia, are prone to landslides (Figure 16.1.3-6). Damaging debris avalanches result when a heavy downpour follows persistent steady rainfall. A single storm can cause hundreds or thousands of landslides in a localized area. In 1969, torrential rainfall associated with Hurricane Camille caused 1,584 landslides in West Virginia's Spring Creek watershed. Southeast of the Appalachian Plateau Province, the ridges of the Valley and Ridge and Blue Ridge Provinces are covered by extensive colluvium (i.e., unconsolidated sediment) that is highly susceptible to sliding. (Radbruch-Hall, et al., 1982)

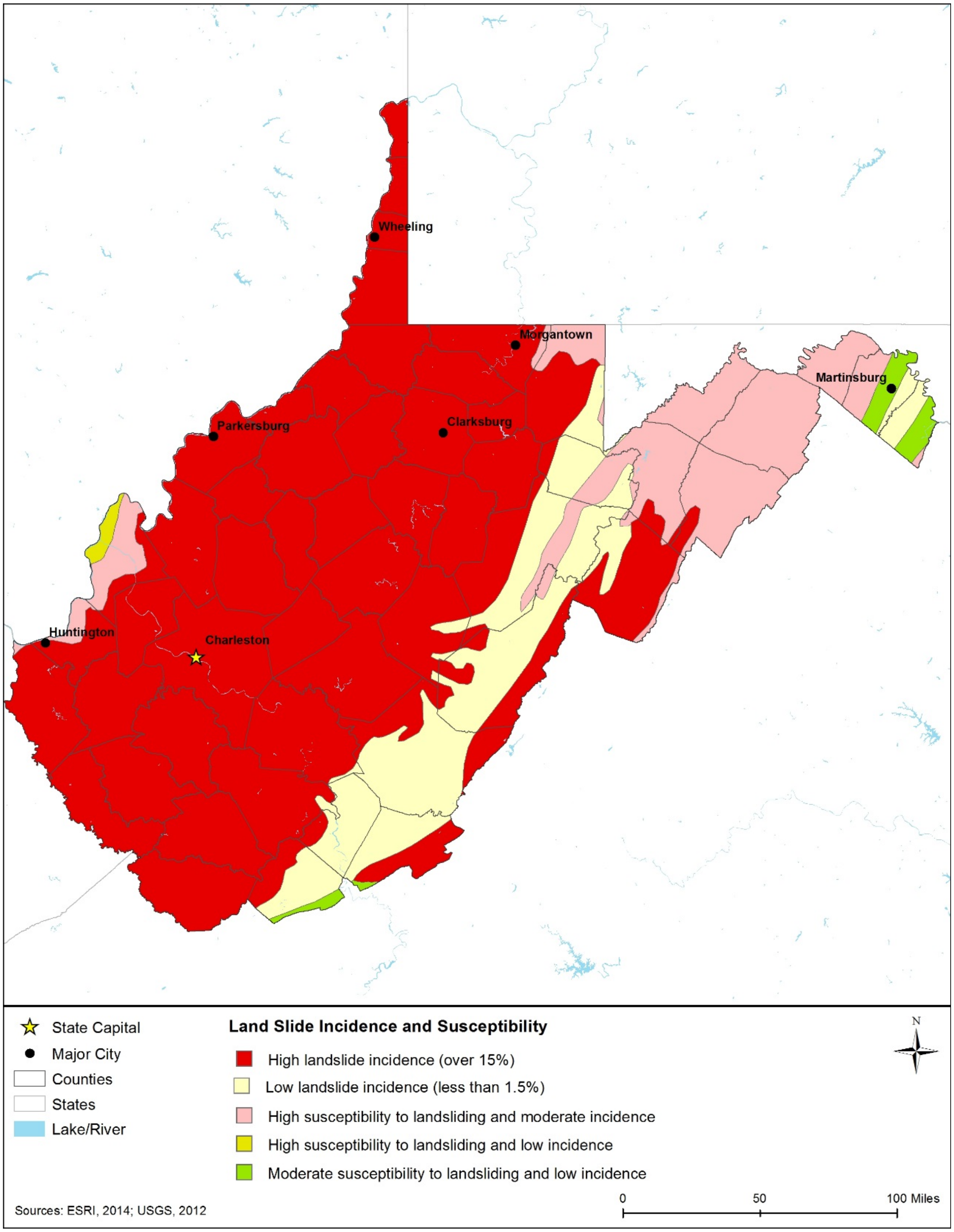

Figure 16.1.3-6: West Virginia Landslide Incidence and Susceptibility Hazard Map[62]

[62] Susceptibility hazards not indicated in Figure 16.1.3-6 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014d)

Subsidence

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 layers of silt or clay, which do not transport groundwater, confine an aquifer, 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)

In eastern West Virginia, subsidence is commonly attributable to karst topography.[63] Karst sinkholes are usually brought on by sinking soils resulting from caves or simply cavities below. Karst topography in West Virginia occurs along a band that includes the Valley and Ridge Province in the eastern third of the state. Figure 16.1.3-7 displays the locations of karst topography within West Virginia. Monroe County, WV, contains 18 sinkholes per square kilometer and is considered to be among the densest regions for sinkholes worldwide. Monroe County's limestone also contributes to the formation of West Virginia's most extensive cave complex (West Virginia Division of Tourism, 2015a).

In other parts of West Virginia, mine subsidence, which occurs when the land over underground mines settles after the mine roof falls in, is a significant cause of land subsidence. The problem is so pervasive throughout the state that mine subsidence insurance is a component of every homeowner's insurance policy in 40 coal-mining counties throughout the state. (WVGES, 2007)

[63] Karst: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or ground water." (USGS, 2015d)

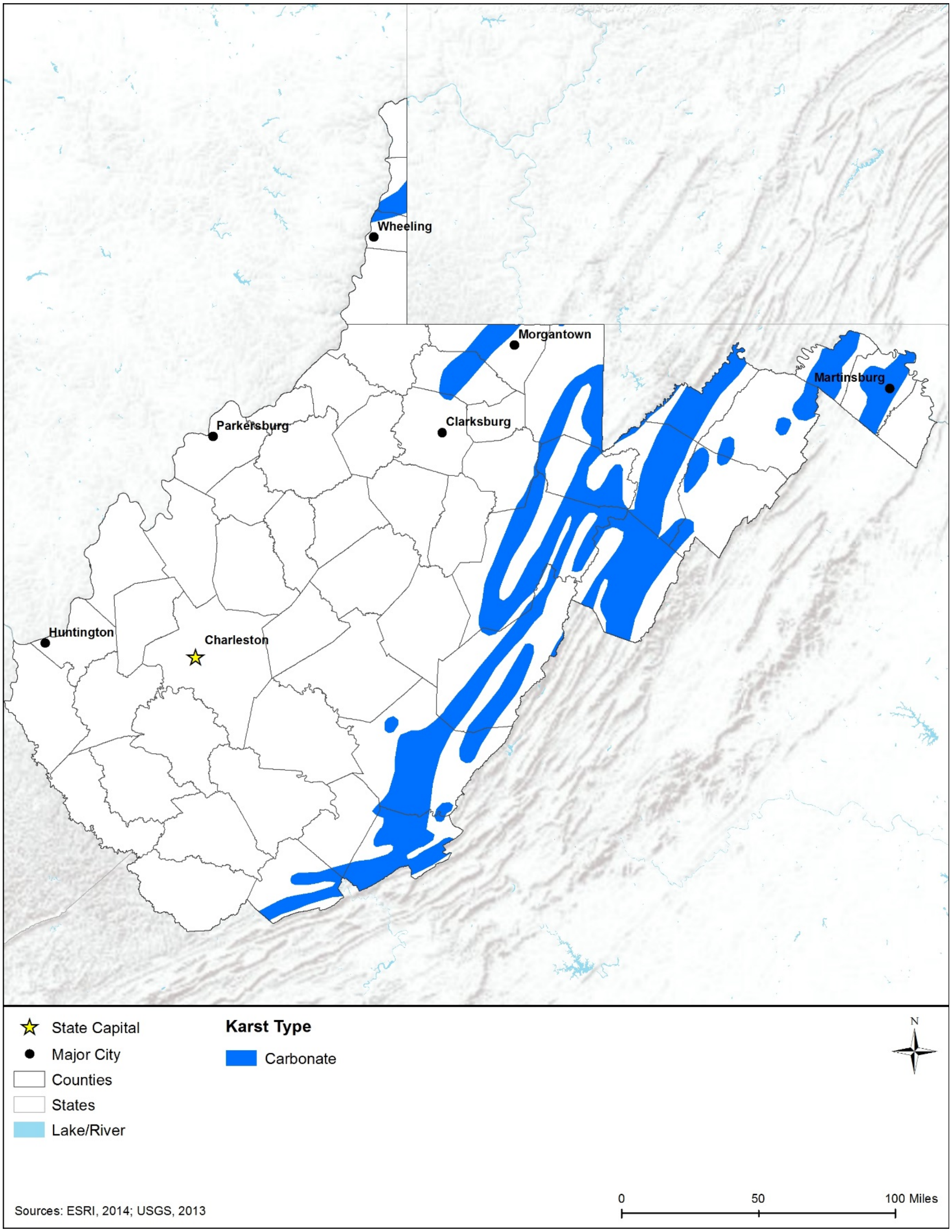

Figure 16.1.3-7: Areas in West Virginia Subject to Land Subsidence Due to Karst Topography

16.1.4. Water Resources

16.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 16.1.5). 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 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 and economic and ecological wellbeing. (USGS, 2014e)

16.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 16.1.4-1 summarizes the major West Virginia laws and permitting requirements relevant to the state's water resources.

Table 16.1.4-1: Relevant West Virginia Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia National Pollutant Discharge Elimination System (WV/NPDES) Permit program	WVDEP	Any point source that discharges pollutants to surface waters including sewage collection and treatment systems, industrial wastewater systems, and municipal and industrial landfills (WVDEP, 2015a).
CWA Section 401 permit	WVDEP	Section 401 certification required for all activities that require a federally issued permit (WVDEP, 2015c).
CWA Section 404 permit, Nationwide Permit, West Virginia Regional Conditions	U.S. Army Corps of Engineers (USACE), Pittsburgh or Huntington District	Certain activities cannot be authorized under the NWP program in Critical Resource Waters[64], which include New River; portions of the Bluestone River, and Meadow River; all waterbodies within state and national forests and recreational areas; streams within National Wilderness Areas; tributaries of Cranberry River, Red Creek, Laurel Fork, and Otter Creek. (USACE, 2012)

16.1.4.3. Environmental Setting: Surface Water

Surface water resources are natural and engineered lakes, ponds, rivers, and streams. According to the WVDEP, West Virginia has 21,114 miles of perennial streams, 11,164 miles of intermittent streams, and 108 public lakes, reservoirs, and ponds (WVDEP, 2014b). These

[64] "Critical resource waters include marine sanctuaries and marine monuments managed by the National Oceanic and Atmospheric Administration, and National Estuarine Research Reserves. District Engineers may designate additional critical resource waters, after notice and an opportunity for public comment" (77 FR 10184, 2012)

surface waters supply drinking, agricultural, and industrial water; provide aquatic habitat; and support swimming, fishing, and boating recreational use across the state.

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying ground water, and encompass an area of land that drains all the streams and rainfall to a common outlet (e.g. reservoir, bay). West Virginia's waters (lakes, rivers, and streams) are divided into five regions that include 32 major river basins defined by WVDEP Appendix A, Table A-1: Characteristics of West Virginia's Watersheds, provides detailed information on the state's major watersheds, as defined by WVDEP. Visit http://www.dep.wv.gov/WWE/wateruse/WVWaterPlan/Pages/WatershedAtlas.aspx for information and additional maps about each WVDEP watershed's location, size, and water quality. (WVDEP, 2013a)

West Virginia has 32 major watersheds that are grouped by region. Region One covers the north and northwestern portion of West Virginia. This region includes the Little Kanawha, Middle Ohio North, Middle Ohio South, Upper Ohio North, and Upper Ohio South watersheds. Region Two borders Region One and extends to the West Virginia-Pennsylvania border. This Region includes Cheat River, Youghiogheny River, Dunkard Creek, Monongahela River, Tygart Valley River, and West Fork River watersheds. Region Three lies to the east of Region Two and extends to the West Virginia-Maryland border. This region includes the Cacapon River, Potomac Direct Drains, Shenandoah Hardy, Shenandoah Jefferson, North Branch Potomac River, and South Branch Potomac River. Region Four is the largest of the regions and encompasses 8,494 square miles within central and southern West Virginia. The watersheds includes within this region are Coal River, Elk River, Gauley River, Greenbrier River, James River, Lower Kanawha River, Lower New River, Upper Kanawha River River, and Upper New watersheds. Region Five is located in southwestern West Virginia. This is the smallest region, encompassing 3,352 square miles along the West Virginia-Kentucky border. Watersheds within this region include Big Sandy River, Twelvepole Creek, Lower Guyandotte, Lower Ohio, Tug Fork, and Upper Guyandotte River watersheds. (WVDEP 2013b)

Freshwater

As shown in Figure 16.1.4-1, there are 20 major rivers in West Virginia: Coal River, Big Sandy River, Cacapon River, Cheat River, Dunkard Creek, Elk River, Gauley River, Greenbrier River, Guyandotte River, Kanawha River, Monongahela River, New River, Potomac River, Ohio River, Potomac River, Shenandoah, Tug Fork, Twelvepole Creek, Tygart River, and Youghiogheny River. In eastern West Virginia, rivers and streams drain into the Atlantic, while the state's western rivers and streams drain into the Mississippi River (West Virginia DHSEM, 2013). The Ohio River extends from the Northern Panhandle of West Virginia and flows southwesterly along the West Virginia-Ohio border. The Kanawha River is located in southwestern West Virginia and is a tributary of the Ohio River. The river flows northwesterly to join the Ohio River at Point Pleasant. The Monongahela River originates in Fairmont, West Virginia where the West Fork River and Tygart Valley River converge and continues to flow through

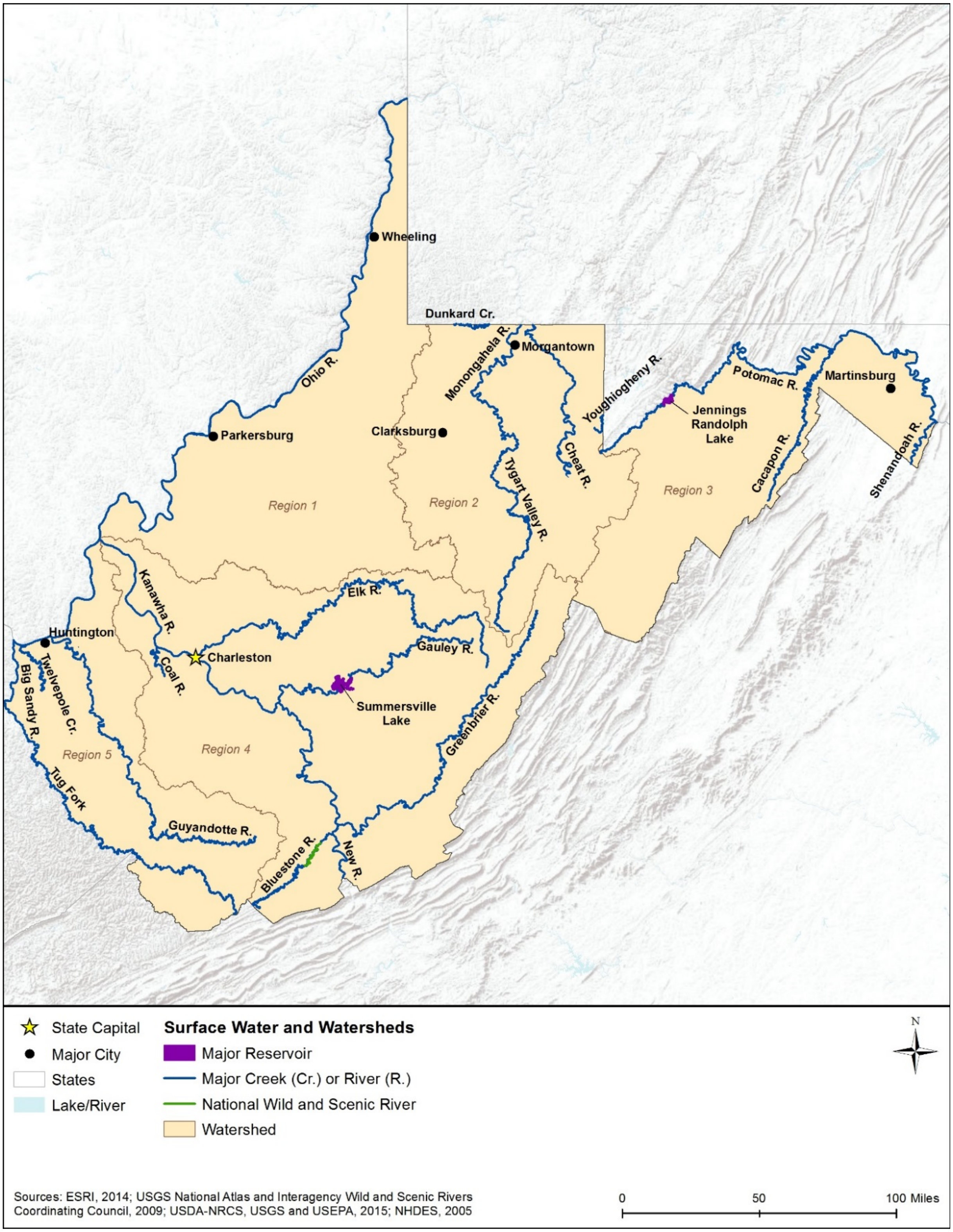

Figure 16.1.4-1: West Virginia Major Watersheds defined by WVDEP, and Surface Waterbodies

northcentral West Virginia. The South Branch Potomac River flows northeasterly to its confluence with the North Branch Potomac River and forms the Potomac River on the West Virginia-Maryland border. (WVDEP 2013b)

Major reservoirs and lakes in West Virginia include Summersville Lake and Jennings Randolph Lake. Summersville Lake is located in southwest West Virginia within the Gauley River Watershed. It is the largest lake in the state and "boasts 2,700 acres of surface area and more than 60 miles of shoreline during summer pool." Jennings Randolph Lake is a 925-acre reservoir in northeast West Virginia. The lake is located along the North Branch of the Potomac River in Mineral County on the West Virginia-Maryland border. (WVDEP, 2013c)

16.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

A segment of the Bluestone River is the only federally designated National Wild and Scenic River in West Virginia (Figure 16.1.4-1) (see Appendix C for more information on the Act). The federally designated segment is 10 miles in length and is located in the southern portion of the state (NPS, 2015a). The Bluestone River is in the southern Appalachians between the Pipestem and Bluestone state parks (NPS, 2015a) (WVDEP, 2013d). The forest habitat surrounding the river is home to over 1,000 species of plants, and the river channel is home to smallmouth bass, rock bass, catfish, and fish species (NPS, 2015a). Streams in the Monongahela National Forest are considered National Study Rivers and are protected under the National Wild and Scenic Rivers Act. River segments include Blackwater River, Sand Run, and Glade Run. (USFWS, 2015a)

Waters of Special Concern

West Virginia has designated a number of waterbodies as Critical Resource Waters. For work or activities affecting these designated waters, a pre-construction notification to the NPS and/or the Forest Service and USACE is required. A project review and/or permit may also be required. Designated waterbodies include:

- The New River;
- Meadow River, from near the US Route 19 Bridge to the Gauley River; and
- Streams within National Wilderness Areas including Cranberry River, Red Creek, Laurel Fork, and Otter Creek. (USACE, 2012)

The West Virginia Natural Stream Preservation Act protects specific water bodies from impound, flood, or diversion due to an increasing population, expanding settlement, and growing mechanization. The following streams and rivers are protected from activities that "impound, divert or flood" the waterbodies. Such protection requires consultation between the lead Federal agency and the agency responsible for management of the waterbody to review the proposed project, determine the specific impact on the waterbody, determine if the proposed action or activity requires a permit, or determine if alternate project(s) or design(s) may be required. Designated waterbodies include:

- Greenbrier River from Knapps Creek to the New River;
- Anthony Creek from its origins to the Greenbrier River;
- Cranberry River from its origins to the Gauley River;
- Birch River from Cora Brown Bridge to the Elk River; and
- New River from Greenbrier River to the Gauley River. (West Virginia Legislature, 2015b)

16.1.4.5. Impaired Waterbodies

Water quality is evaluated by several constituents and attributes, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, pesticides water color, condition of stream banks and lake shores; observations of aquatic wildlife communities; and sampling of fish tissue or sediment. Under Section 303(d) of the CWA, states are required to report a listing of impaired waters, [65] the causes of impairment, and probable sources. Table 16.1.4-2 summarizes the water quality of West Virginia's assessed major waterbodies by category, percent impaired, designated use,[66] cause, and probable sources as of 2010. Figure 16.1.4-2 shows the Section 303(d) waters in West Virginia as of 2014.

As shown in Table 16.1.4-2, various sources affect West Virginia's waterbodies, causing impairment. More than 60 percent of West Virginia's assessed rivers and streams are impaired. Designated uses of these impaired waterbodies include public water supply, agriculture/wildlife, recreation, industrial uses, and aquatic life. More than fifty percent of West Virginia's assessed lakes, reservoirs, and ponds are impaired due to polychlorinated biphenyls (PCBs), sediment, nutrients, metals, and oxygen depletion. (USEPA, 2015b)

Table 16.1.4-2: Section 303(d) Impaired Waters of West Virginia, 2010

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	58%	62%	Public water supply, agriculture/wildlife, recreation, water supply industrial, aquatic life	Pathogens[c] , metals, PCBs	None reported.
Lakes, Reservoirs, and Ponds	59%	51%	Recreation, water supply industrial, agriculture/wildlife, public water supply, aquatic life	PCBs, sediment, nutrients, metals, oxygen depletion	None reported.

Source: (USEPA, 2015b)
[a] Some waters may be considered for more than one water type.
[b] West Virginia has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease. (USEPA, 2015c)

[65] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters. (USEPA, 2015c)
[66] Designated Use: state and authorized Indian Tribe water quality standards specify which uses (such as recreation, aquatic life use support, or drinking water supply) individual waters should support. (USEPA, 2015c)

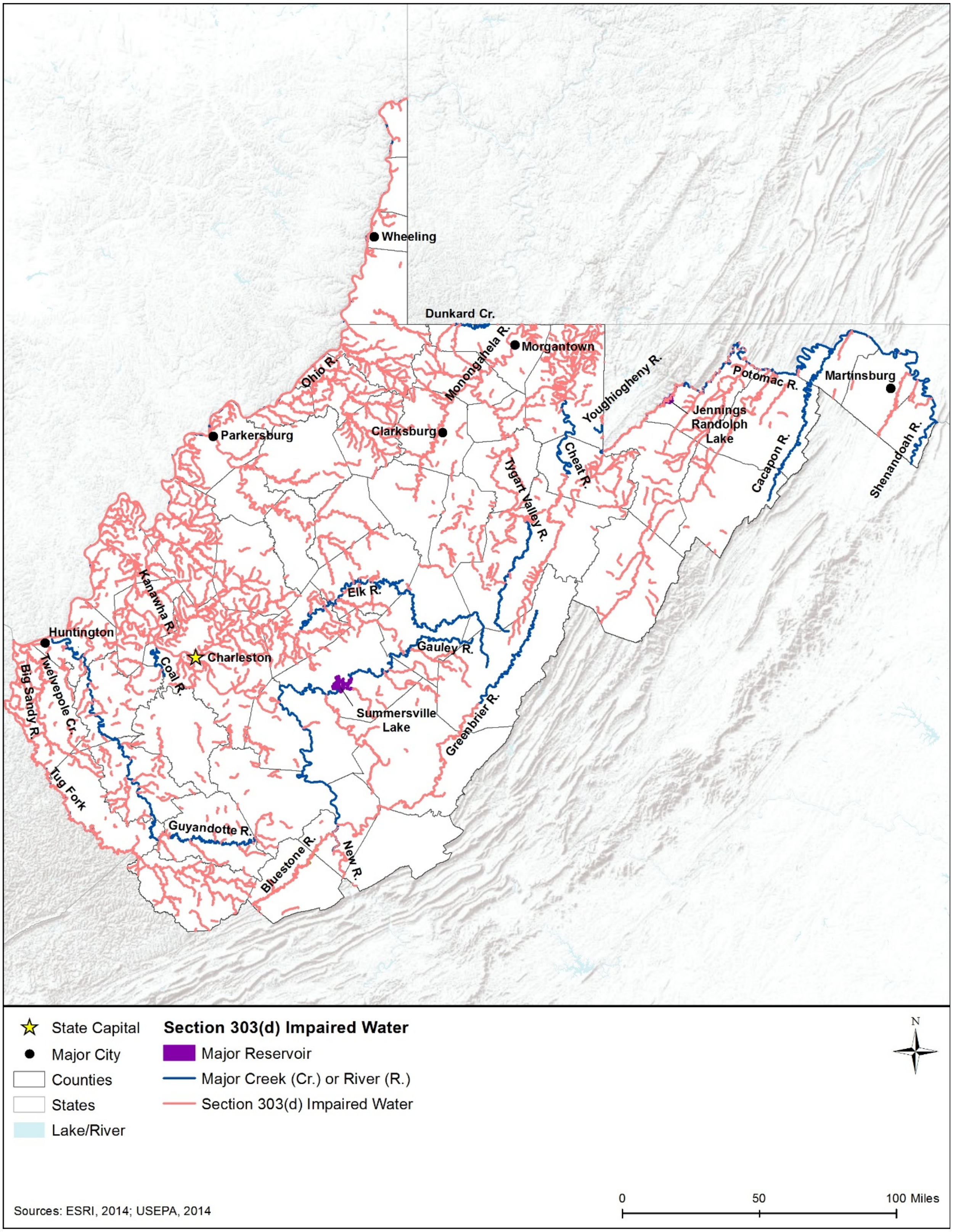

Figure 16.1.4-2: Section 303(d) Impaired Waters of State, 2014

West Virginia's Watershed Assessment Branch conducts waterbody sampling throughout the state to determine their quality according to the federal CWA. The state uses a Watershed Basin Schedule for sampling efforts. This approach uses a five-year rotation, so that one-fifth of the state's watersheds are sampled and assessed. To address pollutant-impaired waters, West Virginia has worked with the U.S. Environmental Protection Agency (USEPA) and other stakeholders to assure completion of total maximum daily loads (TMDLs). West Virginia uses a Pre-TMDL Development Monitoring program to collect data for use in TMDL modelers and stream restoration plans. Additionally, West Virginia randomly selects sites throughout the state to collect data and provide estimates of conditions of wadeable streams within specific watersheds or ecoregions. (WVDEP, 2015d)

West Virginia also implements an Ambient Water Quality Monitoring Network, a bimonthly statewide trend-monitoring program. The program uses 26 targeted, long-term monitoring stations at the mouth of large rivers throughout the state. A recent trend analysis report showed that total suspended metals, total phosphorus, and several metals are decreasing throughout the state. Additionally, areas previously impacted by acid rain are improving. Agriculture and mining continue to be issues for water quality in areas of West Virginia. (WVDEP, 2015d) More information on these monitoring programs is available at www.dep.wv.gov/WWE/ watershed/wqmonitoring/Pages/waterquality.aspx.

16.1.4.6. Floodplains

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

The primary type of floodplain in West Virginia is riverine and lake floodplains. These floodplains occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous areas in West Virginia, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014b)

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). West Virginia is especially vulnerable to flash flooding due to its topography (small basins) and development patterns. There are several causes of flooding in West Virginia, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, rapid snowmelt, hurricanes, and tropical storms. (WVDEP, 2013d)

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. The majority of West Virginia is at high risk of flooding. More flood claims, injuries, and deaths have occurred in the western part of the state, while major crop damage due to flooding has occurred in the panhandle of the West Virginia. From 1993-2012, there have been 1,757 recorded flood events in West Virginia totaling approximately $1 billion in property damage and $3.5 million in crop damage. Most (44 of the 50) Federal Disaster Declarations for West Virginia from 1954-2013 were due to flood damages. (West Virginia DHSEM, 2013)

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 320 communities in West Virginia through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities “to adopt and enforce floodplain management regulations and to implement broader floodplain management programs” and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 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. As of May 2014, West Virginia had seven communities participating in the CRS (FEMA, 2014d).[67]

16.1.4.7. 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)

[67] A list of these seven 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).

or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle. Table 16.1.4-3 provides details on aquifer characteristics in the state; Figure 16.1.4-3 shows West Virginia's principal and sole source aquifers.

West Virginia's principal aquifers consist of carbonate-rock aquifers[68] and sandstone aquifers.[69] Approximately 42 percent of West Virginia residents rely on groundwater resources for their domestic water supply, withdrawing approximately 70 million gallons of groundwater per day. According to water census data from 2004, "industry, irrigation, commercial, and mining uses accounted for 54 million gallons per day in groundwater withdrawals." Generally, the water quality of West Virginia's aquifers is suitable for drinking and daily water needs. Groundwater quality issues within the state include elevated iron and manganese concentrations, presence of contaminants, and fecal-indicator bacteria and nutrients. West Virginia's groundwater is susceptible to surface water contamination from the state's chemical industry, agricultural practices, and coal mining. (USGS, 2012d)

Table 16.1.4-3: Description of West Virginia's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Mississippi aquifers: Shale, sandstone and siltstone aquifers with minimal limestone	Eastern West Virginia	Water is hard, and useable at shallow depths, but too saline at great depth. Saline contamination from past oil/gas extraction is present locally at shallow depths.
Valley and Ridge aquifers Consist of permeable rocks of primarily sandstone, shale, and carbonates	Southern and Eastern Western West Virginia	Water is generally suitable for municipal supplies and other purposes, with locally excessive iron, hardness, and low pH (acidic).
Valley and Ridge carbonate-rock aquifers Contiguous fractured-bedrock aquifers.	Far East West Virginia	Water is generally suitable for municipal supplies and other purposes, with locally excessive iron, hardness, and low pH (acidic). Groundwater flow system is different where these rocks are folded and where they are not. Soluble carbonate rocks and easily eroded shales underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and some cherty dolomite underlie ridges.
Pennsylvania aquifers: Sandstone, shale, and clay aquifer with coal deposits and minimal limestone	Western border to Central- Eastern West Virginia	Water is hard, and useable at shallow depths, but too saline at great depth. Where mine drainage is present, water can be acidic and have high concentrations of metals. Saline contamination from past oil/gas extraction is present locally at shallow depths.

[68] 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)

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

Aquifer Type and Name	Location in State	Groundwater Quality
Piedmont and Blue Ridge crystalline-rock aquifers: Composed of crystalline metamorphic and igneous (volcanic) rocks of many types	Small section of far east West Virginia	Natural water quality within the Piedmont and Blue Ridge aquifers is generally satisfactory, but locally, dissolved iron concentrations may be high (greater than 0.3 parts per million).

Source: (USGS, 2001b)

16.1.5. Wetlands

16.1.5.1. Definition of the Resource

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

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. (USEPA, 1995)

16.1.5.2. Specific Regulatory Considerations

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 16.1.5-1 summarizes major West Virginia’s state laws and permitting requirements relevant to the state's wetlands.

Table 16.1.5-1: Relevant West Virginia Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Section 401 CWA	WVDNR	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from WVDNR indicating that the proposed activity will not violate water quality standards. Discharges include dredging, filling, and other activities that cause the loss of wetlands, and require permits from the USACE. (WVDEP, 2015c)

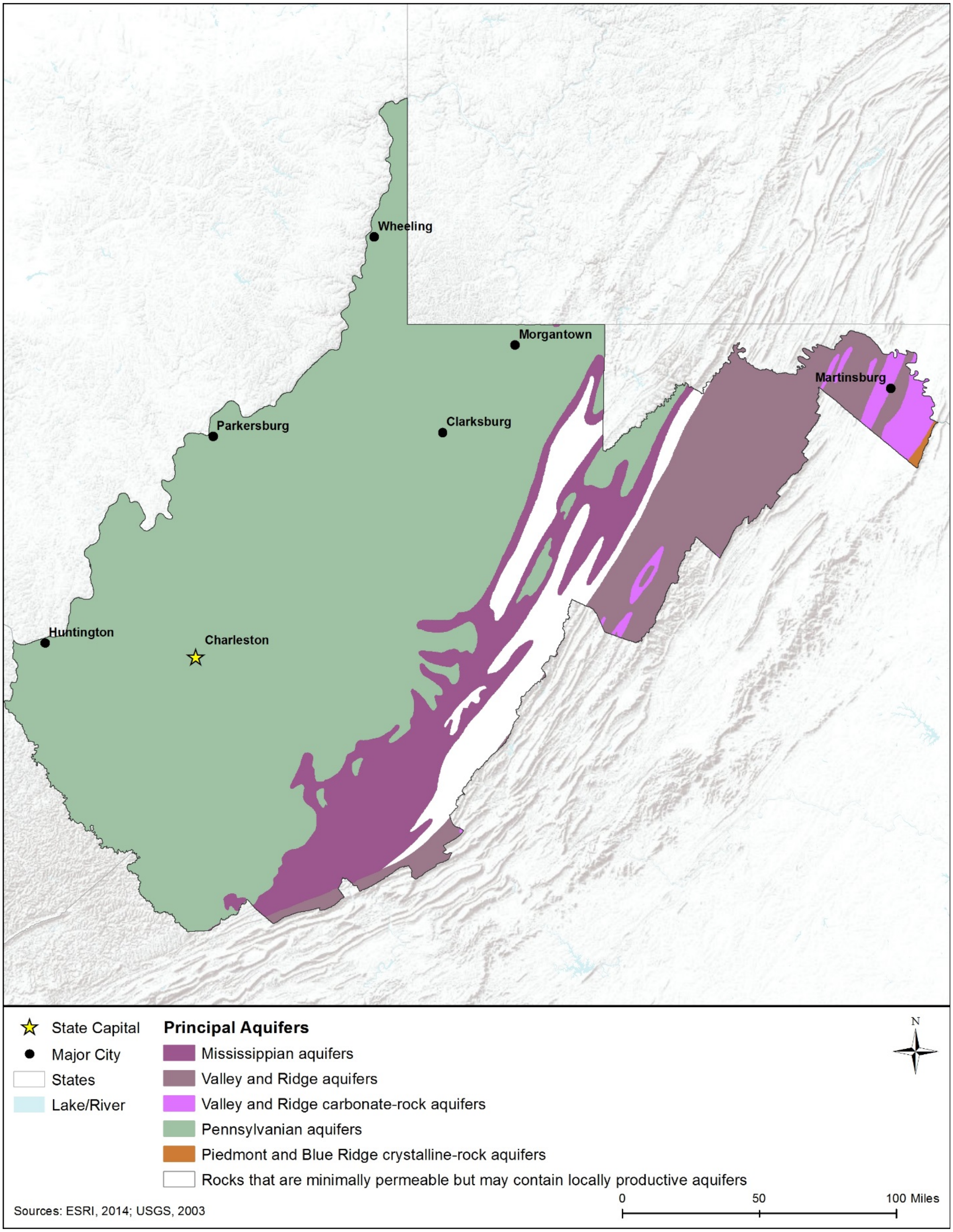

Figure 16.1.4-1: Principal Aquifers of West Virginia

16.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in Cowardin et al. (1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Three of these Systems are present in West Virginia, as detailed in Table 16.1.5-2. The first four of the five major systems include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats.

- 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 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 West Virginia, palustrine (freshwater) wetlands are the main type of wetland. They are found throughout the state. Riverine and lacustrine wetlands comprise approximately six percent of the wetlands in the state. Table 16.1.5-2 uses 2014 NWI data to characterize and map West Virginia 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 that may be conducted, as appropriate, at the site-specific level once those locations are known. As shown in Figure 16.1.5-1, wetlands are distributed throughout the state. The map codes and colorings in Table 16.1.5-2 correspond to the wetland types in the figure.

Table 16.1.5-2: West Virginia 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, often found along rivers and streams. Also, found in isolated depressions.	25,056
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,[70] prairie potholes, and sloughs.	Throughout the state, common in low-lying areas in floodplains.	17,116
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	16,961
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[71], and other miscellaneous wetlands are included in this group.	Common in abandoned fields, depressions (seeps), along hillsides and highways	334
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	1,436
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	2,542

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

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

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

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

Palustrine Wetlands

In West Virginia, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs,[72] and ponds). Common tree types found in palustrine forested wetlands (PFO) in West Virginia are red maple (*Acer rubrum*), black willow (*Salix nigra*), and green ash (*Fraxinus pennsylvanica*). Palustrine scrub-shrub wetlands (PSS) in West Virginia consist of dominant tree species such as arrow woods (*Viburnum dentatum*), alders (*Alnus sp.*), willows (*Salix sp.*), meadowsweets (*Filipendula ulmaria*), St. John's-wort (*Hypericum perforatum*), high-bush blueberry (*Vaccinium corymbosum*), and chokeberries (*Aronia sp.*). PFO and PSS are the most common type of palustrine wetlands within West Virginia. Palustrine emergent wetlands (PEM), or freshwater marsh, fen, and slough[73], in West Virginia support diverse plant and animal populations. Common PEM plants in West Virginia include cattails (*Typha latifolia*), bur-reeds (*Sparganium sp.)*, arrowheads (*Sagittaria sp*.), sedges (*Carex sp*.), sweet flag (*Acorus calamus*), and spatterdock (*Nuphar polysepala*). (Tiner, 1996)

Palustrine wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds formed by water lilies and other floating-leaved or free-floating plants. These are the easiest wetlands to recognize and occur throughout the state (Metzler & Tiner, 1992).

In 1982, West Virginia inventoried nearly 46,000 acres including vegetated wetlands and nonchannel waterbodies (e.g., ponds, lakes, and reservoirs). The USFWS mapped roughly 57,000 acres of wetlands in the state as part of the NWI in the late 1980s. (Tiner, 1996) As of 2014 NWI, there were approximately 63,445 acres of wetlands in the state, less than one percent of West Virginia's total land area (USFWS, 2014a). The most common palustrine (freshwater) wetland type in the state was PFO/PSS (39 percent), followed by PEM (27 percent), and PUB/PAB (ponds) (27 percent). (WVDEP, 1997) Based on the USFWS NWI 2014 analysis, ratios have remained similar, with PFO/PSS being the dominant wetland type (42 percent), followed by PEM (29 percent), PUB/PAB (ponds) (29 percent), and other palustrine wetlands (1 percent) (USFWS, 2014a). Main threats to palustrine wetlands in West Virginia include drainage, filling, construction and development, agricultural conversion, pollution, and mining (WVDEP, 1997).

Wetland distribution is not uniform in West Virginia. The state's largest wetland area is Canaan Valley in (as seen in northeastern portion of Figure 16.1.5-1), comprising nine percent of West Virginia's total wetlands. This 6,700-acre complex includes scrub shrub and bog wetlands and "more than 580 plant species, 290 vertebrate species, and threatened and endangered species

[72] Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation. (Adirondack Park Agency, 2013)
[73] Slough: "swamp or shallow lake system, usually a backwater to a larger body of water." (NOAA, 2014).

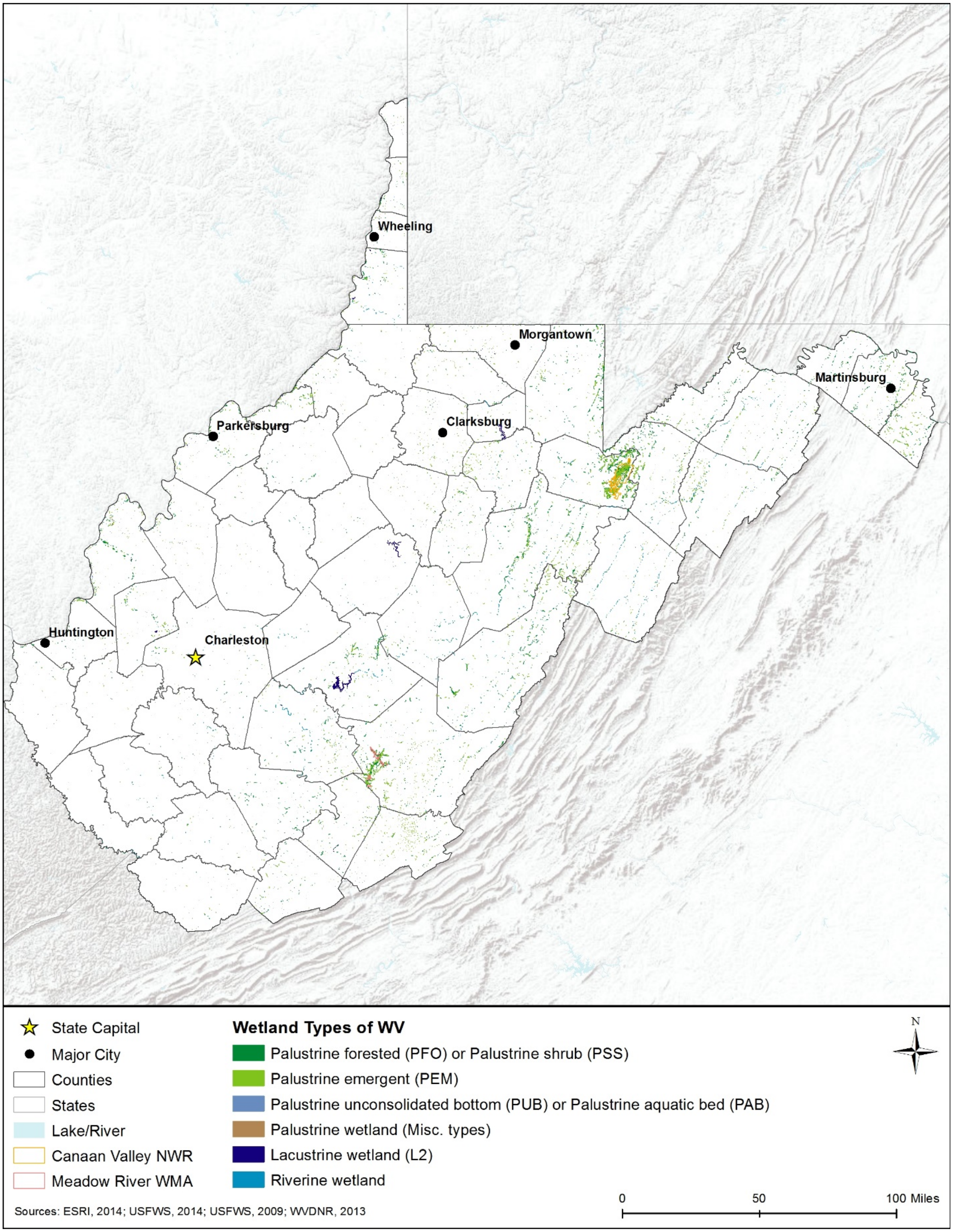

Figure 16.1.5-2: Wetlands by Type, in West Virginia, 2014

such as the Cheat Mountain salamander and the West Virginia northern flying squirrel" (WVDEP, 1997) (USEPA, 2015d). Meadow River Wildlife Management Area (WMA), in the southeastern part of the state (Figure 16.1.5-1) is the second largest wetland area in the state. The WMA "protects approximately 2,374 acres of meadows, glades, and wetlands" (USEPA, 2015e). These two areas comprise approximately 30 percent of the state's total wetlands (Tiner, 1996).

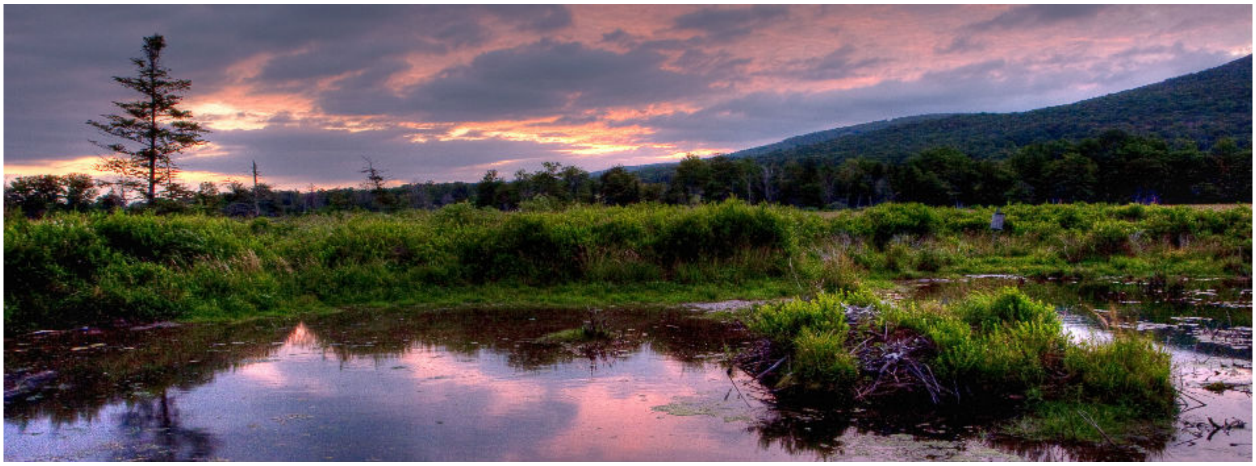

Figure 16.1.5-3: Sunrise at Canaan Valley National Wildlife Refuge

Source: (USFWS, 2015d)

Riverine and Lacustrine

Riverine wetlands are associated with flowing water systems (such as rivers, creeks, perennial streams, intermittent streams, and similar waterbodies) and contiguous wetlands. These wetland types are often fringing wetlands of small widths along river edges or occasionally meadows. Riverine wetlands comprise 2 percent of total wetlands in the state (USFWS, 2014a).

Lacustrine wetlands are associated with large standing waterbodies (such as lakes and reservoirs) and contiguous wetlands formed in the lake basin. Lacustrine wetlands in West Virginia are connected to the surrounding upland and form around the edges of lakes and around islands that sit in the middle of a water body. Lacustrine wetlands comprise 4 percent of the total wetlands in the state (USFWS, 2014a).

Other Important Wetland Sites

West Virginia does not have any state regulated types of wetlands of concern.

Other important wetland sites in West Virginia include:

- There are 15 National Natural Landmarks (NNLs) in the state, which range in size from 10 acres to over 3,000 acres, owned by USFWS, WVDNR, other conservation organizations, and individuals (NPS, 2012a). Section 16.1.8, Visual Resources, describes West Virginia's NNLs.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including Natural

Resources Conservation Service (NRCS) Agricultural Conservation Easement Program, Farm Service Agency Conservation Reserve Program, and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, and Ducks Unlimited. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds approximately 1,470 acres in conservation easements in West Virginia (National Conservation Easement Database, 2015).

16.1.6. Biological Resources

16.1.6.1. Definition of the Resource

This section describes the biological resources of West Virginia. Biological resources include terrestrial[74] vegetation, wildlife, fisheries and aquatic[75] habitats[76], and threatened[77] and endangered[78] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Due to the significant topographic variation and large tracts of contiguous forests within the state, West Virginia supports a wide diversity[79] of biological resources, and is considered a biodiversity hotspot within the U.S. (WVDNR, 2014). Each of these topics is discussed in more detail below.

16.1.6.2. Specific Regulatory Considerations

The proposed project must meet the requirements of NEPA and other applicable laws and regulations. The pertinent federal laws relevant to the protection and management of biological resources in West Virginia are summarized in Appendix C. Table 16.1.6-1 summarizes major state laws relevant to the state's biological resources.

[74]Terrestrial: "Pertaining to land." (USEPA, 2015a)
[75]Aquatic: "Pertaining to water." (USEPA, 2015a)
[76]Habitat: "The environment in which an organism or population of plants or animals lives; the normal kind of location inhabited by a plant or animal." (USEPA, 2015a)
[77]Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (16 U.S.C §1532(20)). (USEPA, 2015a)
[78]Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range." (16 U.S.C §1532(6)). (USEPA, 2015a)
[79]Diversity: "An ecological measure of the variety of organisms present in a habitat." (USEPA, 2015a)

Table 16.1.16-1: Relevant West Virginia Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Noxious Weed Act (West Virginia Code Annotated [WVC] 12-D-1 through 12-D-12)	West Virginia Department of Agriculture (WVDA)	Charges the Commissioner of the WVDA as responsible for establishing and updating the list of prohibited and regulated noxious weeds[80]. Deems the Commissioner responsible for surveying for noxious weeds and when found taking the steps necessary to eradicate them.
Regulated release of fish, water animal, and other aquatic organisms. (WVC 20-2-64)	WVDNR	Deems it illegal to release any listed aquatic invasive species[81] into the waters of the state as well as any other fish, water animal, or aquatic organism without and authorized stocking[82] permit.
West Virginia Plant Pest Act (WVC 19-12-14)	WVDA	Charges the Commissioner of the WVDA as responsible for establishing rules and regulations for the eradication or suppression of plant pests[83]. Responsible for establishing quarantines to prevent the spread of plant pests detected within the state. Deems it illegal for any person to sell, move, transport, or deliver any plant pests or other insects or noxious weeds within or to the state.

16.1.6.3. Terrestrial Vegetation

The distribution of flora[84] within the state is a function of the characteristic geology[85], soils, climate[86], and water of a given geographic area and correlates with distinct areas identified as ecoregions[87]. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions, and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (NWF, 2015a) (USDA, 2015a) (World

[80] Noxious weeds: "any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health." (Federal Noxious Weed Act of 1974).
[81] Invasive species: "These are species that are imported from their original ecosystem. They can out-compete native species as the invaders often do not have predators or other factors to keep them in check." (USEPA, 2015a)
[82] Stocking: "Adding fish to a body of water, such as a lake, pond or stream." (USEPA, 2015a)
[83] "Plant pest" is defined by 7 CFR §340.1 as "any living stage (including active and dormant forms) of insects, mites, nematodes, slugs, snails, protozoa, or other invertebrate animals, bacteria, fungi, other parasitic plants or reproductive parts thereof; viruses; or any organisms similar to or allied with any of the foregoing; or any infectious agents or substances, which can directly or indirectly injure or cause disease or damage in or to any plants or parts thereof, or any processed, manufactured, or other products of plants."
[84] Vegetation within an area.
[85] USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability.
[86] 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, 2015a)
[87] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables." (USEPA, 2015a)

Wide Fund, 2015). Ecoregion boundaries often coincide with geographic regions of a state. West Virginia is comprised of two main geographic regions: the Ohio River Valley and the Appalachian Mountains. The Ohio River Valley covers approximately one fourth of the state along the western border and the Appalachian Mountains cover the eastern three quarters of the state. 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[88] United States has 84 ecoregions. This section provides an overview of the terrestrial vegetation resources for West Virginia at USEPA Level III (Woods, Omernik, & Brown, 1999).

As shown in Figure 16.1.6-1, the USEPA divides West Virginia into four Level III ecoregions. These ecoregions support a variety of different plant communities, all based on their general location within the state. Communities are predominately forested and range from deciduous[89] hardwood forests at lower elevations to coniferous[90] spruce-fir forest at high elevations. The topographic relief within the state heavily influences microclimates that shape these forest communities. Table 16.1.6-2 provides a summary of the general abiotic[91] characteristics, vegetative communities, and the typical vegetation found within each of the four West Virginia Level III ecoregions.

[88] Conterminous: "sharing a common boundary." (Oxford Dictionary)
[89] Deciduous: "Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally." (USEPA, 2015a)
[90] Coniferous: "Cone-bearing trees, mostly evergreens, that have needle-shaped or scale-like leaves." (USEPA, 2015a)
[91] Abiotic: "Nonliving characteristic of the environment; the physical and chemical components that relate to the state of ecological resources." (USEPA, 2015a)

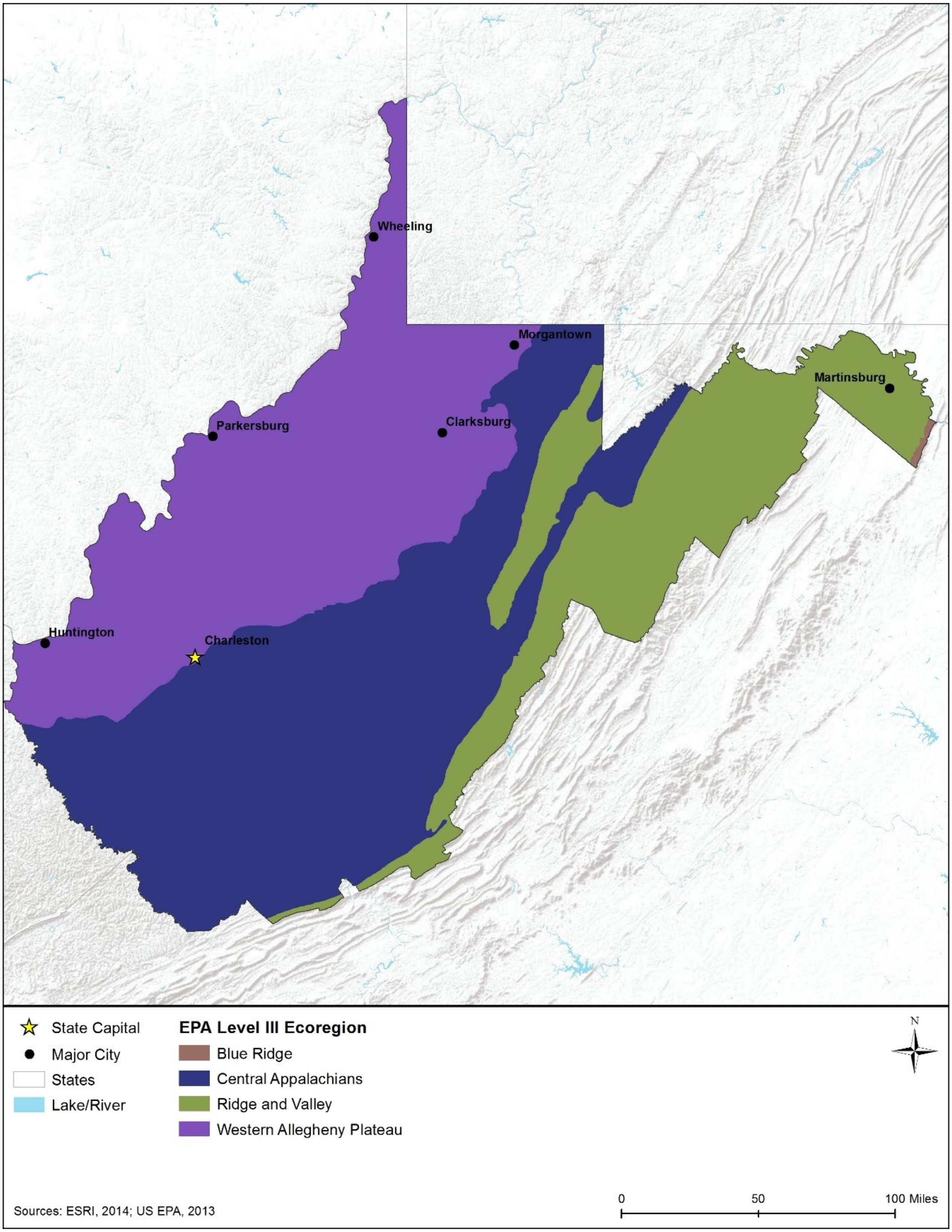

Figure 16.1.6-1: USEPA Level III Ecoregions in West Virginia

Table 16.1.6-1: USEPA Level III Ecoregions of West Virginia

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Region: Appalachian Mountains				
66	Blue Ridge	A mix of high plateaus[92] transitioning to rugged mountains with elevations above 6,600 ft above mean sea level (amsl). Densely forested area with clear high-gradient streams.	Appalachian Oak Forest	• **Deciduous Trees –** white oak (*Quercus alba*) and red oak (*Quercus rubra*)
67	Ridge and Valley	Low-lying region of forested ridges and agricultural valleys that run parallel from southwest to northeast. Approx. 50% forest cover surrounded by mountainous regions at higher elevation. Elevation varies widely from 500 to 4,300 ft amsl.	Appalachian Oak Forest and Hemlock Forest	• **Deciduous Trees –** white oak, red oak, black oak (*Quercus velutina*), hickory (*Carya spp.*), and red maple (*Acer rubrum*). • **Conifer Trees –** eastern white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*)
69	Central Appalachians	Predominately forested plateau with rugged terrain and a cool climate with extensive rainfall. Siltation and acidification of streams is common from coal mining in the region. Higher than neighboring regions elevations from 1,200 to 4,600 ft amsl.	Appalachian Oak, Northern Hardwood Forest, and Spruce-Fir Forests	• **Deciduous Trees –** red oak, black cherry (*Prunus serotina*), sugar maple (*Acer saccaharum*) hickory, and red maple • **Conifer Trees –** eastern white pine, eastern hemlock, and red spruce (*Picea rubens*).
70	Western Allegheny Plateau	Rugged plateau composed of a mix of native forest, dairy, livestock, pasture and general farms dispersed throughout valleys and rounded hills. Slightly less rugged than the neighboring Central Appalachians.	Mesophytic Forest and Mixed Oak Forest.	• **Deciduous Trees –** American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), mountain maple (*Acer spicatum*), white oak, red oak, tulip-tree (*Liriodendron tulipifera*) • Conifer Trees – eastern hemlock
Geographic Region: Ohio River Valley				
70	Western Allegheny Plateau	Rugged plateau of a mix of native forest, dairy, livestock, pasture and general farms dispersed throughout valleys and rounded hills. Slightly less rugged than the neighboring Central Appalachians.	Mesophytic Forest and Mixed Oak Forest.	• **Deciduous Trees –** American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), mountain maple (*Acer spicatum*), white oak, red oak, tulip-tree (*Liriodendron tulipifera*) • Conifer Trees – eastern hemlock

Sources: (USEPA, 2013a) (USEPA, 2015f) (Woods, Omernik, & Brown, 1999)

[92] Plateau: “An elevated plain, tableland or flat-topped region of considerable extent.” (USEPA, 2015a)

Communities of Concern

Currently, no vegetative communities of concern are listed in West Virginia. "The West Virginia Natural Heritage Program is currently developing a vegetation classification system to use as the basis for tracking and ranking occurrences of all types of terrestrial ecological communities[93] in the state" (WVDNR, 2015a).

Nuisance and Invasive Plants

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

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

Noxious weeds and other invasive plants pose a large threat to West Virginia's agricultural and forest resources. Noxious weeds can have adverse ecological and economic impacts to these resources by displacing native species, degrading wildlife habitat, and increasing soil erosion[94]. The West Virginia Noxious Weed Act of 1976 (Chapter 19 Article 12-D-1 through 12-D-12) stipulates that the commissioner of the West Virginia Department of Agriculture be responsible for the establishment and enforcement of the statewide noxious weed list, and updates to that list, as necessary. A total of 17 state-listed noxious weeds are regulated in West Virginia as set forth in the Legislative Rules of West Virginia Title 61 series 14A. None of these species occur on the Federal Noxious Weed List (USDA, 2014). However, West Virginia has adopted the Federal Noxious Weed list as an extension of the West Virginia Noxious Weed List. All 17 species are terrestrial in nature. The following species, by vegetation type, are regulated in West Virginia, in addition to the species on the Federal list:

- **Trees –** tree of heaven (*Ailanthus altissima*)
- **Shrubs –** Russian olive (*Elaeagnus angustifolia*), multiflora rose (*Rosa multiflora*), marrow's honeysuckle (*Lonicera morrow*), and tartarian honeysuckle (*Lonicera tatarica*)

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[93] 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, 2015a)

[94] Erosion: "The general process or the group of processes whereby the materials of Earth's crust are loosened, dissolved, or worn away and simultaneously moved from one place to another, by natural agencies, which include weathering, solution, corrosion, and transportation." (USEPA, 2015a)

- **Terrestrial Forbs, Grasses, and Vines –** marijuana (*Cannibus sativa*), plumeless thistle (*Carduus acanthoides*), curled thistle (*Carduus crispus*), musk thistle (*Carduus nutans*), poison hemlock (*Conium maculatum*), purple loostrife (*Lythrum salicaaria*), Japanese stiltgrass (*Microstegium vimineum*), opium poppy (*Papaver somniferum*), kudzu (*Peuraria thunbergiana*), mile-a-minute (*Polygonum perfoliatum*), Japanese knotweed (*Polygonum cuspidatum*), and Johnsongrass (*Sorghum halepense*)

16.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in West Virginia, divided among mammals[95], birds[96], reptiles and amphibians[97], and invertebrates[98]. Terrestrial wildlife consist of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals, furbearers[99], nongame animals, game birds, waterfowl, and migratory birds as well as their habitats. 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 the WVDNR, the state is home to 70 mammal species, 88 reptile and amphibian species, and nearly 300 species of birds (WVDNR, 2015b). Critical habitat[100] for threatened and endangered mammalian species, as defined by the ESA, does exist within West Virginia and is discussed in Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Mammals

Common and widespread mammalian species in West Virginia include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridana*), eastern gray squirrel (*Sciurus carolinensis*), and fox squirrel (*Sciurus niger*). Mammals such as the bobcat (*Lynx rufus*), river otter (*Lutra canadensis*), and fisher (*Martes pennanti*) are uncommon or rare in West Virginia due to restricted habitat or secretive behavior (WVDNR, 2001).

In West Virginia, white-tailed deer, wild boar (*Sus scrofa*), and black bear (*Ursus americanus*) are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), furbearers, and upland and migratory game bird (WVDNR, 2015c). The following eight species of furbearers may be legally hunted or trapped in the West Virginia:

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[95] 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, 2015a)
[96] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves." (USEPA, 2015a)
[97] 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, 2015a)
[98] Invertebrates: "Animals without backbones: e.g. insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015a)
[99] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.
[100] 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)).

raccoon, red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), fisher, beaver (*Castor canadensis*), and river otter.

West Virginia has identified 22 mammals as Species of Greatest Conservation Need (SGCN), five of these SGCN species are federally listed as endangered under the ESA. Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species. The SGCN list consists of at-risk species that are rare or declining, and can receive funding from State Wildlife Grants for efforts to reduce their potential to be listed as endangered. Although these species have been targeted for conservation they are not currently under legal protection, with the exception of those also listed under the ESA. 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 (WVDNR, 2005a).

Birds

The number of native bird species documented in West Virginia varies according to the timing of the data collection effort, changes in bird taxonomy[101], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., mountains, large rivers, and valleys, etc.) found in West Virginia support a large variety of bird species.

Approximately 300 species of birds are known to inhabit West Virginia. Of those species, 75 of them are known to have breeding populations [102] in the state with the remainder being migratory or winter residents (WVDNR, 2015b). Among the 300 species in West Virginia, 74 SGCN have been identified (WVDNR, 2005a).

West Virginia is located within Atlantic Flyway. Spanning nearly 3,000 miles and covering the entire east coast of the U.S., the Atlantic Flyway stretches as far north as the Arctic Tundra and as far south as the Caribbean. It is the most densely human-populated of the four waterfowl migration flyways in North America (Atlantic, Mississippi, Central, and Pacific) (Ducks Unlimited, 2015). Large numbers of migratory birds utilize these flyways 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).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the *Bald and Golden Eagle Protection Act*. Bald eagles are generally found near large rivers and lakes in the eastern part of the state all year (eBird, 2015a). Golden eagles are found

[101] Taxonomy: "A formal representation of relationships between items in a hierarchical structure." (USEPA, 2015a).
[102] Population: "Aggregate of individuals of a biological species that are geographically isolated from other members of the species and are actually or potentially interbreeding." (USEPA, 2015a)

in the eastern part of the state, primarily during winter (eBird, 2015b), and generally nest in mountains and cliffs.

A total of 20 Important Bird Areas (IBAs) have also been identified in West Virginia. IBAs assist in achieving local conservation priorities to provide important habitat for native bird populations during breeding[103], migratory stops, feeding, and over-wintering areas. A variety of habitats are designated as IBAs, including forests, scrub/shrub, grasslands, freshwater wetlands[104], and bodies of water. These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the northwest portion of the state within the Ohio River Valley. IBAs in this region include the Lewis Wetzel WMA, Sand Hill WMA, and the Ritchie Mines WMA. These IBAs are mostly forested communities that are key habitat for species that require intact forest interiors for breeding such as the cerulean warbler (*Setophaga cerulea*) (National Audubon Society, 2015a).

The 20 IBAs are in the following geographic regions within West Virginia:

Appalachian Mountains

- New River Gorge – Garden Ground Mt. IBA
- Greenbrier River Drainage and Adjacent Mts.
- New River Gorge – Garden Ground Mt. IBA
- Whitby – Bowyer Creek
- Monongahela National Forest – Coberly Sods
- Coopers Rock State Forest IBA
- Guyandotte Mountain Vicinity

Ohio River Valley

- Beech Fork State Park
- Stumptown WMA
- Dutch Ridge
- Cedar Creek State Park
- Kanawha State Forest, Wallback WMA, Dutch Ridge
- Coopers Rock State Forest IBA
- North Bend State Park
- Ritchie Mines WMA
- Sand Hill WMA
- Murphy Preserve
- Wallback WMA
- Lewis Wetzel WMA
- Sand Hill WMA Boone

[103] 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, 2015a)
[104] Wetlands: “Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.” (USEPA, 2015a)

Reptiles and Amphibians

A total of 88 reptile and amphibian species occur in West Virginia, including 35 salamanders, 14 frogs and toads, 13 turtles, 6 lizards, and 20 snakes. "Salamanders are a diverse group of animals, and the Appalachian Mountains provide a "hotspot" of this diversity, containing nearly 15% of the world's species" (NPS, 2010). Some of these salamander species are found nowhere else in the world. The region's combination of a cool climate and diverse forest and freshwater ecosystems allows for such biodiversity (Smithsonian Conservation Biology Institute, 2015). Of the 88 native reptile and amphibian species, 39 SGCN have been identified. Many of these species occur in a restricted variety of habitats such as rivers, creeks, springs, and moist forested hillsides. Although a large number of the state's reptile and amphibian species have specific habitat requirements many species can be found throughout the state (WVDNR, 2004) (WVDNR, 2015b).

Harvest and collection of West Virginia's reptile and amphibian species is regulated by the WVDNR. Some of which are not allowed to be harvested and are protected by closed seasons, and others are allowed to be harvested with regulated bag and possession limits. The season is permanently closed for five turtle species, three frog and toad species, and ten salamander species. All other turtle, frog, toad, lizard, snake, and salamander species are allowed to taken according to the appropriate collection dates, daily bag limits, and possession limits (WVDNR, 2015d) (WVDNR, 2015e).

Invertebrates

West Virginia is home to an unknown number invertebrate species, including a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, spiders, mites, millipedes, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. West Virginia is also home to 20 species of tiger beetles, of which 12 are listed as SCGN. The state is also home to 44 damselfly species and 102 dragonfly species, of which 72 are listed as SGCN. In the U.S., one third[105] of all agricultural output depends on bee and other insect pollinators[106].

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. Bees play an important role in natural and agricultural systems and are responsible for 35 percent of global crop production. West Virginia is home to six major groups of bees including honey bees (*Apis* spp.), bumble bees (*Bombus* spp.), carpenter bees (*Xylocopa* spp.), mason bees (*Osmia* spp.) and leaf cutter bees, sweat bees, and digger bees (*Anthophorini* spp.) (West Virginia University, 2015). With the exception of the eastern panhandle of the state, the majority of West Virginia agriculture is based in livestock and grassland production due to shallow soils unsuitable for row crops. As such, agriculture in West Virginia is not as dependent on pollinator services as agriculture in other regions of the U.S. However, a small concentration of orchards in the

[105] Food and Agricultural Organization of the United Nations.
[106] Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015a)

eastern panhandle of the state is dependent on pollinator services for production (NRCS, 2015g) (West Virginia University, 2015).

Invasive Wildlife Species

Invasive terrestrial wildlife species in West Virginia includes rodents, birds, insects, feral cats, and feral hogs. The West Virginia Department of Agriculture is the only state agency mandated to control invasive species. However, the West Virginia Divisions of Natural Resources and Forestry, Environmental Protection, and Division of Highway are actively involved in invasive species management (monitoring, inventories, reporting, and control). (WVDNR, 2014)

Invasive insects in particular pose a large threat to West Virginia's forest and agricultural resources. Species such as the gypsy moth (*Lymantria dispar*), a destructive pest-the hemlock woolly adelgid (*Adelges tsugae*), and emerald ash borer (*Agrilus planipennis*)-an exotic beetle, have been documented in the state and are known to cause irreversible damage to native forests. The Asian longhorn beetle (*Anoplophora glabripennis*) is a similar species that has been documented in neighboring states, but has not been documented in West Virginia to date. These, and any other insect species that could cause disease or damage in any plants, are considered plant pests under West Virginia's Plant Pest Act. Further, according to West Virginia Code §19-12-14, it is illegal for any person to sell, move, transport, or deliver any plant pests within or to West Virginia. In addition, quarantines have been enacted in an effort to reduce the spread of many plant pests. Currently, federal quarantines are in place that restrict the transport of plant materials with the potential to contain the gypsy moth and the emerald ash borer. A state quarantine is also in place for the gypsy moth in West Virginia (USDA, 2015b) (WVDNR, 2014).

16.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in West Virginia, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. A distinctive feature of the West Virginia landscape with regard to aquatic wildlife is the coldwater trout streams and rivers scattered throughout the state's mountainous terrain. These water bodies provide habitat for a variety of aquatic wildlife that require high a high dissolved oxygen content and low sediment load. No Essential Fish Habitat identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in West Virginia. Critical habitat for threatened and endangered fish species, as defined by the ESA, does exist within West Virginia and is discussed in Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

West Virginia is home to 180 species of freshwater fish, including three hybrid species, with 72 of these species listed as SGCN. These species range in size from small darters and minnows to larger species such as salmon and sturgeon. Approximately 20 percent of these species are considered sport fish, with the remaining 80 percent classified as nongame species. These species are grouped into 24 families, as follows: lampreys, freshwater eels, herrings, freshwater catfishes, bowfins, drums, gars, killfishes, livebearers, minnows/carps, mooneyes, mudminnows, paddlefishes, perches, pikes, sculpins, silversides, sticklebacks, sturgeons, suckers, temperate basses, sunfishes, trout, and trout-perch. Lampreys, minnows, suckers, madtoms, sculpins, and darters account for 53 of the 72 species listed as SGCN. A brief description of those families that contain common species, notable sport fish species, or species of concern is presented below (WVDNR, 2005a) (WVDNR, 2015b).

The bullheads/catfishes family includes 12 species, three of which are designated as SGCN, the black bullhead (*Ameiurus melas*), mountain madtom (*Noturus eleutherus*), and northern madtom (*Noturus stigmosus*). All three species are smaller members of the catfish family that rarely reach an adequate size to be targeted by fishermen. The black bullhead is found in the Ohio and New River drainages, but both the mountain and northern madtom are only found in the Ohio River drainages (WVDNR, 2000) (WVDNR, 2005a).

Approximately 60 species of minnows/carps occur in West Virginia, with 23 of them listed as SGCN. Three of these species, the bigmouth shiner (*Notropis dorsalis*), pugnose minnow (*Opsopoeodus emiliae*), and Mississippi silvery minnow (*Hybognathus nuchalis*), are believed to have been extirpated from the state due to habitat alteration and dam construction. Common and widely distributed minnow species in West Virginia include the fathead minnow (*Pimephales promelas*), common carp (*Cyprinus carpio*), and golden shiner (*Notemigonus crysoleucas*). Minnows are not typically a popular sportfish, but are a commercially important fish and an important prey source for larger fish and other wildlife (WVDNR, 2000) (WVDNR, 2005a).

The paddlefish family in West Virginia is comprised of just one species, which is listed as a SGCN. Paddlefish are the largest species inhabiting West Virginia waters. They prefer slow or quiet areas of large rivers or reservoirs, and are found in the Ohio, Kanawha, Monongahela, and the Little Kanawha rivers in West Virginia. WVDNR is currently conducting a restoration project for this species and currently no fishing is allowed for paddlefish in West Virginia (WVDNR, 2000) (WVDNR, 2005a).

A total of 31 species of perches occur in West Virginia, with 20 of these species being darters. A total of 17 of these darter species are listed as SGCN in the state. The lower Elk River contains the largest diversity of Darters in the state, where 18 species coexist including eight of the 17 Darter SGCN. Walleye (*Sander vitreus*) and sauger (*Sander canadensis*) are larger members of the perch family and are important sport fish in West Virginia. Walleye occur in large lakes and reservoirs in the Ohio, New, and Potomac River drainages. Sauger prefer deep fast moving water of large rivers and streams, and are only found in the Ohio River drainage in West Virginia (WVDNR, 2000) (WVDNR, 2005a).

Six species of pike occur in West Virginia’s waters, including the grass pickerel (*Esox americanus*) which is listed as a SGCN. Grass pickerel are only found in the Ohio River drainage within the state. Although not native, northern pike (*Esox lucius*) have become established in certain lakes in the Ohio and Potomac River drainages through stocking efforts by WVDNR. Northern pike are found in bays of lakes and reservoirs with dense weed growth and submerged logs. The northern pike’s voracious predatory nature has made it an excellent sport fish avidly sought after by fishermen (WVDNR, 2000) (WVDNR, 2005a).

The sucker family includes 18 species in West Virginia. Eight of these sucker species are listed as SGCN in West Virginia. Common and widespread sucker species include the white sucker (*Catostomus commersoni*) and the northern hog sucker (*Hypentelium nigricians*), which can be found in all of West Virginia's major river drainages (WVDNR, 2000) (WVDNR, 2005a).

The sunfish family includes 14 species, many of which are common throughout the state and highly popular with sport fishermen. The most commonly encountered species are the bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), largemouth bass (*Micropterus salmoides*), and smallmouth bass (*Micropterus dolomieu*). These sunfish species live in a wide variety of habitats, including rocky, cool lakes streams, and reservoirs. The warmouth (*Lepomis gulosus*) and orange spotted sunfish (*Lepomis humilis*) are listed as SGCN in West Virginia. Both of which are only found in the Ohio River drainages within the state (WVDNR, 2000) (WVDNR, 2005a).

Four species of trout inhabit West Virginia's waters including the brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*). The brook trout is the only native trout to West Virginia and is listed as a SGCN. Brook trout are typically found in high elevation cold mountain streams. Trout are among the most popular game fish in West Virginia. They occupy the coldwater streams and lakes throughout the state (WVDNR, 2000) (WVDNR, 2005a).

Six species of lamprey are found in West Virginia, and all six species are listed as SGCN. These species are almost exclusively found in the Ohio River drainages within the state. Most lampreys are parasitic species that attach themselves to larger fish as adults. Similar to salmon these species often return to the same small species were they were born to spawn and die. River alterations and construction of dams have caused them to decline across much of their native range (WVDNR, 2000) (WVDNR, 2005a).

Four species of scuplin are listed as SGCN in West Virginia, including the Banded sculpin (*Cottus carolinae*), Slimy Sculpin (*Cottus cognatus*), Bluestone sculpin (*Cottus sp 1*), and Potomac Sculpin (*Cottus girardi*). These species of sculpin can be found in the Potomac and Shenandoah River systems, the New drainage of the Bluestone River system, and in the Tennessee drainage (WVDNR, 2000) (WVDNR, 2005a).

Three species of chub are listed as SGCN in West Virginia, including the Speckled chub (*Macrhybopsis hyostoma*), Silver chub (*Macrhybopsis storeriana*), and Bluehead chub (*Nocomis leptocephalus*). The Speckled and Silver chub can be found in the Mississippi River basin, and the Bluehead chub can be found in the New and Tennessee drainages (WVDNR, 2000) (WVDNR, 2005a).

The remaining species designated as SGCN include the American Eel (*Anguilla rostrate*), the Banded Killifish (*Fundulus diaphanous*), and the Central Mudminnow (*Umbra limi*). The American Eel and the Banded Killifish both reside in creeks and rivers found recently in the Ohio River watershed, and historically in the Potomac watershed. The Central Mudminnow resides in creeks and rivers found in the Ohio River watershed (WVDNR, 2000) (WVDNR, 2005a).

Shellfish and Other Invertebrates

A total of 69 species of freshwater mussels are known to exist in the waters of West Virginia. Freshwater mussels are an important food source for many wildlife species such as waterfowl, fish, muskrat, and other furbearers. Mussels are also important water quality indicators, as they often require streams with a high oxygen content that are degraded by sedimentation. Out of the 69 species of freshwater mussels, 42 of them in the state are listed as SGCN, and 6 of them are listed as federally endangered under the ESA. River diversions, impoundments, and dredging activities are the primary threats to freshwater mussel species. Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

West Virginia is also home to 21 species of crayfish, of which 5 are burrowing species and 16 stream and river dwelling species. Of the 21 crayfish species, 8 of them are listed as SGCN within the state. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), West Virginia is also home to an unknown number of smaller invertebrates such as amphipods[107], and the woodlice pillbug[108] species (WVDNR, 2005a).

Invasive Aquatic Species

To date, West Virginia has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select aquatic invasive species. According to West Virginia code §20-2-64, it is illegal to possess, sell, import, or release into the waters of the state bighead carp (*Hypophthalmichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*), black carp (*Mylopharyngodon piceus*), largescale silver carp (*Hypophthalmichthys harmandi*), diploid white amur (*Ctenopharyngodon idella*) or snakehead (*Channa* spp.). Also, according to West Virginia code §20-2-64, it is illegal to release any fish, water animal or other aquatic organism into the waters of the state without the authorization of a stocking permit issued by the WVDNR.

Invasive species such as the snakehead fish (*Channa argus*) have been detected in neighboring states and pose a large threat to West Virginia's waterways. Aquatic invasive species that have been detected in West Virginia include the Asian carp (both big head carp and silver carp), zebra mussel (*Dreissena polymorpha*), Asian clam (*Corbicula fluminea*), Chinese mystery snail (*Cipangopaludina chinensis malleata*), rusty crayfish (*Orconectes rusticus*), virile crayfish (*Orconectes virilis*), grass carp (*Ctenopharyngodon idella*), gold fish (*Carassius auratus*), and mosquito fish (*Gambusia affinis*) (WVDNR, 2014) (WVDNR, 2015d) (WVDNR, 2015f).

16.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C. §1531 *et seq*.) in West Virginia. The USFWS has identified 13 endangered and 7 threatened species known to occur in West Virginia (USFWS, 2015e). Federally listed wildlife species are known to occur throughout

[107] Amphipod: "A small, shrimp-like crustacean." (USEPA, 2015a)
[108] Pillbug: A small crustacean known as an isopod due to its nearly identical, jointed legs. Its body is divided into a series of hardened, overlapping segments, and can easily rolls up into a tight ball. (Bechinski & Merickel, 2009).

the state within the Appalachian Mountains as well as the Ohio River Valley; however, federally listed plant species are generally limited to aquatic habitats, wetlands, and floodplains within the state. Of these 20 federally listed species, 2 have designated critical habitat (USFWS, 2015f). There are no candidate species[109] identified by USFWS as occurring within the state (USFWS, 2015g). The 20 federally listed species include 3 mammals, 1 bird, 1 fish, 1 amphibian, 8 invertebrates, and 6 plants (USFWS, 2015e); these protected species are described in the following sections.

Mammals

Two endangered and one threatened mammal species are federally listed and known to occur in West Virginia as summarized in Table 16.1.6-3. The Indiana bat (*Myotis sodalist*) and northern long-eared bat (*Myotis septentrionalis*) are found throughout the state, while the Virginia big-eared bat (*Corynorhinus townsendii virginianus*) is found only in two mountains in central West Virginia. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in West Virginia is provided below.

Table 16.1.6-2: Federally Listed Mammal Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Indiana Bat	*Myotis sodalis*	E	No	Trees and snags; caves and abandoned mines; found throughout West Virginia.
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Trees and snags; caves and abandoned mines found throughout the state.
Virginia Big-eared Entire Bat	*Corynorhinus townsendii virginianus*	E	Yes, five caves throughout the state.	Caves in karst regions with large presence of oak hickory or beech maple hemlock trees; found in the mountains of central West Virginia.

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

[a] E = Endangered, T = Threatened

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

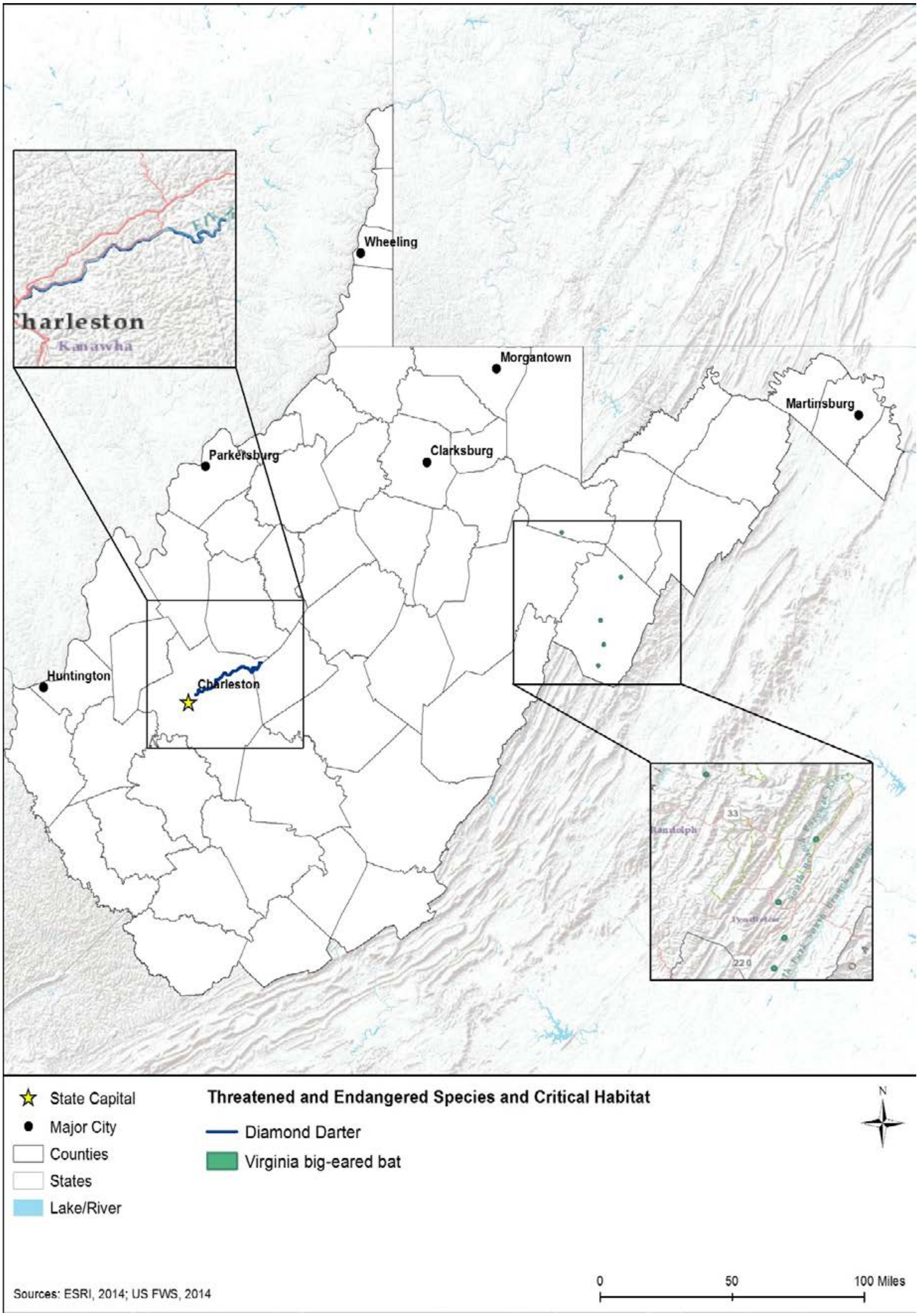

Figure 16.1.6-2: ESA Designated Critical Habitat for West Virginia

Indiana Bat Photo credit: USFWS

Indiana Bat. The endangered Indiana bat is a small, insectivorous mammal measuring approximately 3.0 to 3.5 inches in length with a wingspan of 9.5 to 10.5 inches. The Indiana bat has dull grayish chestnut fur and strongly resembles the more common little brown bat (*Myotis lucifugus*) (USFWS, 2006a). The Indiana bat was originally federally listed as "in danger of extinction[110]" under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was grandfathered into the ESA of 1973 as an endangered species (Harrington, 1982). In 2009, only 387,000 Indiana bats were known to exist in its range, less than half of the population of 1967 (USFWS, 2015h). Regionally, this species is found in the central portion of the eastern U.S., from Vermont west to Wisconsin, Missouri, and Arkansas, and south and east to northwest Florida. In West Virginia, the Indiana bat is known to occur in 55 counties throughout the state (USFWS, 2015i).

In the fall, Indiana bats migrate to hibernation[111] sites in caves and abandoned mines in order to mate and build up fat reserves for hibernation season in the winter. Upon emerging from hibernation, the bats feed near hibernations sites (within 10 miles) before they migrate to summer habitats, where the females roost (USFWS, 2006a). Some of these summer habitats can be as far as 300 miles away from hibernation areas (USFWS 2004). Indiana bats roost in trees during the day and feed at night in a variety of habitats, although streams, floodplain forests, ponds, and reservoirs are preferred. Females roost together in maternity colonies under the loose bark of dead or dying trees, or under the loose bark of shaggy-barked trees, although the physical characteristics of individual trees appear to be more of a factor than the species of tree. Nevertheless, tree species that have been noted as preferred by Indiana bat include shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), and American elm (*Ulmus rubra*) (USFWS, 2012).

The threats to this species include the disturbance and intentional killing of hibernating and maternity colonies, disturbances to air flow in caves from the improper installation of security gates, habitat fragmentation[112] and degradation, the use of pesticides or other environmental contaminants, and White Nose Syndrome (USFWS, 2004) (USFWS, 2015h). White Nose Syndrome is a rapidly spreading fungal disease that afflicts hibernating bats (USGS-NWHC, 2015).

Northern Long-eared Bat. The threatened northern long-eared bat is a brown furred, insectivorous bat with long ears. This bat is medium-sized, relative to other members of the

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

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

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

genus *Myotis*, reaching a total length of 3 to 3.7 inches in length (USFWS, 2015k). The northern long-eared bat was listed as endangered in 2013 (78 FR 72058 72059, December 2, 2013) and was relisted 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. In West Virginia, the northern long-eared bat is known to occur throughout the state (USFWS, 2015l).

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, 2015k).

White Nose Syndrome is the leading cause for the decline of this species. The numbers of northern long-eared bats in hibernacula[113] has decreased by 99 percent in the northeast U.S. (USFWS, 2015l). 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, 2015k).

Virginia Big-eared Bat. The endangered Virginia big-eared bat is a light to dark brown furred, insectivorous mammal measuring 1.5 to 2 inches long and weighing 7 to 12 grams. The Virginia big-eared bat was listed as endangered in 1979 (44 FR 69206 69208, November 30, 1979). Regionally, this species is known to occur only in Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. In West Virginia, it is known or believed to occur in five counties in the western region of the state, five of the caves in its range within West Virginia are listed as critical habitats (USFWS, 2015m).

This species resides in caves for both the summer and winter time, usually in karst regions with large presence of oak hickory or beech maple hemlock trees. The Virginia big-eared bat prefers cold area in the entrance of caves and in the winter during hibernation they move deeper in the caves (USFWS, 1984). The preferred habitat for the Virginia big-eared bat is found in the mountains of West Virginia. The primary threat to the Virginia big-eared bat is human disturbance of their habitat such as filling, removal of rock, and flooding of caves (WVDNR, 2006).

Birds

One threatened bird species is federally listed and known to occur in West Virginia as summarized in Table 16.1.6-4. This species, red knot (*Calidris canutus rufa*), is found throughout the state when used as a staging area during migration season. Information on the habitat, distribution, and threats to the survival and recovery of this species in West Virginia is provided below.

[113] Hibernacula: "a place of abode in which a creature seeks refuge."

Table 16.1.6-3: Federally Listed Bird Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Red Knot	*Calidris canutus rufa*	T	No	Typically reside within intertidal[114] marines[115], estuaries, and bays; can be found throughout West Virginia during migration.

Source: (USFWS, 2015e)

[a] T = Threatened

Red Knot. The threatened red knot is a medium-sized shorebird; it is approximately nine inches in length with a wingspan up to 20 inches, making it among the largest of the small sandpipers (USFWS, 2005a). It was recently federally listed as a threatened species in 2014 (79 FR 73705 73748, December 11, 2014). The red knot migrates annually from its breeding grounds above the Arctic Circle to the tip of South America where it winters. During spring and fall migration, the red knot travels in "non-stop segments of 1,500 miles and more, ending at stop sites called "staging areas." Some have been documented to fly more than 9,300 miles from south to north every spring and return south in autumn (USFWS, 2005a) (USFWS, 2014c). West Virginia is used as a staging area for migrating red knots, as it is known to occur throughout the state (USFWS, 2015n).

The red knot's preferred habitat is intertidal marines, estuaries, and bays, however the species may also be observed inland within West Virginia during migration seasons. Mussel beds are important food sources for the red knot. The red knots eat mussels and other mollusks mostly all year, however during migration season they eat horseshoe crab (*Limulus polyphemus*) (USFWS, 2005a). Current threats to the red knot include sea level rise, climate change, and reduced food availability at their migration stopover sites (USFWS, 2014c).

Fish

One endangered fish species is federally listed and known to occur in West Virginia as summarized in Table 16.1.6-5. This species, diamond darter (*Crystallaria cincotta*), is found along the Elk River and associated streams. Information on the habitat, distribution, and threats to the survival and recovery of this species in West Virginia is provided below.

Table 16.1.6-4: Federally Listed Fish Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Diamond Darter	*Crystallaria cincotta*	E	Yes, approximately 123 miles along the Elk River and associated streams.	Large warm water rivers with sand and gravel and clear water; found along the Elk River and associated streams in West Virginia.

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

[a] E = Endangered

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

[115] Marine: "Any marine environment, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment." (USEPA, 2015a)

Diamond Darter. The endangered diamond darter is one of the smaller darters with a slender body and member of the perch family, growing three to five inches. This fish is translucent with silvery sides and white belly along with yellow-tan back and dark blotch on the snout (USFWS, 2010a). The diamond darter was listed as endangered in 2013 (78 FR 45074 45095, July 26, 2013). This species was once found along the Appalachian Mountains from Ohio to Tennessee. Currently it is known to only occur in a small region of West Virginia (USFWS, 2013b) (USFWS, 2015o). Based on 2013 population estimates, only about 125 diamond darters were collected in the Elk River in West Virginia (USFWS, 2013b).

Suitable habitats for the diamond darter consist of large warm water rivers with sand and gravel and clear water (USFWS, 2010a). Critical habitat was designated for approximately 123 miles of the Elk River and associated streams in West Virginia in 2013; refer to Figure 16.1.6-3 (78 FR 52363 52387, August 22, 2013). This species tends to be more active at dusk and dawn. Since this species lacks a swim bladder it makes it easier for them to remain at river bottoms with less effort, allowing them to burry themselves in the sand at the bottom with only their eyes protruding to hide from predators throughout the day. The diamond dart also used this characteristic of burring itself in sand to hide and attack prey, as they feed on bottom-dwelling invertebrates and aquatic insects. This species reproduces during late March through May but with degradation of water quality over the years reproduction has been low and the occurring population are decreasing drastically. Current threats to the survival of the diamond darter include impoundment[116], creation of dams, siltation, and additional degradation of water quality from human actions such as resource extraction, agriculture, and road construction (USFWS, 2010a) (USFWS, 2013b).

Amphibians

One threatened amphibian species is federally listed and known to occur in West Virginia as summarized in Table 16.1.6-6. This species, Cheat Mountain salamander (*Plethodon nettingi*), is found at high elevations in Cheat Mountain. Information on the habitat, distribution, and threats to the survival and recovery of this species in West Virginia is provided below.

Table 16.1.6-5: Federally Listed Amphibian Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Cheat Mountain Salamander	*Plethodon nettingi*	T	No	Cool and moist forest with an abundance of red spruce and yellow birch; found along Cheat Mountain in east central West Virginia.

Source: (USFWS, 2015e)

[a] T = Threatened

[116] Impoundment: “water control.”

Cheat Mountain Salamander. The threatened Cheat Mountain salamander is one of the smaller subspecies of the woodland salamanders (*Plethodontids*), growing to approximately four inches. This salamander is black or dark brown with brassy flecks and a dark gray belly (WVDNR, 2015g). The Cheat Mountain salamander was listed as threatened in 1989 (54 FR 34464 34468, August 18, 1989). This species is known to only occur in eastern and central West Virginia along Cheat Mountain in the counties of Grant, Pendleton, Pocahontas, Randolph, and Tucker (USFWS, 2015p). This species is territorial and does not tend to leave its approximate 48 square foot established territory (NWF, 2015b).

Initially, the Cheat Mountain salamander was known to occur in red spruce forests, however, after the 1920's many of the red spruce were cut down and this salamander species has adapted to forest with yellow birch, American beech, and sugar maple. Suitable habitat include cool and moist forest with an abundance of the tree species' listed above, and groundcover comprised of liverwort and other dead logs, sticks, and leafs (WVDNR, 2015g). This species does not have lungs and breathes through its skin, and requires cool moist cover during hot and dry times. During the winter they tend to retreat to underground habitats and once spring comes around the females lay their eggs and unlike other salamanders they protect their eggs from predators (NWF, 2015b) (USFWS, 1991a).

Current threats to the Cheat Mountain salamander include the degradation of forest habitats with abundance of red spruce and northern hardwoods. With the depleted abundance of these trees the high-elevation habitats in the mountains are exposed to sun light and degrade the cool and moist conditions that this species depends on to survive. Additional, threats include clearing for roads or trails as this isolates population because the Cheat Mountain salamander does not tend to cross bare surfaces (WVDNR, 2015g).

Invertebrates

Six endangered, including one non-essential experimental population[117], and two threatened invertebrate species are federally listed and known to occur in West Virginia as summarized in Table 16.1.6-7. One listed snail, the flat-spired three-toothed snail (*Triodopsis platysayoides*), is found in the Cheat River Gorge area and one isopod, Madison Cave isopod (*Antrolana lira*), is found on the eastern edge of the state. Six listed mussels: the pink mucket (pearlymussel) (*Lampsilis abrupta*), clubshell (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), James spinymussel (*Pleurobema collina*), northern riffleshell (*Epioblasma torulosa rangiana*), and tubercled-blossom mussel (*Epioblasma torulosa torulosa*) are found in rivers and streams in various regions of the state, most of which occur in the Ohio and Kanawha Rivers. Information on the habitat, distribution, and threats to the survival and recovery of this species in West Virginia is provided below.

[117] For ESA Section 7 consultation purposes, "nonessential experimental populations are treated as though they are proposed for listing (except on National Wildlife Refuge System and National Park System lands, where they are treated as a species listed as threatened)." (59 Federal Register 42699, August 18, 1994)

Table 16.1.6-6: Federally Listed Invertebrate Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Pink mucket (pearlymussel)	*Lampsilis abrupta*	E	No	Major rivers and their tributaries with mud and sand in shallow riffle areas.
Clubshell	*Pleurobema clava*	E	No	River and streams with clean, loose sand, and gravel; found in along the Ohio, Kanawha, and Elk rivers.
Fanshell	*Cyprogenia stegaria*	E	No	Large rivers with sand and gravel and moderate current; found in rivers and streams within the counties of Fayette, Kanawha, and Wood.
Flat-spired Three-toothed Snail	*Triodopsis platysayoides*	T	No	Upper outcroppings, sandstone, and large boulders; found in Cheat River Gorge area.
James Spinymussel	*Pleurobema collina*	E	No	Sand and gravel bottoms of unpolluted free-flowing streams; found in South Fork Potts Creek.
Madison Cave Isopod	*Antrolana lira*	T	No	Calcite saturated waters in karst aquifers such as flooded limestone caves; found in two site in Jefferson County.
Northern Riffleshell	*Epioblasma torulosa rangiana*	E	No	Clean, firmly packed, coarse sand and gravel in riffles and streams; found in Kanawha County.
Tubercled-Blossom (Pearlymussel)	*Epioblasma torulosa torulosa*	E/XN	No	Shallow sand in the Tennessee River from Wilson Dam downstream to the Pickwick Reservoir.

Source: (USFWS, 2015e)

[a] E = Endangered, T = Threatened, XN = Non-Essential Experimental Population

Pink Mucket (Pearlymussel). The endangered pink mucket *(Lampsilis abrupta)* is a medium size mussel with a smooth yellowish-brown round shell. This species was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). The pink mucket was historically known to occur from Oklahoma east to Virginia and Illinois south to Louisiana, however, due to different factors the populations of these species have decreased and are now only known to occur in small populations throughout its historical range (USFWS, 1997a) (USFWS, 1985) (USFWS, 2015q).

Suitable habitat for the pink mussel consist of major rivers and their tributaries with mud and sand in shallow riffle areas. Threats to the survival of this species include dams that disrupt the natural flow, impoundment, and water quality degradation (USFWS, 1997a).

Clubshell. The endangered clubshell is a small to medium size mussel with yellow to brown shell exterior (USFWS, 1997b). It was federally listed as an endangered species in 1993 (58 FR 5638 5642, January 22, 1993). Regionally this species is known to occur from Michigan south to Tennessee and Illinois east to New York, with an experimental population in Alabama (66 FR 32250 32264, June 14, 2001) (USFWS, 2015r). Currently the clubshell is known to only occur in five percent of its historical range (USFWS, 1997b). In West Virginia, the clubshell currently occurs in seven counties within the state (USFWS, 2015r).

Suitable habitat for the clubshell consist of clean, loose sand, and gravel in medium to small rivers and streams. For their reproductive cycle they require stable, undisturbed habitat and sufficient fish hosts to assist in the complete development of the mussel's larval. This species can live for up to 50 years. The current threats to the clubshell include water quality degradation, sedimentation from development, agricultural runoff, and pollution. Additionally, invasive non-native species, such as the zebra mussels, are becoming a major threat as they are attacking and killing the clubshell (USFWS, 1997b).

Fanshell. The endangered fanshell is a medium-sized freshwater mussel with a subcircular light green to yellow shell with green rays (USFWS, 1991b). It was federally listed as endangered in 1990 (55 FR 25591 25595, June 21, 1990). Regionally, this species in known to occur from Virginia west to Illinois and in Alabama with a non-essential experimental population in Tennessee. In West Virginia, it is known to occur in rivers and streams within the counties of Fayette, Kanawha, and Wood (USFWS, 1991b) (USFWS, 2015s).

Suitable habitat for the fanshell consist of large rivers with sand and gravel and moderate current. For their reproductive cycle, these mussel require stable, undisturbed habitat and fish host to complete the mussel's larvae development. The current threats to the fanshell include dams and reservoirs, as both dams and reservoirs flood suitable habitat location reducing the abundance of sand and gravel along with the presence of host fish. Additionally, water quality degradation is another threat to the survival of the fanshell. Silt and pollution from dredging, agriculture, and industrial runoff have become a major cause for the reduction of these mussels (USFWS, 1997c).

Flat-spired Three-toothed Snail. The threatened flat-spired three-toothed snail has a brown flat-spired shell that can grow to approximately one inch in diameter. The snail's body is dark gray, however, it only has one tooth unlike the name implies (WVDNR, 2009a). The flat-spired three-toothed snail was listed as threatened in 1978 (43 FR 28932 28935, July 3, 1978). This species has a very restricted range and is known to occur only in West Virginia in the Cheat River Gorge area of Monongalia and Preston counties (USFWS, 2005b) (USFWS, 2015t).

Suitable habitat for the flat-spired three-toothed snail include upper outcroppings, sandstone, and large boulders. Most snail tend to occur in the cervices, cracks, or cave-like area in between rocks. The diet for this species consist of organic material such as fungi, flower blossom, and leaves. They feed on leaves and empty snail shells to consume calcium to strengthen their own shell. Not much is known about their reproductive cycle but it is known that they tend to lay eggs in the spring and summer. Current threats to the survival of this species include human disturbances such as recreational activity and development. Due to its very restricted range, the direct crushing of these snails from human disturbances have become a major factor in its survival (WVDNR, 2009a).

James Spinymussel. The endangered James spinymussel is a small freshwater mussel with a yellowish to dark brown shell that grows approximately three inches in length and have one to three short spines. The James spinymussel was listed as endangered in 1988 (53 FR 27689 27693, July 22, 1988). It is regionally known to occur in North Carolina, Virginia, and West Virginia. In West Virginia, it is known to occur in Monroe County along South Fork Potts Creek (USFWS, 1990) (USFWS, 2015u).

Suitable habitat for the James spinymussel consist of sand and gravel bottoms of unpolluted free-flowing streams with a variety of slow to moderate flow regimes. This species feeds on plankton and reproduces sexually with the assistance of seven different fish host. Current threats to this species include loss and depletion of suitable habitat. Degradation of water quality from siltation, impoundment, pollution, and sewage discharge causes these mussel to be more vulnerable to competition. Additionally, the increased invasion of the non-native Asiatic clam (*Corbicula fluminea*) is causing a major threat to the survival of the James spinymussel (USFWS, 1990).

Madison Cave Isopod. The Madison Cave isopod is a freshwater eyeless and unpigmented bug that grows approximately 0.7 inches and is the only species of its genus. It has a flatten body with two pair of antennas, one short and one long pair. The Madison Cave isopod was listed as threatened in 1982 (47 FR 43699 43701, October 4, 1982). It is regionally known to exist in the Great Valley of Virginia and West Virginia (USFWS, 2010b) (USFWS, 2015v). In West Virginia, there have been two site occurrences, one in a cave that intersects with groundwater and another in a well (WVDNR, 2005b).

Suitable habitat for the Madison Cave isopod include calcite saturated waters in karst aquifers such as flooded limestone caves. Little is known about the life history and diet of this species, but studies suggest that the reproduction rate is low for the Madison Cave isopod and most of the occurring population consist of adult isopods. Additionally, no information on the feeding habitats are known but it is believed these isopods are carnivorous and feed on fine particles. The major threat to the survival of this species is the contamination of groundwater from agriculture and urban runoff (USFWS, 2010b) (WVDNR, 2005b).

Northern Riffleshell. The endangered northern riffleshell is a small brownish yellow to yellowish green freshwater mussel that can grow up to three inches long. It was federally listed as endangered in 1993 throughout its range (58 FR 5638 5642, January 22, 1993). It is regionally known to occur in Indian, Kentucky, Michigan, Ohio, Pennsylvania, and West Virginia (USFWS, 1997d) (USFWS, 2015w). In West Virginia, it is known to occur only in streams within Kanawha County. However, efforts to collect population of this species from the Allegheny River and placing them in other river with suitable habitats are being made to aid in recovering populations in West Virginia (USFWS, 2015x).

The preferred habitat for this species is clean, firmly packed, coarse sand and gravel in riffles and streams. For its reproduction lifecycle it requires a stable, undisturbed habitat, and a sufficient source of host fish. The current threats to the survival of the northern riffleshell include dams and reservoirs as they reduce sand and gravel in habitats, as well as, affects the distribution of host fish. The non-native zebra mussels has also become a major threat as they are spreading rapidly and killing the northern riffleshell (USFWS, 1997d).

Tubercled-Blossom (Pearlymussel). The endangered tubercled-blossom mussel is a small to medium size mussel reaching lengths of about three inches. It has a yellowish to brown thick shell (INHS, 2015). The tubercled-blossom mussel was first listed as endangered in 1976 (41 FR 24062 24067, June, 14, 1976) and non-essential experimental population were established for Alabama, Illinois, Kentucky, and West Virginia in 2001 (66 FR 32250 32264, June 14, 2001). In West Virginia, it is believed to occur in the county of Fayette (USFWS, 2015y). The last documented individual was found dead below Kanawha Falls in West Virginia in 1969 (USFWS, 2015z). A non-essential experimental population has been established in the Tennessee River from Wilson Dam downstream to the Pickwick Reservoir (USFWS, 2015y).

Suitable habitats for the tubercled-blossom mussel consist of gravel shoals and shallow sand of large rivers with rapid currents. It is believed that deforestation and the progression of intense agriculture caused the decline of these species (USFWS, 2015z).

Plants

Four endangered and two threatened plants are federally listed for West Virginia as summarized in Table 16.1.6-8. The harperella (*Ptilimnium nodosum*) and northeastern bulrush (*Scirpus ancistrochaetus*) are found in the eastern regions of the state, while the running buffalo clover (*Trifolium stoloniferum*), small whorled pogonia (*Isotria medeoloides*), and Virginia spiraea (*Spiraea virginiana*) are found in central and western regions of the state and the shale barren rock cress (*Arabis serotina*) is found along the Appalachian Mountains. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in West Virginia is provided below.

Table 16.1.6-7: Federally Listed Plant Species of West Virginia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Harperella	*Ptilimnium nodosum*	E	No	Shallow ponds and streambeds; found in Berkeley and Morgan counties.
Northeastern Bulrush	*Scirpus ancistrochaetus*	E	No	Wetlands and vernal ponds[118]; found in Berkeley and Hardy counties
Running Buffalo Clover	*Trifolium stoloniferum*	E	No	Open forest and prairie, within a partial shade woodlot environment and along streams and trails;
Shale Barren Rock Cress	*Arabis serotina*	E	No	Shale barrens with open, scrubby vegetation and pine, oak, and other woodland species; found along the Appalachian Mountains.
Small Whorled Pogonia	*Isotria medeoloides*	T	No	Woodland or forested habitats; found in Greenbrier County

[118] Vernal pools: "Seasonal depressional wetlands." (USEPA, 2015a)

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Virginia Spiraea	*Spiraea virginiana*	T	No	Rocky and often flood scoured banks of high velocity streams and rivers; found along the Gauley, Meadow, Bluestone, and Greenbrier rivers.

Source: (USFWS, 2015e)

[a] E = Endangered, T = Threatened

Harperella. The endangered harperella (*Ptilimnium nodosum*), or pond harperella, is a perennial[119] 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, 2015ac). 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, 2015aa). Within West Virginia, harperella is known or believed to exist in Berkeley and Morgan counties, located in the central to western regions of the state (USFWS, 2015ab).

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, 2015ac).

Northeastern Bulrush. The endangered 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[120] family, that is very similar to other bulrushes, but its flowers and seeds are structurally different. This species was federally listed as endangered in 1991 (56 FR 21091 21096, May 5, 1991). The northeastern bulrush is known to occur from Quebec south to West Virginia (USFWS, 2010c). It is known to occur in Berkeley and Hardy counties (USFWS, 2015ad).

The northeastern bulrush occurs in palustrine wetlands[121] and vernal ponds with seasonally fluctuating water levels. The current threats to the northeastern bulrush include alterations to the surrounding hydrology[122], either by drier or wetter conditions (USFWS, 2006b) (USFWS, 2010c).

Running Buffalo Clover. The endangered running buffalo clover is a perennial species reappearing at the same site each year. The plant has stolons, or runners, run along the surface of the ground and expand the plants rooting area. Running buffalo clover is a white clover species,

[119] Perennial: "Plants that live for more than two growing seasons. Perennial plants either die back after each season (herbaceous plants) or grow continuously (shrubs)." (USEPA, 2015a)
[120] Sedge: "Plants of the family Cyperacae that resemble grasses, but have solid stems." (USFWS, 2015ad)
[121] Palustrine wetlands: "Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens." (USEPA, 2015a)
[122] Hydrology: "Hydrology is the science that deals with the properties, movement, and effects of water found on the earth's surface, in the soil and rocks beneath the surface, and in the atmosphere." (USEPA, 2015a)

with leaves divided into three leaflets, that lack arrow shaped water marks and can appear more robust than similar species (USFWS, 2015ae). The plant was first listed as endangered in 1987 (52 FR 21478 21481, June 5, 1987). The species was once thought to be extinct but has since been rediscovered in the New River Gorge of West Virginia in 1983. Since then other sites have been found Ohio, Kentucky, Indiana, and Missouri. The species has been documented at 35 sites throughout Barbour, Brooke, Fayette, Pendleton, Pocahontas, Randolph and Tucker counties, West Virginia (WVDNR, 2015h).

Suitable habitat for running buffalo clover is open forest and prairie, within a partial shade woodlot environment and along streams and trails (USFWS, 2015ae). The species has been documented growing in clumps along disturbed areas such as game trails, logging roads, cemeteries, Indian mounds, and skid trails. Although the species needs disturbance to survive, major disturbance from construction of roadways or similar infrastructure seem to be the most pressing threat to the clover's existence. These types of disturbance completely remove the clover's habitat compared to minor disturbances within the plants suitable habitat (WVDNR, 2015h).

Shale Barren Rock Cress. The endangered shale barren rock cress is a member of the mustard family and is a biennial plant with a flowering stem composed of 3 to 41 branches. Flowers are small with cream-white petals and yellowish-brown seeds. Mature plants reach up to 40 inches in height (USFWS, 2015af). The shale barren rock cress was listed as endangered in 1989 (54 FR 29655 29658, July 13, 1989). This species only occurs in restricted populations in the states of Virginia and West Virginia, in the mid-Appalachian shale barrens (USFWS, 2015af).

Suitable habitat is limited to the shale barrens with open, scrubby vegetation and pine, oak, and other woodland species (USFWS, 1991c). Shale barrens are also isolated islands of habitat with steep elevations and exposures with relatively sparse vegetation, high temperatures, and low moisture (USFWS, 2015af). Threats to the species include drought, herbivory by deer, and habitat degradation (USFWS, 1991c).

Small whorled pogonia
Photo Credit: USFWS

Small Whorled Pogonia. The threatened small whorled pogonia is a member of the orchid family which grows between 10 to 14 inches in height with greenish yellow flowers (USFWS, 2008). The small whorled pogonia was federally listed as endangered in 1982 (47 FR 39827 39831, September 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852 50857, October 6, 1994). Regionally this species is known to occur in sparse distributions from Maine south to Georgia and eastern to Illinois (USFWS, 2015ag). In West Virginia, there are only two recorded populations of less than three plants each in Greenbrier County (USFWS, 2015ah) (WVDNR, 2015i).

The small whorled pogonia occurs in hardwood stands that include beech, birch, maple, oak, hemlock, and hickory that have an open understory, preferring acidic soils along small streams that have a thick layer of litter (USFWS, 2008). One distinct feature of this species is that it can remain dormant underground for multiple years before reappearing (USFWS, 1992). Current threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2008).

Virginia Spiraea. The threatened Virginia spiraea is a perennial shrub species with many branches. The shrub ranges in height from three to seven feet tall with elliptic leaves two to three inches long. The shrub's white flowers appear in June and July at the ends of branches (WVDNR, 2015j). The Virginia spiraea was first listed as threatened by endangered species legislation in 1990 (55 FR 24241 24247, June 15, 1990). Regionally the species occurs along 24 stream systems in Georgia, Tennessee, North Carolina, Kentucky, West Virginia, Virginia, and Ohio (USFWS, 2015ai). West Virginia has the largest population of any state with an estimated 1,000 to 4,000 individuals occurring along the Gauley, Meadow, Bluestone, and Greenbrier rivers (WVDNR, 2015j).

The Virginia spiraea inhabits rocky often flood scoured banks of high velocity streams and rivers. It is believed that scour is important to the species as it discourages tree growth and prevents canopy closure. Flood frequency and intensity have a large influence on development of suitable habitat for the species. Major threats to the species include dam and reservoir construction that remove or eliminate the species habitat altogether. Damage to the plants from people using the river for recreation is another common threat. Physical damage to the plant stems from hikers, anglers, boaters, and rafters has been observed at many documented sites of Virginia spiraea. This activity is often a result of an attempt to clear the riverbank for fishing or camping sites (USFWS, 2015ai) (WVDNR, 2015j).

16.1.7. Land Use, Recreation, and Airspace

16.1.7.1. Definition of the Resources

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

Land Use and Recreation

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

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. Federal, state, county, or local governments typically manage recreational resources.

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

The FAA Air Traffic Services Unit 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 and Aeronautical Centers, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015b). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

16.1.7.2. Specific Regulatory Considerations

Land use planning in West Virginia is the primary responsibility of local governments (i.e., county, city, and town). The main planning tools for local governments include the comprehensive plan, zoning ordinance, and subdivision and land development ordinance. The West Virginia Code 8a, Land Use Planning sets forth the authority for each of these tools. The comprehensive plan proposes land uses and locations of public facilities and utilities and projects long-term population growth. The zoning ordinance sets forth the rules used to govern the land by dividing localities into zoning districts and establishes allowable uses within the districts (e.g., agriculture, industry, commercial use). The subdivision and land development ordinance manages the process for dividing large land parcels into smaller lots (West Virginia Legislature, 2015b).

16.1.7.3. Land Use and Ownership

For the purposes of this analysis, land use in West Virginia has been classified into three primary land use groups: forest and woodlands[123], agricultural[124], and developed[125]. Land ownership within West Virginia has been classified into four main categories: private, federal, and state.

Land Use

Forest and woodlands comprise the largest portion of land use, with 82 percent of the land area in West Virginia occupied by this category. Agriculture is the second largest area of land use, with nine percent of the total land area. Developed areas and surface water account for approximately eight percent and one percent, respectively, of the total land area in West Virginia (Table 16.1.7-1 and Figure 16.1.7-1) (USGS, 2012a).

Table 16.1.7-1: West Virginia Land Use

Land Use	Square Miles	Percent of Land
Forest and Woodland	19,965	82%
Agricultural Land	2,183	9%
Developed Land	1,877	8%
Surface Water	234	1%

Source: (USGS, 2012a)

Forest and Woodland

West Virginia is located within the Appalachian Mountain Range and is largely dominated by forests and woodlands. This abundance of forested areas has enabled West Virginia to create a thriving forest industry that operates in every county of the State. Forest products produced in West Virginia include timber, furniture, and wood pallets (USGS, 2012a). Individuals, private companies, and corporations privately own most forest and woodland areas (approximately 87 percent) throughout West Virginia. Approximately 13 percent of forest and woodland areas are publicly owned by federal and state agencies (West Virginia Division of Forestry, 2010). Section 16.1.6, Biological Resources, presents additional information about terrestrial vegetation.

[123] 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, 2012a)
[124] 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, 2012a)
[125] Developed: Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g., asphalt, concrete, buildings). (USGS, 2012a)

National Forests

The National Forests located in West Virginia include the Monongahela National Forest and portions of the George Washington and Jefferson National Forests. These National Forests stretch along the Appalachian Mountains, covering 1,655 square miles in West Virginia. The forests are comprised of Appalachian hardwood and mixed pine-hardwood forest types, and are managed for multiple uses, including recreation activities (e.g., camping, hiking) and timber production. The wide range of elevation within the Monongahela National Forest results in a high level of biological diversity, providing habitat to 225 bird species, 75 tree species, eight threatened and endangered species, 12 species of game fish, and 60 species of non-game fish. (USFS, 2015b)

State Forests

The West Virginia Division of Forestry manages seven state forests throughout the State, totaling 93.6 square miles. These forests are managed for multiple-use purposes, including developed and undeveloped outdoor recreation (e.g., hiking, wildlife viewing), timber production, fish and wildlife habitat, hunting and fishing, aesthetic preservation, and forest research/educational purposes. Table 16.1.7-2 presents the names and associated square miles for each of the seven state forests (West Virginia Division of Forestry, 2015).

Table 16.1.7-2: West Virginia State Forests

State Forest	Square Miles
Cabwaylingo State Forest	9.7
Calvin Price State Forest	14.7
Camp Creek State Forest	8.2
Coopers Rock State Forest	19.9
Greenbrier State Forest	8.0
Kumbrabow State Forest	14.8
Seneca State Forest	18.3

Source: (West Virginia Division of Forestry, 2015)

Private Forest and Woodland

Approximately 17,369 square miles, or 87 percent of West Virginia's total forestland, is owned by private landowners, private companies, and corporations (West Virginia Division of Forestry, 2015). Private forestlands indirectly provide some public benefit, including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities. Scattered throughout the State, forests and woodlands on private lands often border agricultural fields, suburban neighborhoods, and state forests (West Virginia Division of Forestry, 2015). For additional information regarding forest and woodland areas, see Section 16.1.6, Biological Resources, and Section 16.1.8, Visual Resources.

Agricultural Land

Agricultural land exists throughout the state on 2,183 square miles or 9 percent of the total land area (Figure 16.1.7-1) (USGS, 2012a). Approximately 21,490 farms exist in West Virginia, of which 98 percent are considered small farms. West Virginia's top agricultural commodities are livestock (e.g., poultry, beef, dairy products, sheep, hogs) and crops (e.g., hay, peaches, apples, soybeans, tobacco). West Virginia's top five agricultural products are broilers (37 percent of total agricultural receipts), cattle and calves (21 percent of total agricultural receipts), chicken eggs, dairy products, and turkeys (USDA, 2012).

Developed Land

Developed land in West Virginia is concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 16.1.7-1). Although only eight percent of West Virginia land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 16.1.7-3 lists the top five developed areas within the State and their associated population estimates.

Table 16.1.7-3: Top Five Developed Areas in West Virginia

City	Population Estimate
Charleston	51,404
Huntington	48,807
Parkersburg	30,981
Morgantown	31,073
Wheeling	27,790
Total Population	190,055
Total State Population	1,850,326

Source: (Census Bureau, 2014)

Land Ownership

Land ownership within West Virginia is classified into four main categories: private, federal, state, and tribal land (Figure 16.1.7-2).

Private Land

The majority of land in West Virginia is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed land (Figure 16.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, forest, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[126]

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

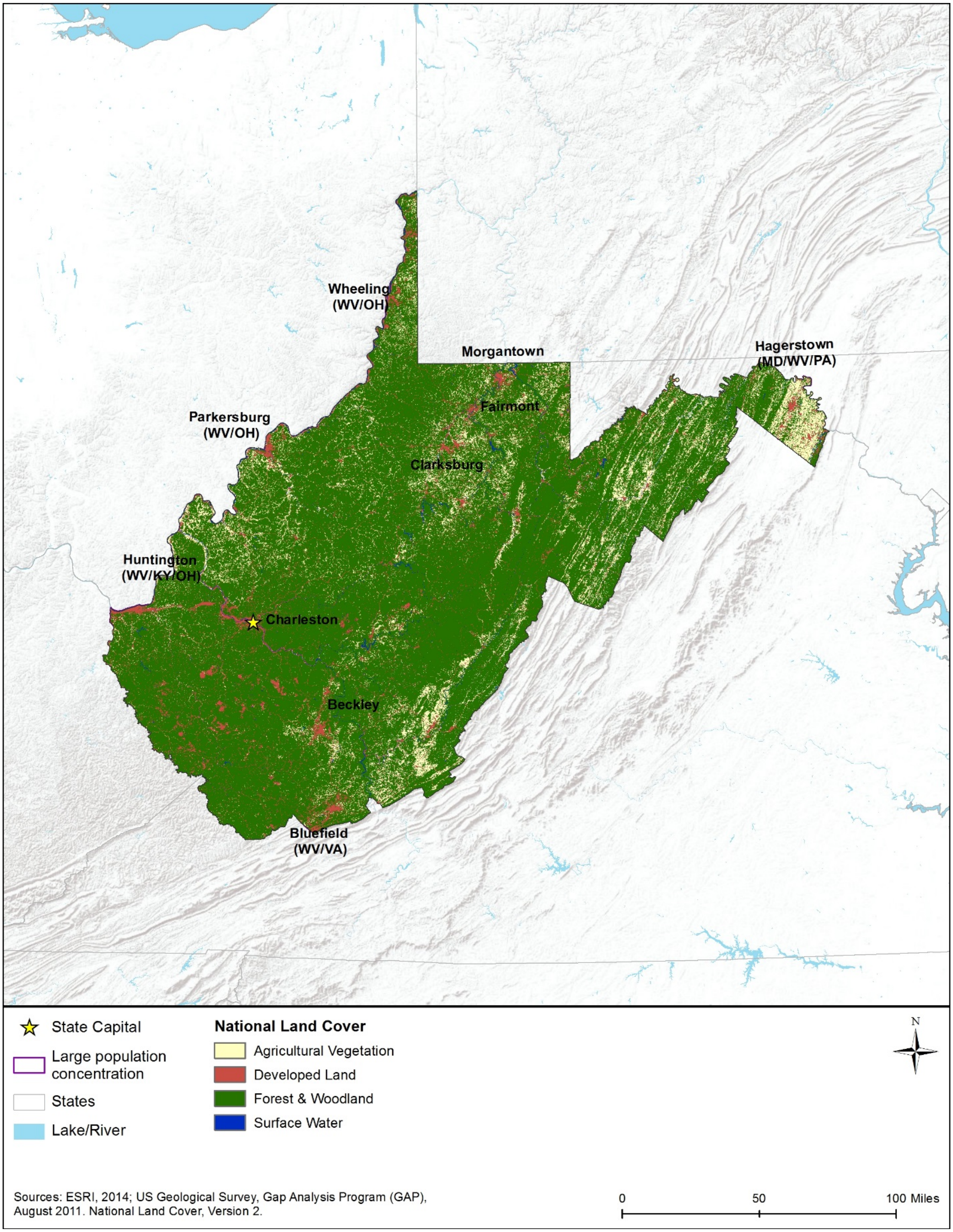

Figure 16.1.7-1: Land Use Distribution

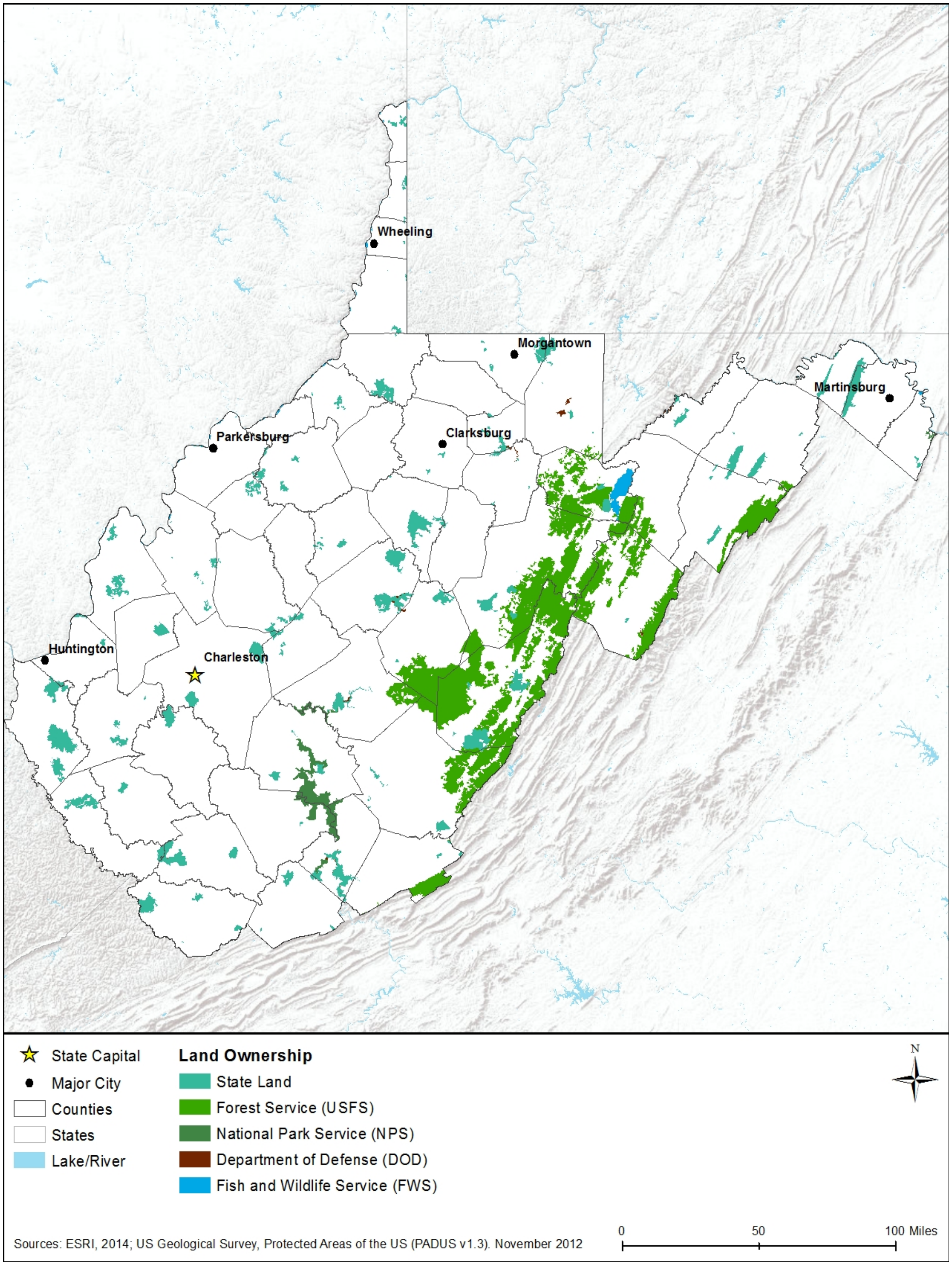

Figure 16.1.7-2: Land Ownership Distribution

Federal Land

The federal government manages 1,897.3 square miles (approximately eight percent) of land in West Virginia, including national parks, national wildlife refuges, and national forests (Figure 16.1.7-2) (USGS, 2014f). Four federal agencies manage federal lands throughout the State (Table 16.1.7-4).

Table 16.1.7-4: Federal Land in West Virginia

Agency	Square Miles	Representative Type
USACE	57.7	Lakes (and associated trails)
USFWS	47.2	Wildlife Refuge
U.S. Forest Service (USFS)	1,655.0	National Forests
National Park Service (NPS)	137.4	Parks, Rivers, Recreation Area, Trails, Landmarks, and Heritage Areas

Sources: (USGS, 2014f)

The following is a brief description of federal land ownership in West Virginia:

- The USACE manages 57.7 square miles of lakes in the State for recreation purposes, some of which have perimeter trails (USGS, 2014f).
- The USFWS owns and manages the Canaan Valley National Wildlife Refuge (47.2 square miles), located adjacent to the northern portion of the Monongahela National Forest (USGS, 2014f).
- The USFS owns and manages 1,655 square miles of land comprised of the Monongahela National Forest and portions of the George Washington and Jefferson National Forests (USGS, 2014f).
- The NPS manages 137.3 square miles of land comprised of a National Scenic Trail, a National Scenic River, two National Recreation Areas, a National River, two National Historic Parks, 16 National Historic Landmarks (NHL), and two National Heritage Areas (NHA), (NPS, 2015b).
- The BLM manages the Hatfield-McCoy Trails, which is a trail system professionally designed for vehicles, hikers, bikers, and horseback riding.

State Land

The West Virginia State government manages 765 square miles of land comprised of state forests, state parks, and WMAs. The WVDNR and West Virginia Division of Forestry manage these areas:

- The WVDNR, Parks and Recreation manages 34 state parks, 5 WMAs, the Greenbrier River Trail, and the North Ben Rail Trail (WVDNR, 2015k).
- The WVDNR, Wildlife Resource Section manages 78 WMAs, totaling 2,188 square miles. These areas are managed to maintain healthy fish and wildlife habitat and provide a wide variety of recreation opportunities (WVDNR, 2015l).
- The West Virginia Division of Forestry manages seven State Forests, totaling 93.6 square miles. These forests are managed for multiple-use purposes, including developed and undeveloped outdoor recreation (e.g., hiking and wildlife viewing), timber production, fish and wildlife habitat, hunting and fishing, aesthetic preservation, and forest research/educational purposes (West Virginia Division of Forestry, 2015).

Tribal Land

Although many Native Americans live and own land in West Virginia, Native American tribal lands (e.g., reservations) do not exist in West Virginia (USGS, 2014f).

16.1.7.4. Recreation

West Virginia has a rugged terrain ranging from dense woodlands, forested foothills, caves, river valleys and gorges, and mountains as high as 4,863 feet. It is a state characterized by small cities, towns, and rural farmlands. On the community level, towns and cities provide an assortment of indoor and outdoor recreational facilities including theaters, museums, community and recreation centers, athletic fields, courts, and arenas, swimming pools, playgrounds, picnicking areas, theme/amusement parks, multi-use trails, ski areas, dog parks, and boat launches and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. There are 34 state parks and five WMAs managed by the WVDNR, Parks and Recreation (West Virginia State Parks, 2009a).

Rail transportation routes are well developed in this state, particularly to support the coal, lumber, and limestone industries. The Cass Scenic Railway and the Beckley and Pocahontas Exhibition Coal Mine tours are popular tourist sites relating to this history.

Federally, the NPS, USFS, USFWS, and the USACE manage areas in West Virginia with substantial recreational attributes.

This section discusses key recreational opportunities and activities representative of various regions of West Virginia. The state can be roughly categorized by three recreational regions, each of which are presented in the following sub-sections. For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 16.1.8, Visual Resources; and for information on culturally/historically significant resources (e.g., National Historic Sites, NHLs, sites on the National Register of Historic Places (NRHP), and Natural Heritage Areas), see Section 16.1.11, Cultural Resources.

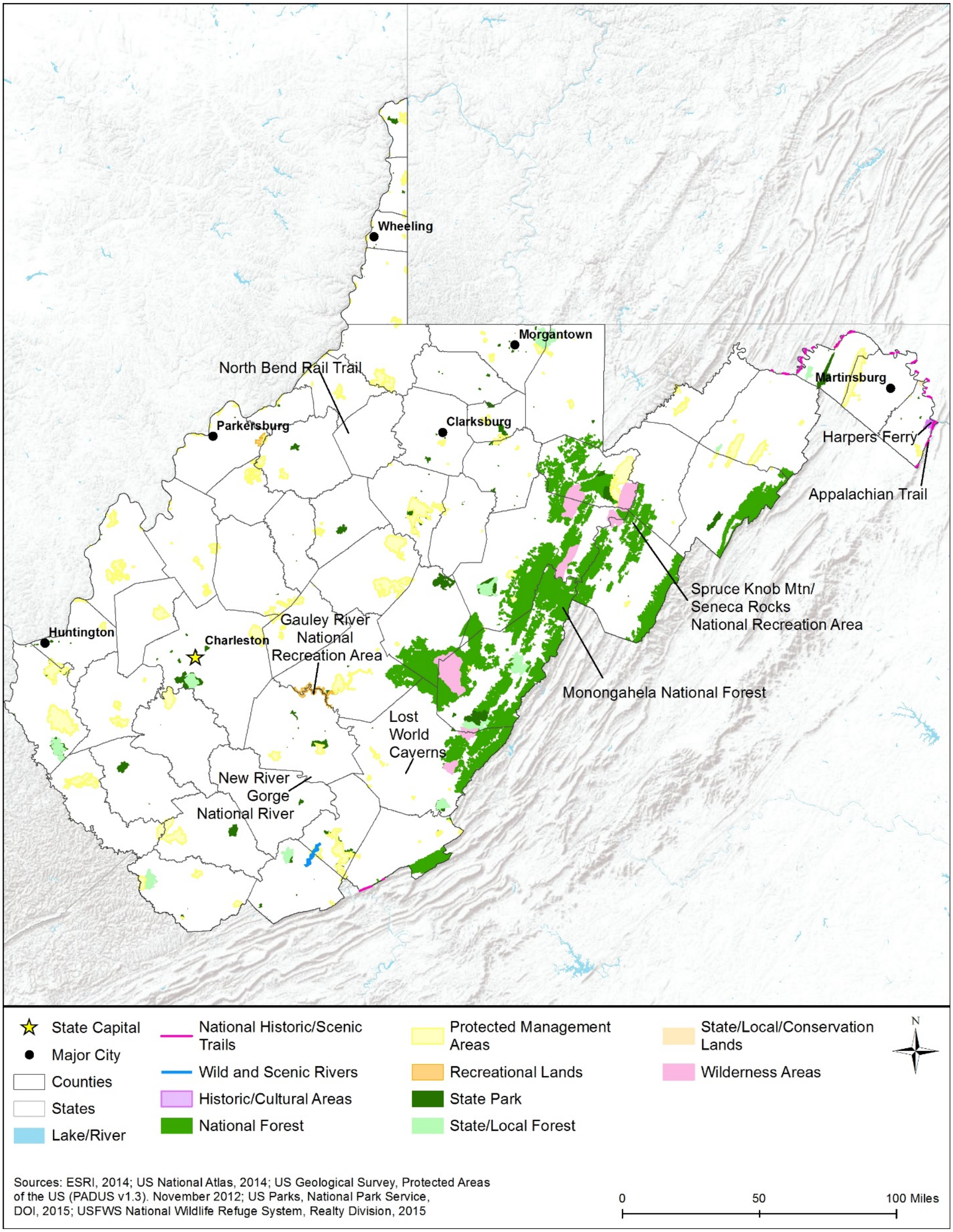

Figure 16.1.7-3: West Virginia Recreation Resources

Western Region

The Western Region is bordered by the Ohio River and Kentucky to the west and Pennsylvania to the north (Figure 16.1.7-1). This region has a variety of outdoor recreational opportunities as well as entertainment, sports, cultural, and historical venues provided by the largest cities Wheeling, Huntington, and Charleston. Oglebay Resort, Grand Vue Park, and several casinos are popular tourist destinations (West Virginia Division of Tourism, 2015a). The Ohio River Valley has a gentle landscape, with many small towns and farms. Wineries, arts and crafts studios, festivals and museums are prevalent (West Virginia Division of Tourism, 2015b).

The southern portion of this region contains the Hatfield-McCoy Mountains, where the eastern U.S.'s largest network of Off-Highway Vehicle trails have been developed (West Virginia Division of Tourism, 2015c). Eight separate trail systems provide a total of over 700 miles of maintained trails (Hatfield-McCoy Regional Trail Authority, 2012).

Central Region

The Central Region is known best for its lakes and rivers, especially the Gauley, New, Cheat and Tygart Rivers. Gauley River National Recreation Area has Class V+ rapids for challenging whitewater boating (Recreation.gov, 2014). The New River Gorge National River and its bridge is heavily visited for its scenic views, walks, watersports, and an annual parachute or wing suit jumping event (West Virginia Division of Tourism 2015d). A 10.5-mile section of the Bluestone River is classified as a National Scenic River (NPS, 2015c).

West Virginia's North Bend Rail Trail (a segment of the coast-to-coast American Discovery Trail) emphasizes railroad elements as it crosses 36 bridges and travels through 13 tunnels. The Caperton/Mon River/Decker's Creek Rail Trail is also heavily used in this area (Rails-to-Trails Conservancy, 2015).

Eastern Region

This region is bordered by Maryland to the north and Virginia's George Washington and Jefferson National Forests on the east (Figure 16.1.7-1). The Monongahela Nation Forest is the most dominant recreation feature and is heavily used annually by approximately1.3 million visitors (USFS, 2015c). Spruce Knob – Seneca Rocks National Recreation Area contains the highest peak in West Virginia and acclaimed rock climbing opportunities (USFS, 2015d). The “Via Ferrata” guided climbing center draws thousands of visitors wanting to try the sport and learn the basic skills (NROCKS Outdoor Adventures, 2015). Privately owned “Lost World Caverns” attracts many visitors wanting to explore one of the largest and most accessible limestone caves in the state (West Virginia Division of Tourism 2015e).

The Eastern Panhandle area in the northeast portion of this region contains the Ohio, Monongahela, Potomac River, and Chesapeake Bay watersheds. Civil War historical sites, including Harpers Ferry are also located here. The four miles of the Appalachian National Scenic Trail that pass through West Virginia, pass through here. Other popular attractions are Berkeley Springs and the Nature Conservancy's Ice Mountain Preserve/National Natural Landmark (The Nature Conservancy, 2015).

The Augusta Heritage Center in Elkins preserves and promotes the traditional local, regional, and ethnic crafts, music, dance, and folklore of West Virginia (Davis and Elkins College, 2015). The National Radio Astronomy Observatory's Green Bank single dish radio telescope is the world's largest of its kind. The site has a Science Center and tours (National Radio Astronomy Observatory , 2015).

The Cranberry Glades Botanical Area is the largest wilderness (50,000 acres) east of the Mississippi River, and is popular for hiking, backpacking, fishing, and cross-country skiing (West Virginia Division of Tourism 2015e).

16.1.7.5. 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 (FAA, 2015c).

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 16.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[127] service is based on the airspace classification." (FAA, 2008).

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

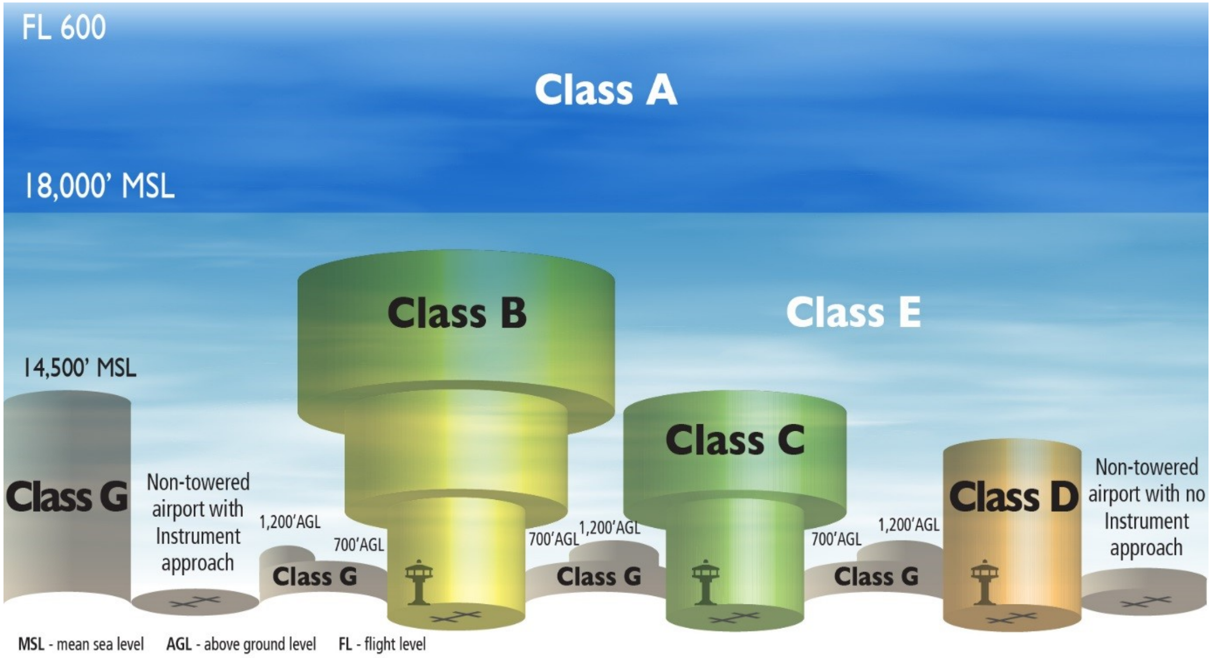

Figure 16.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[128]. Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[129]
- **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.

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

- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

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 16.1.7-5).

Table 16.1.7-5: 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."

SUA Type	Definition
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 SUA, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Source: (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 16.1.7-6, 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 16.1.7-6: 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 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.

Type	Definition
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, 2008) (FAA, 2015d)

16.1.7.6. 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 because 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 constructioNAlteration of a facility that may impinge upon the NAS. Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

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

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.

West Virginia Airspace

The West Virginia Aeronautics Commission (WVAC) is an agency of the WVDOT responsible for maintaining an air transportation system that will continue to meet current needs and future demands. The WVAC "fosters and assists in the development of aeronautics in West Virginia and encourages the establishment of airports and air navigation facilities" (WVDOT, 2015b). There is one FAA FSDO for West Virginia located in Charleston (FAA, 2015b).

West Virginia airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the State's airport system, as well as addressing key issues associated with their airports (NASAO, 2015). Figure 16.1.7-5 presents the different aviation airports/facilities located in West Virginia, while Figure 16.1.7-6 and Figure 16.1.7-7 present the breakout by public and private airports. There are approximately 126 airports (public and private) within West Virginia as presented in Table 16.1.7-7 and Figure 16.1.7-6 and Figure 16.1.7-7 (USDOT, 2015h).

Table 16.1.7-7: Type and Number of West Virginia Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	36	39
Heliport	0	40
Seaplane	0	10
Ultralight	0	1
Balloonport	0	0
Gliderport	0	0
Total	36	90

Source: (USDOT, 2015h)

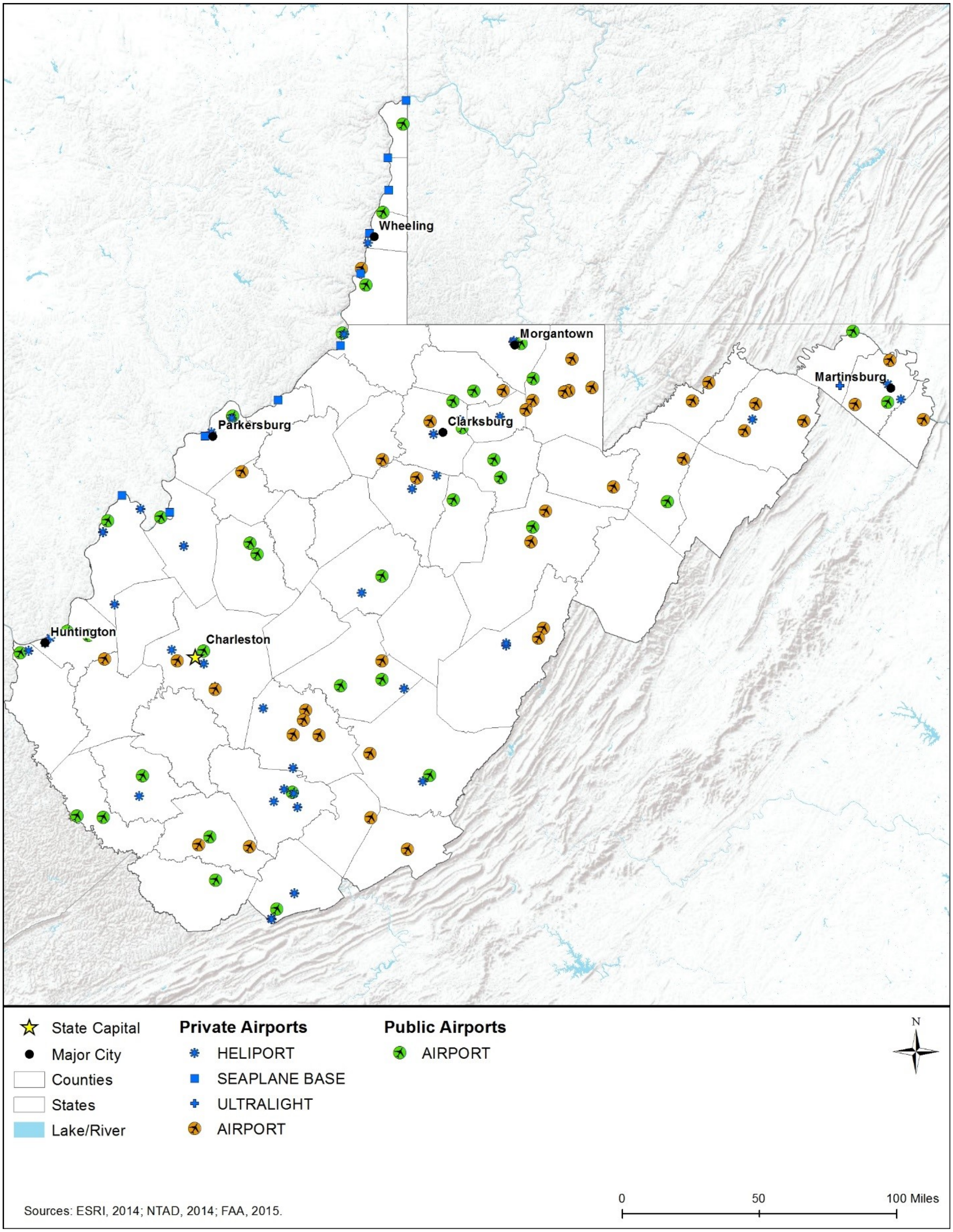

Figure 16.1.7-5: Composite of West Virginia Airports/Facilities

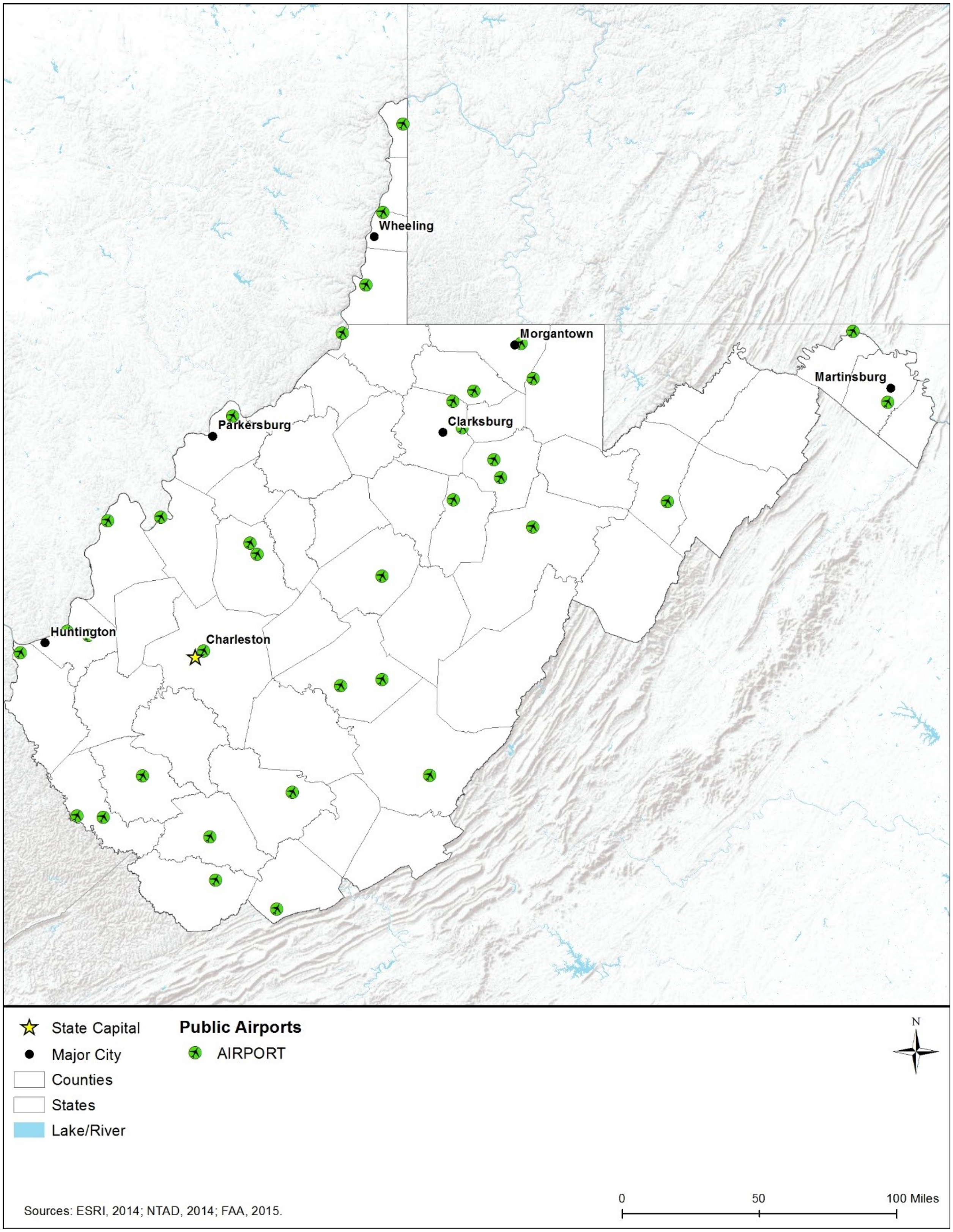

Figure 16.1.7-6: Public West Virginia Airports/Facilities

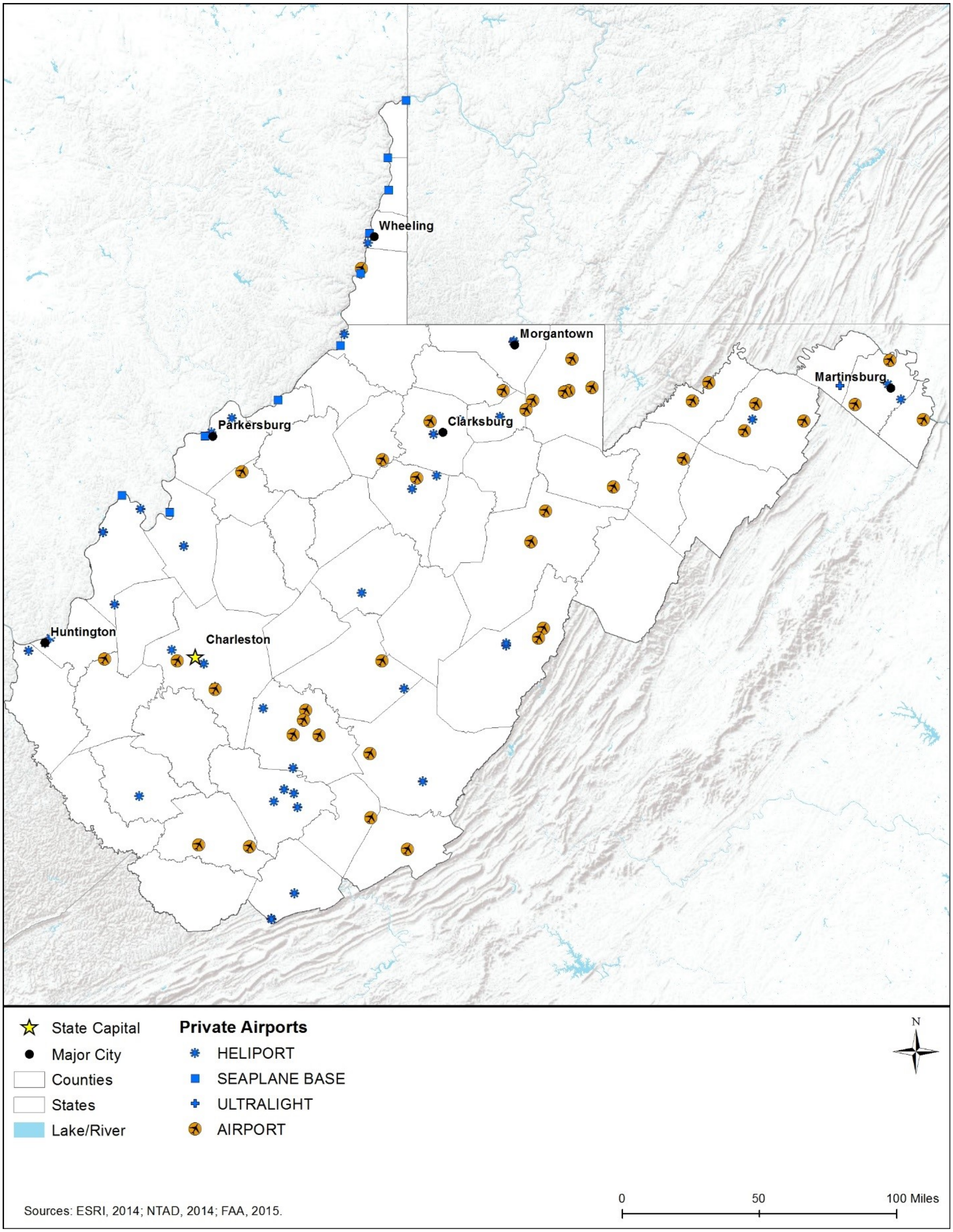

Figure 16.1.7-7: Private West Virginia Airports/Facilities

There are Class C, D, and E controlled airports for West Virginia as follows:

- One Class C –
  - Charleston Yeager
- Seven Class D –
  - Benedum, Clarksburg
  - Tri-State/Milton J. Ferguson Field (HTS), Huntington
  - Greenbrier Valley Airport, Lewisburg
  - Eastern West Virginia Regional/Shepherd Field, Martinsburg
  - Morgantown Municipal-Walter L. Bill Hart Field
  - Wood County Airport-Gill Robb Wilson Field, Parkersburg
  - Wheeling-Ohio County
- Six Class E –
  - Raleigh County Memorial
  - Mercer County, Bluefield
  - Elkins-Randolph County-Jennings Randolph Field, Elkins
  - Eastern West Virginia Regional/Shepherd Field, Martinsburg
  - Morgantown Municipal-Walter L. Bill Hart Field
  - Wood County Airport-Gill Robb Wilson Field, Parkersburg (FAA, 2014b).

There is one SUA located in West Virginia as follows:

- MOA Evers – 1,000 feet Above Ground Level (AGL) up to, but not including, FL 180 (FAA, 2015f).

There is one TFR [32126 (3)] in Virginia that extends into the eastern panhandle of West Virginia. When active, the airspace restrictions associated with this TFR may impact the airspace in the Martinsburg and panhandle areas (FAA, 2015g).

Figure 16.1.7-8 presents the SUAs in West Virginia. MTRs in West Virginia, presented in Figure 16.1.7-9, consist of ten Visual Routes, twelve Instrument Routes, and eleven Slow Routes.

UAS Considerations

The NPS signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating UA on lands or waters administered by the National Park Service” (NPS, 2014a). There are six National Park units within West Virginia that have to comply with this agency directive (NPS, 2015b).

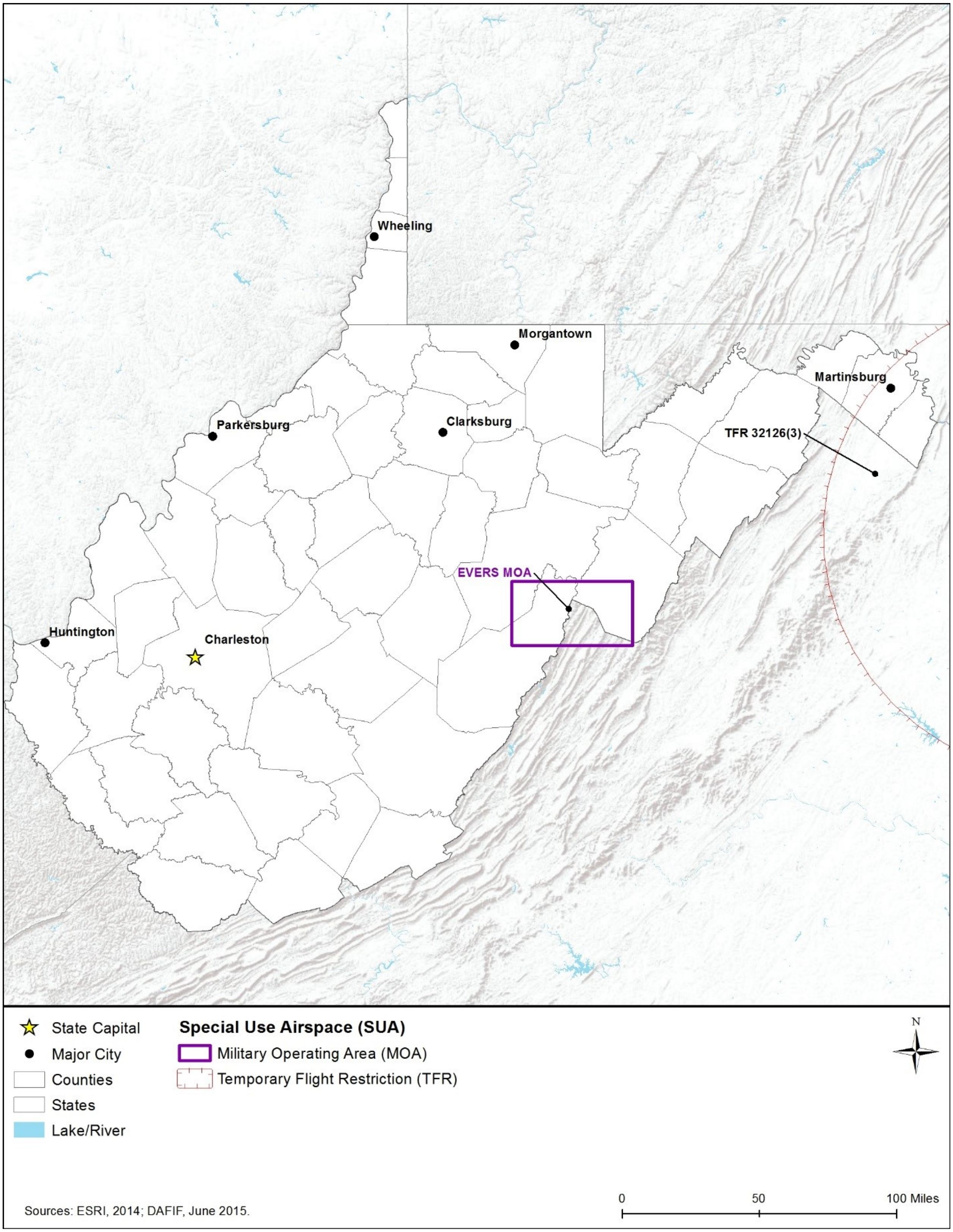

Figure 16.1.7-8: SUAs in West Virginia

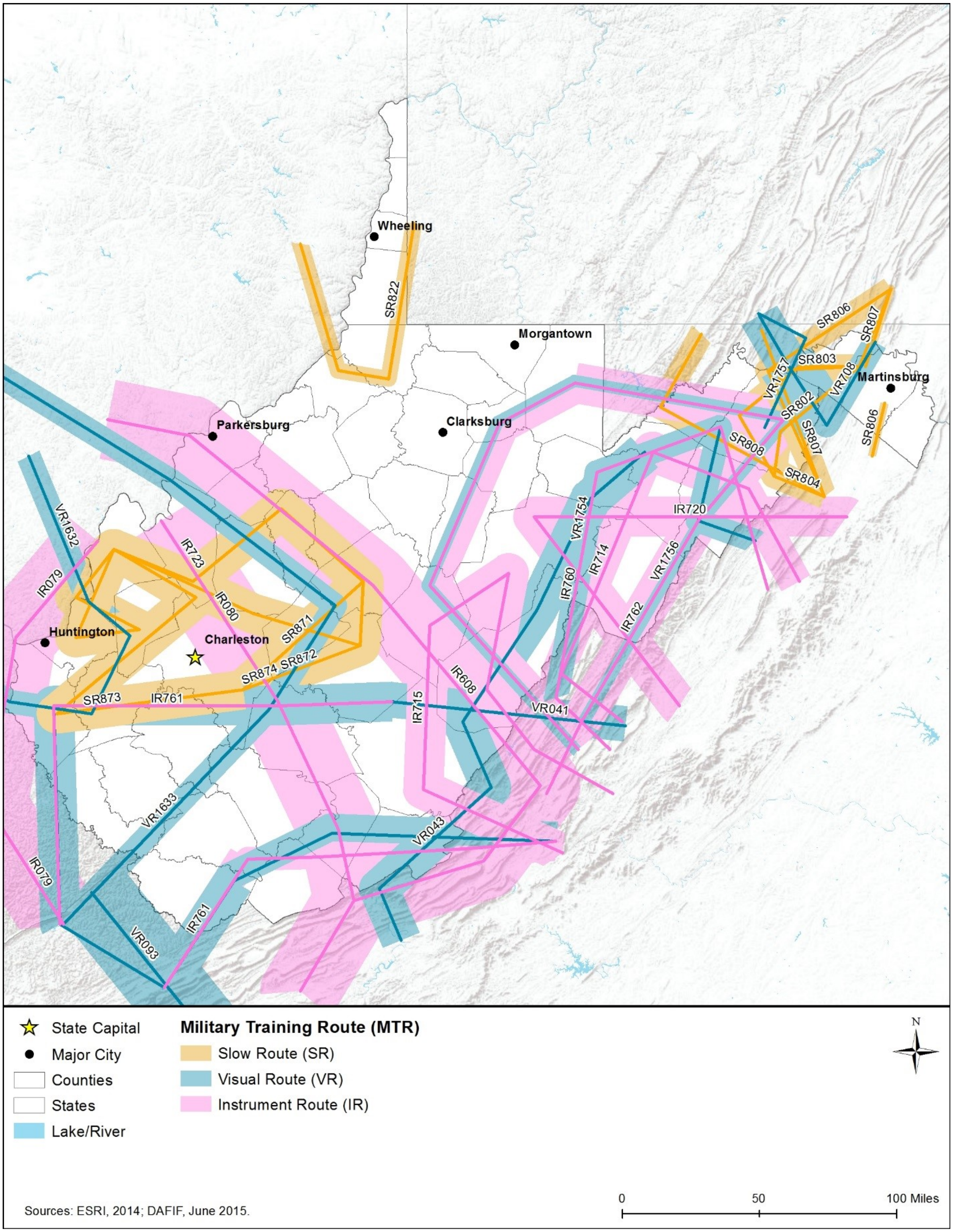

Figure 16.1.7-9: MTRs in West Virginia

16.1.8. Visual Resources

16.1.8.1. Definition of the Resource

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

16.1.8.2. Specific Regulatory Considerations

Table 16.1.8-1 presents state and local laws and regulations that relate to visual resources for West Virginia.

Table 16.1.8-1: Relevant West Virginia Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Code §29-1-8a	State Historic Preservation Office (SHPO)	Grants SHPO the authority to comment upon whether a cemetery is historic and eligible to be listed in the NRHP.
West Virginia Code Chapter 20	WVDNR	West Virginia’s natural resources laws are enforced by conservation officers in the Division of Natural Resources, who also enforce hunting, fishing, boating, and litter law violations. Conservation Officers also enforce laws related to environmental/solid waste, forestry, and state parks.

The West Virginia Wildlife Diversity Program and Natural Heritage Program in the WVDNR within the DOC are responsible for conserving threatened and endangered species, nongame wildlife, and their habitats. The Natural Heritage Program maintains a “statewide ecological inventory of rare plant and animal species, wetlands and other ecological communities” (WVDNR, 2003a).

16.1.8.3. Character and Visual Quality of the Existing Landscape

West Virginia is nicknamed “the Mountain State” because of the Blue Ridge Mountains along its eastern boundary and the Allegheny Mountains lying west of the Blue Ridge. The tallest peak in the state is Spruce Knob at 4,863 feet. While the state is mostly rugged with mountainous terrain, it also has vast river valleys with lower elevations near rivers such as the Ohio and Shenandoah Rivers. New River Gorge, which is a canyon 1,000 feet deep carved by the New River, is also found in the state. The Ohio River forms West Virginia’s western boundary (see the figures below).

Over three-quarters of West Virginia is forest and woodland, while agricultural vegetation and developed land are under 10 percent each (Homer, 2015). Forested areas generally have continuous, natural looking cover; gradual transitions of line and color; and lack any disturbance or disruption of the landscape. Agricultural areas generally have some abrupt lines and colors between crops and pastures, few tall structures (aside from grain silos and some trees), and no urban development. Scenic values may vary in developed areas, which include industrial, commercial, and residential areas, as well as roads and paved areas.

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 16.1.7 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.

16.1.8.4. 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 16.1.8-1 shows areas that are included in the NRHP that may be considered visually sensitive. In West Virginia, there are 1,029 NRHP listed sites, which includes two NHAs, 16 NHLs, and two National Historical Parks. Some state sites and parks may also be included in the NRHP, whereas others are not designated at this time.

Planning and management of cultural resources using The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes requires the NPS to protect all aspects of the historic landscape, such as forests, gardens, trails, structures, ponds, and farming areas (NPS, 2015d). 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, 2015d). Figure 16.1.8-1 shows areas that are included in the NRHP that may be considered visually sensitive.

National Heritage Areas

NHAs 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 West Virginia may contain scenic or aesthetic areas considered visual resources or visually sensitive. There are three NHAs in West Virginia: the National Coal Heritage Area, the Wheeling NHA, and Journey Through Hallowed Ground. The

National Coal Heritage Area highlights coalfield history and culture, while the Wheeling NHA "celebrates 19th century westward expansion and industrialization." The Journey Through Hallowed Ground NHA is a key landscape of the Civil War, and includes the homes and birthplaces of nine U.S. presidents. (NPS, 2015e)

National Historic Landmarks

NHLs 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, 2015f). 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 West Virginia, there are 16 NHLs as shown in Table 16.1.8-2 (NPS, 2015g).

Table 16.1.8-2: West Virginia National Historical Landmarks

National Historic Landmark Name	
Andrews Methodist Episcopal Church	Matewan Historic District
Baltimore and Ohio Railroad Martinsburg Shops	Old Main, Bethany College
Campbell Mansion	Reber Radio Telescope
Clover Site	Traveller's Rest
Davis and Elkins Historic District	Alexander Wade House
Elkins Coal and Coke Company Historic District	West Virginia Independence Hall
Grave Creek Mound	Weston Hospital
The Greenbrier	Wheeling Suspension Bridge

Source: (NPS, 2015g)

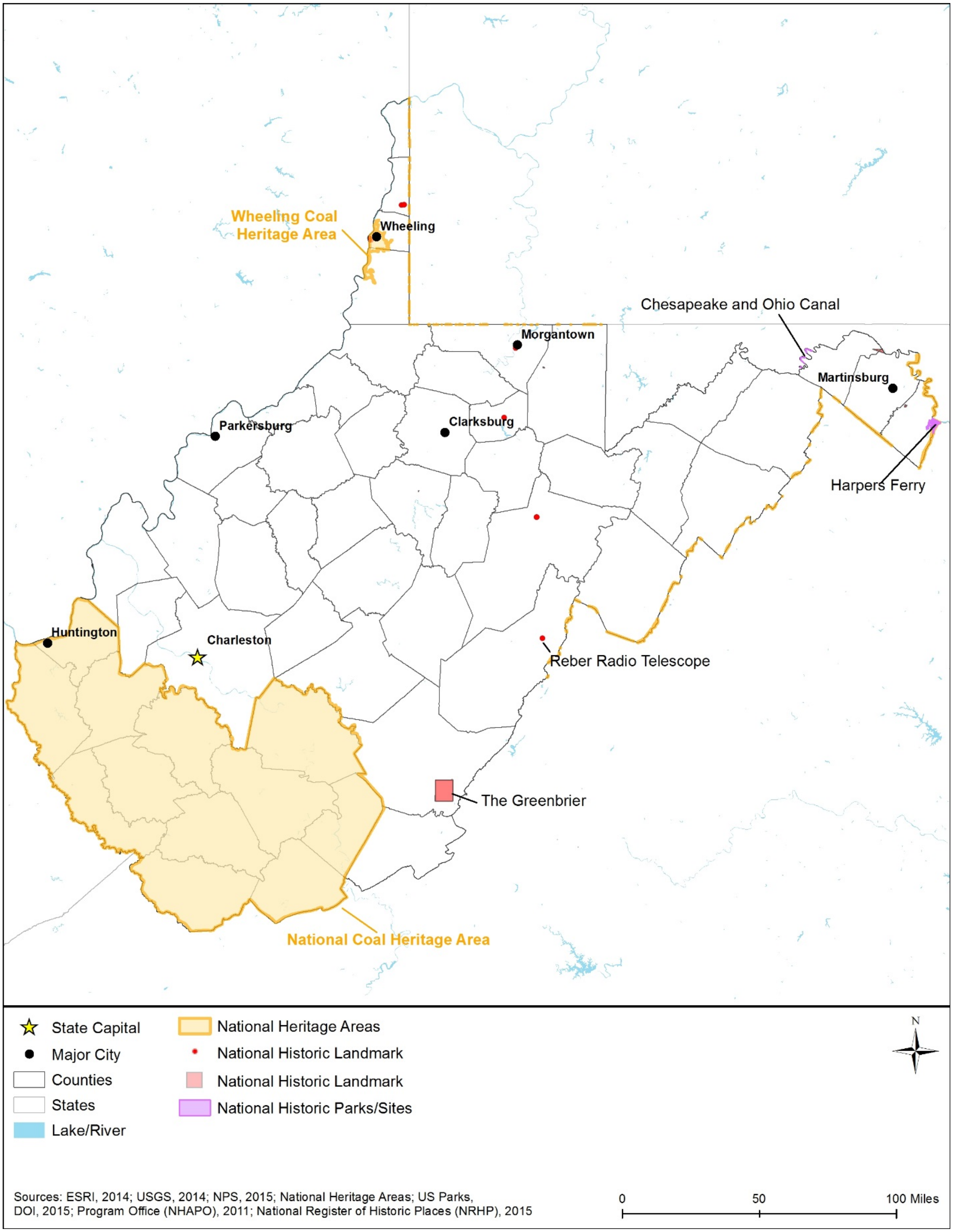

Figure 16.1.8-1: Cultural and Heritage Resources that May Be Visually Sensitive

State Historic Sites

West Virginia does not maintain a state-specific inventory of historic places.

16.1.8.5. Parks and Recreation Areas

Park and recreation areas include state parks, National Recreation Areas, 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. For additional information about park and recreation areas, including national and state parks, see Section 16.1.7, Land Use, Airspace, and Recreation.

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to West Virginia residents and visitors. There are 34 state parks throughout West Virginia, most of which likely contain scenic or aesthetic areas considered to be visual resources or visually sensitive. Table 16.1.8-3 contains a sampling of state parks and their associated visual attributes. For a complete list of West Virginia State Parks, visit http://www.wvstateparks.com/Parks_History.htm. (West Virginia State Parks, 2009a)

Table 16.1.8-3: Examples of West Virginia State Parks and Associated Visual Attributes

State Park	Visual Attributes
Cathedral State Park	Ancient hemlock trees, vascular flora, sloping hills
Cedar Creek State Park	Rolling hills, valleys, log cabin, school house and teacher memorial, ponds, trials
Holly River State Park	Dense forests, mountains, waterfalls, knob views
Tomlinson Run	Stream, forested hills, sandstone and shale cliffs, wildflowers, wildlife, ponds, lakes
Lost River State Park	Ridges, ancient pines, wildlife, mountain views, valley views

Source: (West Virginia State Parks, 2009b)

In addition to state parks, West Virginia also has eight state forests. These forests provide all manner of visual resources such as rock cliffs, gorges, boulders, cliffs, ridges, mountains, forest valleys, flora and fauna (West Virginia State Parks, 2009a). Seneca State Forest is one of West Virginia's oldest forests offering camping, fishing, hiking, and hunting (Seneca State Forest, 2014). Table 16.1.8-4 lists West Virginia's eight state forests (see Figure 16.1.8-2).

Table 16.1.8-4: West Virginia State Forests

State Forest Name	
Calvin Price State Forest	Greenbrier State Forest
Camp Creek State Forest	Kanawha State Forest
Coopers Rock State Forest	Kumbrabow State Forest
Cabwaylingo State Forest	Seneca State Forest

Source: (WVDNR, 2009b)

Figure 16.1.8-2: Seneca State Forest

Source: (Seneca State Forest, 2014)

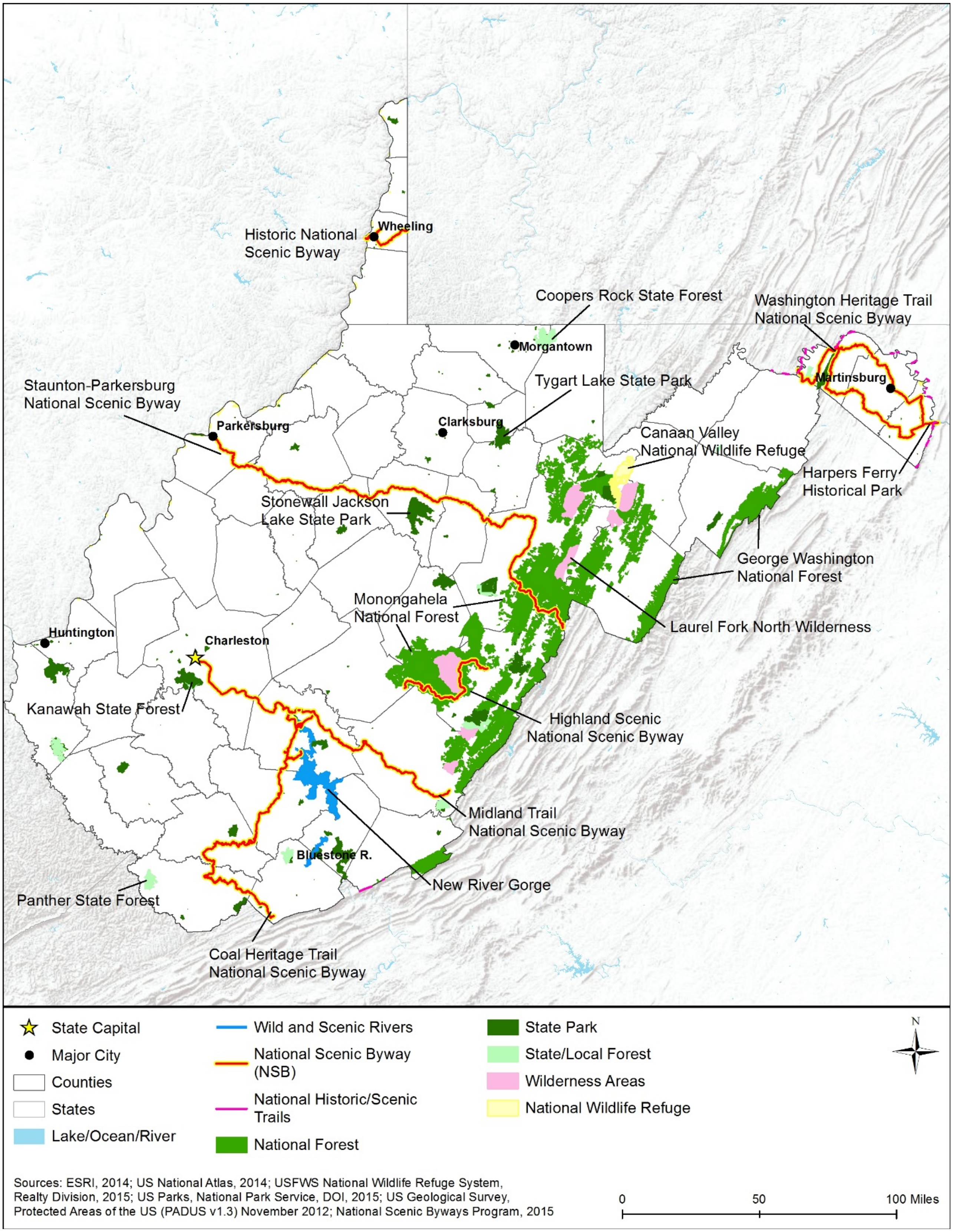

Figure 16.1.8-3: Natural Areas that May Be Visually Sensitive

U.S. National Park System and National Forests

The National Park System and U.S. Department of Agriculture (USDA) National Forests contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation. Owned by the U.S. government, these areas are maintained for the public's use. In West Virginia, there are two National Historical Parks, two National Recreation Areas, and one National Forest. Table 16.1.8-5 identifies the NPS and USDA units located in West Virginia and Figure 16.1.8-3 displays them on the map. The Chesapeake and Ohio Canal National Historical Park starts in Georgetown, D.C. traversing 184 miles through parts of West Virginia and along the Potomac River and ending in Cumberland, MD (NPS, 2015h). For additional information regarding parks and recreation areas, see Section 16.1.7, Land Use, Airspace, and Recreation.

Table 16.1.8-5: West Virginia NPS and USDA Forest Service Areas

NPS and USDA Forest Service Areas	
Chesapeake and Ohio Canal National Historic Park	Monongahela National Forest
Gauley River National Recreation Area	Spruce Knob-Seneca Rocks National Recreation Area
Harpers Ferry National Historical Park	

Source: (NPS, 2015b), (USDA, 2015c)

Figure 16.1.8-4: Chesapeake and Ohio Canal National Historic Park

Source: (NPS, 2015h)

State and Federal Trails

West Virginia boasts numerous trails for nature walking, hiking, biking and other recreation in the state forests and parks. These are designated for parks and recreation use, and there is no separate designation as scenic or historical, although all have aesthetic value and some may have historical value as well. The WVDNR Parks and Recreation maintains a list of trail information by park at http://www.wvstateparks.com/Hikes_Walks.html (West Virginia State Parks, 2009c).

Designated under Section 5 of the National Trails System Act (16 USC 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, 2012b). The only National Scenic Trail in West Virginia is the Appalachian NST administered by the NPS. The Appalachian NST is a 2,185-mile trail through the Appalachian Mountains traversing 14 states (NPS, 2015i).

In addition to National Scenic Trails, the National Trails System Act authorized the designation of National Recreational Trails near urban areas by either the Secretaries of the Interior or Agriculture, depending upon the ownership of the designated land (American Trails, 2015). In West Virginia, there are 12 National Recreation Trails administered by a variety of organizations including federal, state, local and non-profits. Non-profit organizations administer five trails: Canaan Valley Institute Trail System, Huntington Museum of Art System, Mon River, Caperton, Deckers Creek Trails, and the Ohio River Water Trail. The USFS manages the Whispering Spruce National Recreation Trail and the USACE administers the Weston and Gauley Bridge Turnpike. The Hatfield-McCoy Trails, which is a trail system professionally designed for vehicles, hikers, bikers, and horseback riding, weaves over 500 miles in southern West Virginia on private and corporate owned property (the BLM provides design advice and guidance, but does not own, manage, or administer the land). The McTrail, North Bend Rail Trail, Potomac River Water Trail, Ralph S. Larue/West Fork Trail, and Sunrise Carriage Trail all fall under the purview of local and state management (National Recreation Trails, 2015).

16.1.8.6. 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.

National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. This Act defined wilderness as land untouched by man and primarily affected only by the "forces of nature" and as that which "may also contain ecological, geological, or other features of scientific, education, scenic, or historical value." Over 106 million acres of federal public lands have been designated as wilderness areas. Twenty-five percent of these federal lands are in 47 national parks (44 million acres). These designated wilderness areas are managed by the USFS, BLM, USFWS, and NPS. (NPS, 2015j)

West Virginia is home to nine federally managed Wilderness Areas, totaling 132,615 acres, including Big Draft Wilderness, Cranberry Wilderness, Dolly Sods Wilderness, Laurel Fork South Wilderness, Laurel Fork North Wilderness, Mountain Lake Wilderness, Otter Creek Wilderness, Roaring Plains West Wilderness, and Spice Run Wilderness (NPS, 2015j). All of these Wilderness Areas are in the Monongahela National Forest, except for Mountain Lake (USFS, 2015a)

State Forest Preserves and Conservation Areas

The WVDNR manages its parks, forests, and WMAs "to promote conservation by preserving and protecting natural areas of unique or exceptional scenic, scientific, cultural, archaeological, or historical significance and to provide outdoor recreational opportunities for the citizens of this state and its visitors." (West Virginia State Parks, 2009a). The DNR divides the state lands by district and manages each using an approved management plan. These areas may be contained within national and state parks and WMAs and refuges listed in Section 16.1.7 (WVDNR, 2003b). For specific information related to each of the areas, see WVDNR's State Parks and Forests at http://www.wvstateparks.com/map.html (West Virginia State Parks, 2009b).

Rivers Designated as National 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. West Virginia has one designated National Scenic River, the Bluestone River. The designated 10 miles of the Bluestone River flow through an 800-foot gorge and provide whitewater rafting, fishing, and hiking opportunities (National Wild and Scenic Rivers System, 2015). The state does not classify its own separate wild, scenic or recreation rivers.

In addition, New River Gorge has a distinct designation as a National River, one of only four National Rivers in the country. The park covers "over 70,000 acres of land along the New River Gorge is rich in cultural and natural history, and offers an abundance of scenic and recreational opportunities" (NPS, 2015k).

Figure 16.1.8-5: Bluestone River

Source: (NPS, 2015k)

National Wildlife Refuges and State Wildlife Management Areas

National Wildlife Refuges (NWRs) are a network of lands and waters managed by the USFWS. These lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats." There are two NWRs in West Virginia: Canaan Valley National Wildlife Refuge and Ohio River Islands National Wildlife Refuge (see Figure 16.1.8-3) (USFWS, 2015aj). Canaan Valley NWR consists of 16,550 acres of "unique wetlands and uplands of [its] high elevation, moist valley" housing rare species of plants and animals (USFWS, 2014d). Ohio River Islands NWR is comprised of "[22] islands and four mainland tracts along 362 miles of the Upper Ohio River." Although most of the refuge lies in West Virginia, Pennsylvania and Kentucky also house two of the refuge islands each. The Ohio River NWR was established to conserve the "wild" Ohio River including the "wildlife and habitats native to the [river] and its floodplains" as it rests within one of the busiest inland waterways in the U.S. (USFWS, 2014e).

The WVDNR Parks and Recreation manages wildlife in 6 districts on 1.4M acres of land (8 percent of total state land) including specific WMAs for the conservation of "high quality habitats for a variety of wildlife species and to improve public access to these resources"

(WVDNR, 2015l). All five WMAs managed by the WVDNR Parks and Recreation are located in the southern part of the state (West Virginia State Parks, 2009b). For additional information on wildlife refuges and management areas, see Section 16.1.6, Biological Resources.

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 West Virginia, there are 15 NNLs (Table 16.1.8-5). Some of the visual resources located within these areas include an example of Pleistocene habitats (Canaan Valley, Figure 16.1.8-6), the largest cave system in the state (Oregon Cave System), a balsam fir swamp (Blister Swamp), and one of the "largest intermountain karst areas" in the nation (Germany Valley Karst Area) (NPS, 2012a).

Figure 16.1.8-6: Canaan Valley

Source: (NPS, 2012c)

Table 16.1.8-5: West Virginia National Natural Landmarks

NNL Name	
Big Run Bog	Germany Valley Karst Area
Blister Run Swamp	Greenville Saltpeter Cave
Canaan Valley	Ice Mountain
Cathedral Park	Lost World Caverns
Cranberry Glades Botanical Area	Organ Cave System
Cranesville Swamp Natural Sanctuary	Shavers Mountain Spruce Hemlock Stand
Fisher Spring Run Bog	Sinnett-Thorn Mountain Cave System
Gaudineer Scenic Area	

Source: (NPS, 2012a)

16.1.8.7. 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 DOT, FHWA, manages the National Scenic Byways Program (USDOT, 2015i). West Virginia has six designated National Scenic Byways: Coal Heritage Trail, Highland Scenic Highway, Historic National Road, Midland Trail, Staunton-Parkersburg Turnpike, and Washington Heritage Trail (see Section 16.1.7 Land Use, Airspace, and Recreation). The Historic National Road is also designated an All-American Road, which is one of the nation's most scenic byways with multiple inherent qualities (e.g., cultural, historic, scenic) (USDOT, 2012).

Similar to National Scenic Byways, the West Virginia Byways are recognized by the West Virginia Department of Commerce (WVDOC) for their "unique and picturesque glimpse into the Mountain State's history and natural beauty." There are 10 State Byways (see Figure 16.1.1-1 in Section 16.1.1, Infrastructure), including the Coal Heritage Trail, which is also a designated National Scenic Byway (see Table 16.1.8-6). In addition to West Virginia Byways, there are 11 State Backways in West Virginia (WVDOC, 2015).

Table 16.1.8-6: West Virginia Byways and Backways

Byway/Backway Name	
Back Mountain Backway	Midland Trail Byway
Camp Allegheny Backway	Mountain Parkway Backway
Cedar Creek Road Backway	Mountain Parkway Byway
Cheat River Byway	Mountain Shadow Trail Backway
Cheat Mountain Backway	Northwestern Turnpike Byway
Coal Heritage Trail Byway	Paint Creek Backway
Farm Heritage Road Byway	Paint Creek Byway
Little Kanawha Byway	Rich Mountain Backway
Lowell Backway	Williams River Backway
Lower Greenbrier River Byway	Wolf Creek Backway
Old Route 7 Byway	

Source: (WVDOC, 2015)

16.1.9. Socioeconomics

16.1.9.1. 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 USC 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.

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

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8). This PEIS addresses environmental justice in a separate section (Section 16.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 16.1.7, Land Use, Recreation, and Airspace); infrastructure and public services (Section 16.1.1, Infrastructure); and aesthetic considerations (Section 16.1.8, 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.

16.1.9.2. 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.

16.1.9.3. Communities and Populations

This section discusses the population and major communities of West Virginia. 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 16.1.9-1 presents the 2014 population and population density of West Virginia in comparison to the East region[130] and the nation. The estimated population of West Virginia in 2014 was 1,850,326. The population density was 77 persons per square mile (sq. mi.), which is considerably lower than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, West Virginia was the 38th largest state by population among the 50 states and the District of Columbia, 41st largest by land area, and had the 30th greatest population density (Census Bureau, 2015d) (Census Bureau, 2015e).

Table 16.1.9-1: Land Area, Population, and Population Density of West Virginia

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
West Virginia	24,259	1,850,326	77
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

Sources: (USGS, 2012a) (Census Bureau, 2015d) (Census Bureau, 2015e)

Population growth is an important subject for this PEIS given FirstNet's mission. Table 16.1.9-2 presents the population growth trends of West Virginia from 2000 to 2014 in comparison to the East region and the nation. While the state of West Virginia experienced an annual growth rate of 0.24 percent in the 2000 to 2010 period, the state experienced a population loss between 2010 and 2014 (-0.4 percent). Both the region and nation showed considerably higher growth rates in both periods compared to the state.

Table 16.1.9-2: Recent Population Growth of West Virginia

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
West Virginia	1,808,344	1,852,994	1,850,326	44,650	-2,668	0.24%	-0.04%
East Region	69,133,382	72,444,467	73,899,862	3,311,085	1,455,395	0.47%	0.50%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (Census Bureau, 2015f) (Census Bureau, 2015d)

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

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 16.1.9-3 presents

[130] The East region comprises 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.

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 the state's population will increase by approximately 25,735 people, or 1.39 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.09 percent, which is consistent with the historical rate from 2010 to 2014. The projected growth rate of the state is significantly lower than that of the region (0.57 percent) and nation (0.80 percent).

Table 16.1.9-3: Projected Population Growth of West Virginia

Geography	Population 2014 (Estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC) 2014 to 2030
West Virginia	1,850,326	1,775,932	1,976,190	1,876,061	25,735	1.39%	0.09%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.45%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.63%	0.80%

Sources: (Census Bureau, 2015d) (ProximityOne, 2015) (UVA Weldon Cooper Center, 2015)

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

Population Distribution and Communities

Figure 16.1.9-1 presents the distribution and relative density of the population of West Virginia. 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 (Census Bureau, 2015g).

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 (Census Bureau, 2010b). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. The very sparsely populated area in the eastern portion of the state is the Monongahela National Forest region, located in the Allegheny Mountains, much of which is protected from development. For more information about the Monongahela National region, see Section 16.1.7, Land Use, Airspace, and Recreation.

Table 16.1.9-4 provides the populations of the 10 largest population concentrations in West Virginia, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[131] In 2010, the largest population concentration was the Charleston area (the state's capital area), which had over 150,000 people. The state had one other population concentration over 100,000; this was the West Virginia portion of the Hagerstown area. The smallest of these 10 population concentrations was the Fairmont area, with a 2010 population of 33,409.

The fastest growing area, by average annual rate of change from 2000 to 2010, was the West Virginia portion of the Hagerstown area, with an annual growth rate of 7.93 percent; however, much of this increase was probably due to an enlargement of the geographic area to take in existing development/population. Other population concentrations had more modest growth rates. Several areas experienced population losses during this period, including the Charleston area, with the greatest negative rate of change, -1.76 percent.

Table 16.1.9-4 also shows that the top 10 population concentrations in West Virginia accounted for 37.6 percent of the state's population in 2010. Much of the state's population is dispersed across more sparsely populated areas. Population growth in the 10 areas from 2000 to 2010 amounted to 142.6 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.

[131] 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.

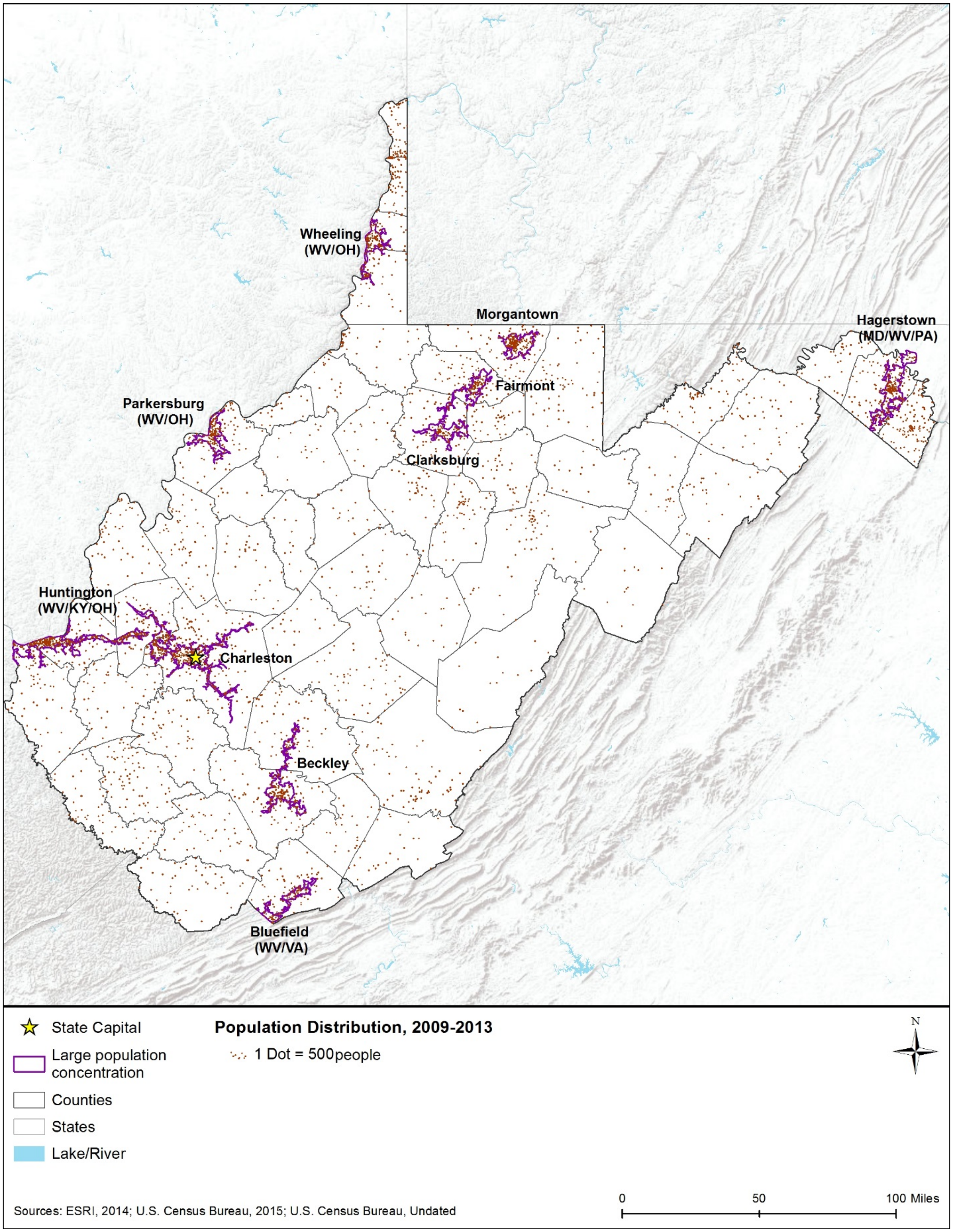

Figure 16.1.9-1: Population Distribution in West Virginia, 2009–2013

Table 16.1.9-4: Population of the 10 Largest Population Concentrations in West Virginia

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Beckley	46,860	64,022	62,397	5	17,162	3.17%
Bluefield (WV/VA) (WV Portion)	33,447	36,903	36,859	9	3,456	0.99%
Charleston	182,991	153,199	153,728	1	(29,792)	-1.76%
Clarksburg	35,469	43,988	43,538	8	8,519	2.18%
Fairmont	36,358	33,409	34,379	10	(2,949)	-0.84%
Hagerstown (MD/WV/PA) (WV Portion)*	33,466	71,787	74,416	3	38,321	7.93%
Huntington (WV/KY/OH) (WV Portion)	88,423	112,268	113,999	2	23,845	2.42%
Morgantown	55,997	70,350	71,202	4	14,353	2.31%
Parkersburg (WV/OH) (WV Portion)	64,248	59,643	59,402	6	(4,605)	-0.74%
Wheeling (WV/OH) (WV Portion)	55,688	51,067	51,324	7	(4,621)	-0.86%
Total for Top 10 Population Concentrations	632,947	696,636	701,244	NA	63,689	0.96%
West Virginia (statewide)	1,808,344	1,852,994	1,853,619	NA	44,650	0.24%
Top 10 Total as Percentage of State	35.0%	37.6%	37.8%	NA	142.6%	NA

Sources: (Census Bureau, 2010b) (Census Bureau, 2015h) (Census Bureau, 2015i)

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

*The large population increase from 2000 to 2010 reflects a large change in the area definition for the Hagerstown (West Virginia portion) urbanized area, from 30 sq. mi. in 2000 to 70 sq. mi. in 2010. Thus, much of the “growth” was due to expansion of the area’s Census Bureau boundary to take in existing development/population

16.1.9.4. 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 EMS and facilities. This PEIS addresses public services in Section 16.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 16.1.9-5 compares several economic indicators for West Virginia to the East region and the nation. The table presents two indicators of income[132] – 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 16.1.9-5, the per capita income in West Virginia in 2013 ($23,159) was $9,693 lower than that of the region ($32,852), and $5,025 lower 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 16.1.9-5 shows that in 2013, the MHI in West Virginia ($41,195) was $19,309 lower than that of the region ($60,504), and $11,055 lower 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 16.1.9-5 compares the unemployment rate in West Virginia to the East region and the nation. In 2014, West Virginia's statewide unemployment rate of 6.5 percent was higher than the rate for the region (6.0 percent) and somewhat higher than the rate for the nation (6.2 percent).[133]

Table 16.1.9-5: Selected Economic Indicators for West Virginia

Geography	Per Capita Income 2013	MHI 2013	Average Annual Unemployment Rate 2014
West Virginia	$23,159	$41,195	6.5%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015b) (Census Bureau, 2015j) (Census Bureau, 2015k) (Census Bureau, 2015l)

[132] 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." (Census Bureau, 2015m)

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

Figure 16.1.9-2 and Figure 16.1.9-3 show how MHI in 2013 (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 Figure 16.1.9-1 (Census Bureau, 2010b). Following these two maps, Table 16.1.9-6 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 West Virginia.

Figure 16.1.9-2 shows that, in general, most counties in West Virginia had MHI levels below the national median, with the exception of the Hagerstown and Huntington areas (West Virginia portions). Many counties had very low MHI levels compared to the national median. Table 16.1.9-6 is consistent with those observations. It shows that the Hagerstown area (West Virginia portion) had the highest MHI among the state's top 10 populations at $51,294, compared to the state's average of $41,043. MHI was lowest in the West Virginia portion of the Bluefield area ($33,466), which is the second smallest of the areas shown in the table.

Table 16.1.9-6 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 distributed throughout the state. The lowest unemployment rates were generally in the counties around the top 10 populations, with the exception of the Beckley and Bluefield areas. Many West Virginia counties had very high unemployment rates compared to the national average. When comparing unemployment in the population concentrations to the state average (Table 16.1.9-6), the majority of these populations had unemployment rates below the state average (8.4 percent), and within approximately two percentage points. The West Virginia portions of the Hagerstown and Parkersburg areas had 2009–2013 unemployment rates above the state average (12.2 percent and 10.1 percent, respectively).

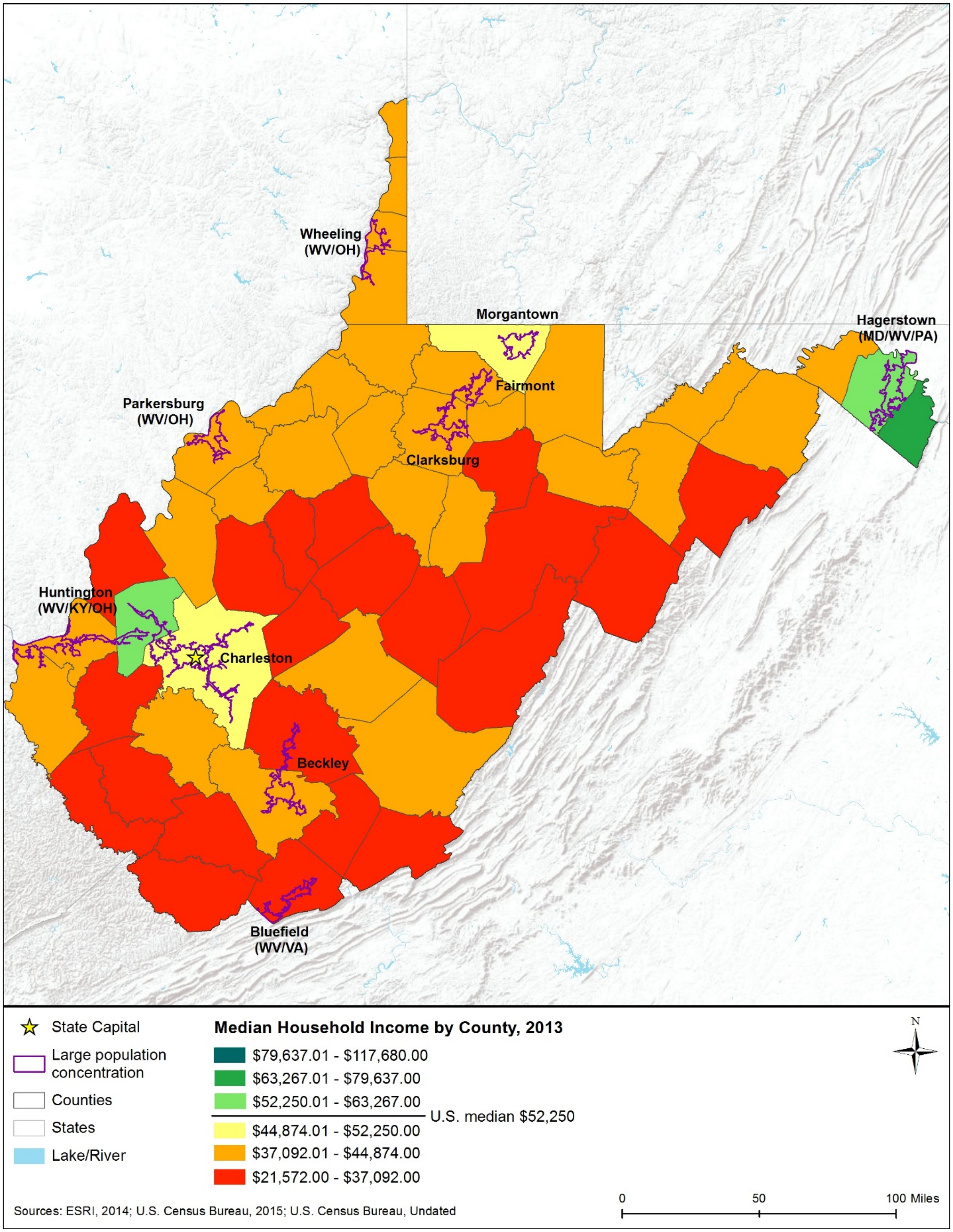

Figure 16.1.9-2: Median Household Income in West Virginia, by County, 2013

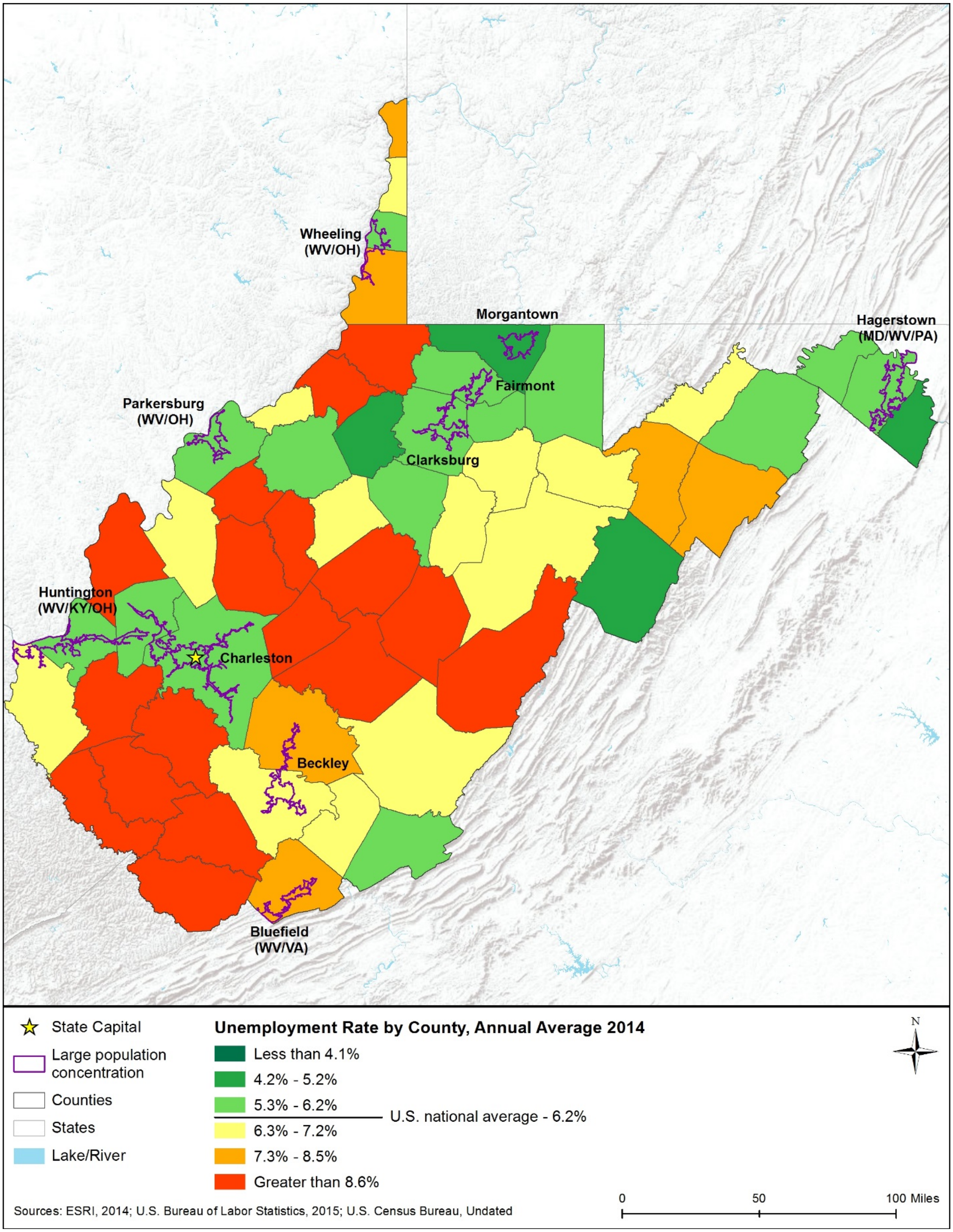

Figure 16.1.9-3: Unemployment Rates in West Virginia, by County, 2014

Table 16.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in West Virginia, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Beckley	$37,602	7.0%
Bluefield (WV/VA) (WV Portion)	$33,466	6.3%
Charleston	$46,349	7.0%
Clarksburg	$43,469	7.4%
Fairmont	$40,496	4.7%
Hagerstown (MD/WV/PA) (WV Portion)	$51,294	12.2%
Huntington (WV/KY/OH) (WV Portion)	$41,413	7.6%
Morgantown	$38,819	6.3%
Parkersburg (WV/OH) (WV Portion)	$39,371	10.1%
Wheeling (WV/OH) (WV Portion)	$36,943	6.5%
West Virginia (statewide)	$41,043	8.4%

Source: (Census Bureau, 2015n)

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 16.1.9-7 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 slightly lower in West Virginia than in the East region and the nation. The percentage of government workers was higher in the state than in the region and nation. The percentage of self-employed workers in the state was similar to the state and nation.

By industry, West Virginia has a mixed economic base and some notable figures in the table are as follows. Most industries in West Virginia in 2013 had similar percentages (within two percentage points to the percentages for the East region and nation. As one exception, the state had a significantly higher percentage of workers in “agriculture, forestry, fishing and hunting, and mining” than the region or nation did. Also, the state had a considerably lower percentage of workers in “professional, scientific, management, administrative, and waste management services” and “finance and insurance, and real estate and rental and leasing” than the region or nation did.

Table 16.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	West Virginia	East Region	United States
Civilian Employed Population 16 Years and Over	752,310	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	76.4%	79.3%	79.7%
Government workers	19.0%	15.1%	14.1%
Self-employed in own not incorporated business workers	4.4%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			

Class of Worker and Industry	West Virginia	East Region	United States
Agriculture, forestry, fishing and hunting, and mining	5.4%	0.9%	2.0%
Construction	6.5%	5.8%	6.2%
Manufacturing	8.1%	8.5%	10.5%
Wholesale trade	2.3%	2.5%	2.7%
Retail trade	12.1%	11.1%	11.6%
Transportation and warehousing, and utilities	5.5%	4.6%	4.9%
Information	1.8%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	4.1%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	8.4%	12.3%	11.1%
Educational services, and health care and social assistance	26.3%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.5%	8.9%	9.7%
Other services, except public administration	4.2%	4.9%	5.0%
Public administration	6.6%	5.5%	4.7%

Source: (Census Bureau, 2015o)

Table 16.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 16.1.9-7 for 2013.

Table 16.1.9-8: Employment by Relevant Industries for the 10 Largest Population Concentrations in West Virginia, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Beckley	4.4%	4.4%	2.3%	6.5%
Bluefield (WV/VA) (WV Portion)	4.9%	4.4%	2.2%	5.6%
Charleston	4.6%	5.0%	2.4%	11.1%
Clarksburg	6.2%	7.1%	1.2%	8.8%
Fairmont	4.6%	4.2%	1.8%	9.2%
Hagerstown (MD/WV/PA) (WV Portion)	6.3%	5.9%	2.8%	7.8%
Huntington (WV/KY/OH) (WV Portion)	4.3%	3.8%	2.0%	8.3%
Morgantown	3.8%	1.8%	2.0%	11.3%
Parkersburg (WV/OH) (WV Portion)	5.1%	4.7%	1.8%	8.1%
Wheeling (WV/OH) (WV Portion)	4.6%	4.7%	1.6%	6.6%

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
West Virginia (statewide)	6.5%	5.3%	1.8%	7.7%

Source: (Census Bureau, 2015n)

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 16.1.9-9 compares West Virginia to the East region and nation on several common housing indicators.

As shown in this Table 16.1.9-9, in 2013 West Virginia had a lower percentage of housing units that were occupied (84.0 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, West Virginia had a considerably higher percentage of owner-occupied units (72.3 percent) than the region (62.8 percent) or nation (63.5 percent). This is reflected in the higher percentage of detached single-unit housing (also known as single-family homes) in West Virginia in 2013 (70.8 percent) compared to the region (52.7 percent) and nation (61.5 percent). The homeowner vacancy rate in West Virginia (1.8 percent) was somewhat higher than the rate for the region (1.6 percent) and nearly matched the nation's rate (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (Census Bureau, 2015n). The vacancy rate among rental units was higher in West Virginia (7.7 percent) than in the region (5.5 percent) or nation (6.5 percent).

Table 16.1.9-9: Selected Housing Indicators for West Virginia, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
West Virginia	879,424	84.0%	72.3%	1.8%	7.7%	70.8%
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: (Census Bureau, 2015p)

Table 16.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Table 16.1.9-10 shows that during this period, the percentage of occupied housing units ranged between 83.0 to 91.2 percent across these population concentrations.

Table 16.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in West Virginia, 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
Beckley	28,671	88.6%	69.1%	1.9%	5.9%	74.1%
Bluefield (WV/VA) (WV Portion)	17,975	87.3%	66.2%	2.6%	5.1%	63.6%
Charleston	74,225	89.9%	68.5%	1.9%	7.3%	69.8%
Clarksburg	20,168	87.5%	70.7%	3.3%	8.8%	75.6%
Fairmont	16,342	87.1%	69.9%	0.8%	10.4%	73.6%
Hagerstown (MD/WV/PA) (WV Portion)	31,113	91.2%	70.4%	3.2%	8.8%	64.8%
Huntington (WV/KY/OH) (WV Portion)	53,390	88.8%	63.8%	1.9%	5.9%	68.8%
Morgantown	32,243	83.0%	48.0%	3.1%	2.7%	42.9%
Parkersburg (WV/OH) (WV Portion)	28,273	88.2%	67.5%	2.7%	6.4%	75.1%
Wheeling (WV/OH) (WV Portion)	25,662	88.5%	67.4%	2.8%	6.8%	69.2%
West Virginia (statewide)	880,951	84.2%	73.4%	2.0%	7.8%	71.0%

Sources: (Census Bureau, 2015q)

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 16.1.9-11 provides indicators of residential property values for West Virginia 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 (Census Bureau, 2015m).

The table shows that the median value of owner-occupied units in West Virginia in 2013 ($103,200) was considerably lower than the corresponding values for both the East region ($249,074) and the nation ($173,900).

Table 16.1.9-11: Residential Property Values in West Virginia, 2013

Geography	Median Value of Owner-Occupied Units
West Virginia	$103,200
East Region	$249,074
United States	$173,900

Source: (Census Bureau, 2015p)

Table 16.1.9-12 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 West Virginia portion of the Bluefield and Wheeling areas had median values ($83,000 and $86,700, respectively) considerably lower than the state median value ($98,500). These areas also had the lowest MHIs (Table 16.1.9-12). The Beckley, Clarksburg, Fairmont, and Parkersburg (West Virginia portion) areas had median property values close to the state value. The other population concentrations had property values considerably above the state value, with highest value found in the Morgantown area ($170,000).

Table 16.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in West Virginia, 2009–2013

Area	Median Value of Owner-Occupied Units
Beckley	$95,200
Bluefield (WV/VA) (WV Portion)	$83,000
Charleston	$110,100
Clarksburg	$93,800
Fairmont	$98,300
Hagerstown (MD/WV/PA) (WV Portion)	$158,800
Huntington (WV/KY/OH) (WV Portion)	$118,500
Morgantown	$170,000
Parkersburg (WV/OH) (WV Portion)	$99,300
Wheeling (WV/OH) (WV Portion)	$86,700
West Virginia (statewide)	$98,500

Sources: (Census Bureau, 2015q)

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[134] are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and Internet services (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 16.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar

[134] 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. (Census Bureau, 2006).

figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures were 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 16.1.9-13 shows that the state government in West Virginia received more total revenue in 2012 on a per capita basis than its counterparts in the nation, and nearly matched the revenue received by counterparts in the region. On the other hand, local governments in the state received approximately half the total revenue in 2012 on a per capita basis received by their counterparts in the region and nation. The West Virginia state government had a higher level of intergovernmental[135] revenue from the federal government than its counterparts elsewhere. The West Virginia state and local governments obtained significantly less revenue per capita from property taxes than counterparts in the region or nation. General sales taxes were similar on a per capita basis for the West Virginia state government and regional and national counterparts. Selective sales taxes, and public utility taxes specifically, were higher on a per capita basis for the West Virginia state government, and lower for West Virginia local governments, compared to their counterparts in the region and nation. Individual and corporate income tax revenues, on a per capita basis, were significantly lower for the West Virginia state government than for its counterparts in the region, and similar to those for counterparts in the nation. West Virginia local governments did not obtain revenues from general sales taxes, individual income taxes, and corporate income taxes (Census Bureau, 2015r) (Census Bureau, 2015s).

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

Table 16.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue*	West Virginia		Region		United States	
	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue ($M)	$13,247	$5,519	$522,354	$431,898	$1,907,027	$1,615,194
Per capita	$7,140	$2,975	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal ($M)	$4,267	$250	$135,435	$20,289	$514,139	$70,360
Per capita	$2,300	$135	$1,849	$277	$1,638	$224
Intergovernmental from State ($M)	$0	$2,092	$0	$120,274	$0	$469,147
Per capita	$0	$1,128	$0	$1,642	$0	$1,495
Intergovernmental from Local ($M)	$92	$0	$9,810	$0	$19,518	$0
Per capita	$49	$0	$134	$0	$62	$0
Property Taxes ($M)	$6	$1,429	$2,215	$144,319	$13,111	$432,989
Per capita	$3	$770	$30	$1,971	$42	$1,379
General Sales Taxes ($M)	$1,277	$0	$49,123	$15,874	$245,446	$69,350
Per capita	$688	$0	$671	$217	$782	$221
Selective Sales Taxes ($M)	$1,282	$125	$38,070	$5,996	$133,098	$28,553
Per capita	$691	$67	$520	$82	$424	$91
Public Utilities Taxes ($M)	$156	$28	$4,314	$2,261	$14,564	$14,105
Per capita	$84	$15	$59	$31	$46	$45
Individual Income Taxes ($M)	$1,756	$0	$102,813	$18,838	$280,693	$26,642
Per capita	$946	$0	$1,404	$257	$894	$85
Corporate Income Taxes ($M)	$192	$0	$14,112	$6,733	$41,821	$7,210
Per capita	$104	$0	$193	$92	$133	$23

Sources: (Census Bureau, 2015r) (Census Bureau, 2015s)

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

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 (Census Bureau, 2006).

16.1.10. Environmental Justice

16.1.10.1. 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 E.O. (CEQ, 1997). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015g) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015h).

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)

16.1.10.2. Specific Regulatory Considerations

In 2003, the WVDEP issued an Environmental Equity Policy. The policy aims to ensure that "no segment of the population, because of its status as a low income or minority community or any other factors relating to its racial or economic makeup, [will] bear a disproportionate share of the risks and consequences of environmental pollution or be denied equal access to environmental benefits." With this policy, West Virginia sought to incorporate environmental justice into WVDEP's programs, policy making, and regulatory activities. (University of California, Hastings College of Law, 2010) (WVDEP, 2003).

Within WVDEP, the Office of the Environmental Advocate provides support and guidance to West Virginia residents requesting help with department processes (WVDEP, 2015e). WVDEP developed two guidance documents (i.e., the Citizen's Guide, and the Permit Hearings and Appeals Guide) to inform communities about getting involved in the environmental decision-making process. The Citizen's Guide provides guidelines for accessing public information, outlines permitting procedures, explains the rulemaking processes, and includes an environmental terms glossary. The Permit Hearings and Appeals Guide provides a step-by-step overview and directions for participating in public hearings and appeals. (University of California, Hastings College of Law, 2010).

WVDEP has also created an interactive mapping system, which allows the public to locate open dump cleanup projects, landfill closure projects, and oil and gas wells. (University of California, Hastings College of Law, 2010).

16.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 16.1.10-1 presents 2013 data on the composition of West Virginia's population by race and by Hispanic origin. The state's population has significantly lower percentages of individuals who identify as Black/African American (3.4 percent), Asian (0.6 percent), or Some Other Race (0.3 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; for Asian, 5.8 percent and 5.1 percent respectively; and for Some Other Race, 4.8 percent and 4.7 percent respectively.) Most (93.7 percent) of the state's population identifies as White. This percentage is considerably higher than that of the East region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in West Virginia that identifies as Hispanic (1.4 percent) is substantially smaller than in the East region (12.2 percent), and 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. West Virginia's All Minorities population percentage (7.4 percent) is considerably lower than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 16.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for West Virginia (18.5 percent) is substantially higher than that for the East region (13.3 percent) and the nation (15.8 percent).

Table 16.1.10-1: 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		
West Virginia	1,854,304	93.7%	3.4%	0.1%	0.6%	0.1%	0.3%	1.8%	1.4%	7.4%
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: (Census Bureau, 2015t)

"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 16.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
West Virginia	18.5%
East Region	13.3%
United States	15.8%

Source: (Census Bureau, 2015u)

16.1.10.4. Environmental Justice Screening Results

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

Figure 16.1.10-1 visually portrays the results of the environmental justice population screening analysis for West Virginia. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (Census Bureau, 2015g) (Census Bureau, 2015v) (Census Bureau, 2015w) (Census Bureau, 2015x) and Census Bureau urban classification data (Census Bureau, 2010b).

Figure 16.1.10-1 shows that much of West Virginia has high potential for environmental justice populations. The distribution of these high potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is also fairly even across the state. Given West Virginia's very low rates of minority populations and its high poverty rate, it is likely that Figure 16.1.10-1 mostly reflects relative prevalence of low-income populations.

It is important to understand how the data behind Figure 16.1.10-1affect 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 16.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to NEPA criteria), and “appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group” (CEQ, 1997). Section 16.2.10 addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

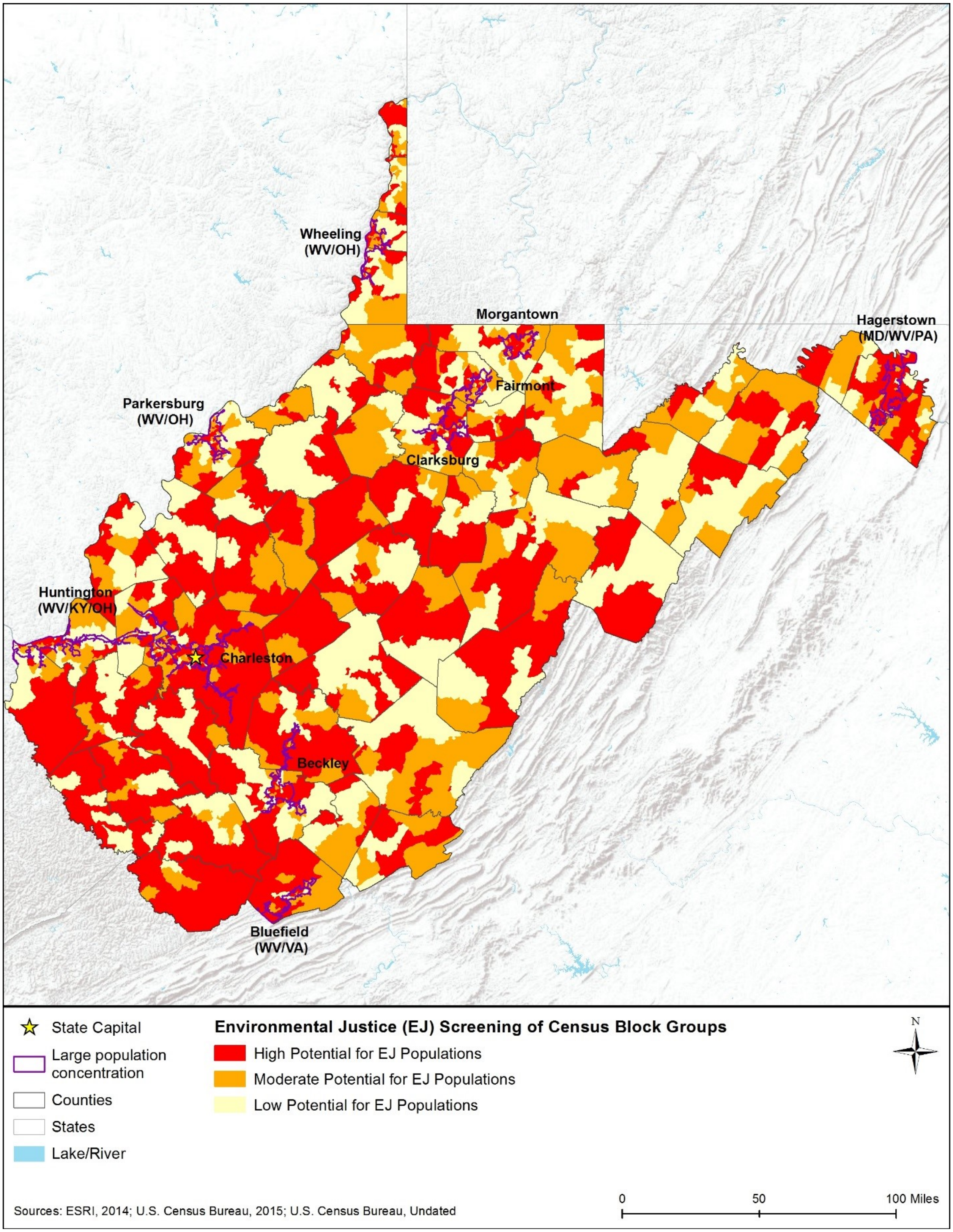

Figure 16.1.10-1: Potential for Environmental Justice Populations in West Virginia, 2009–2013

16.1.11. Cultural Resources

16.1.11.1. Definition of Resource

For the purposes of this 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 of 1966, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 USC 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, 2015l); 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 (ACHP, 2004);

16.1.11.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to 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.

West Virginia has a state law that is similar to the NHPA (refer to Table 16.1.11-1). However, federal laws and regulations supersede state laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 16.1.11-1: Relevant West Virginia Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Protection of Historic and Prehistoric Sites, 2005 West Virginia Code - §29-1-8b	West Virginia Division of Culture and History (SHPO)	This act parallels the NHPA for projects on state-owned lands, and "prohibits the disturbance or destruction of historic and prehistoric landmarks, sites, and districts" without permission from the SHPO (West Virginia Division of Culture and History 2015b).

16.1.11.3. Cultural Setting

West Virginia has been inhabited by human beings for about 12,000 years (Holliday, Johnson, & 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 early human habitation evidence in the state 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 33 archaeological sites and archaeological districts listed on the NRHP in West Virginia, of which there are 10 prehistoric and 22 are historic. (NPS, 2014c)

Archaeologists typically divide large study areas into regions as shown in Figure 16.1.11-1. West Virginia contains one physiographic region, Appalachian Highlands, which is divided into three provinces. The Appalachian Plateaus province covers the majority of the state, from the western state border to the Allegheny Structural Front. The Valley and Ridge province covers all state land east of the Appalachian Plateaus province, except for its easternmost tip, which is part of the Blue Ridge province.

16.1.11.4. Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited present day West Virginia and the greater Northeast geography of North America: The Paleoindian period (12,000 to 10,000 B.C.), Archaic (11,000 to 3,000 B.C.), and Woodland (3,000 B.C. to A.D. 1600) (Pauketat, 2012; Institute of Maritime History, 2015; Holliday, Johnson, & Stafford, 1999). Figure 16.1.11-2 shows a timeline representing these periods of early human habitation in North America, including present day West Virginia. 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 throughout the state. 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; Donahue, Jull, Zabel, & Holliday, 1984; Holliday, Johnson, & Stafford, 1999).

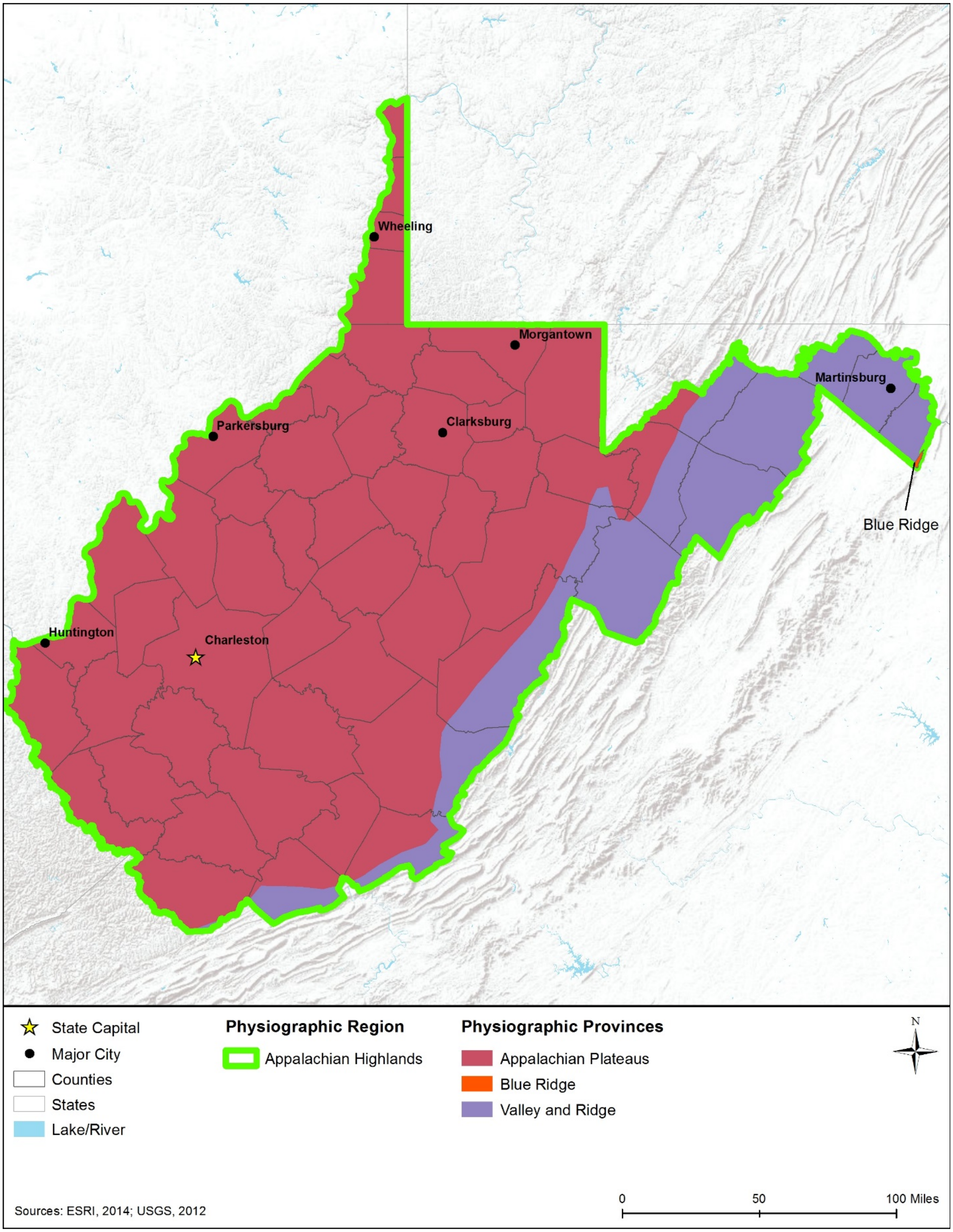

Figure 16.1.11-1: West Virginia Physiographic Regions

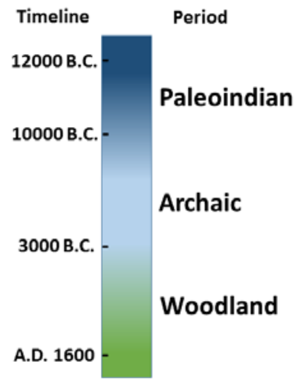

Figure 16.1.11-2: Timeline of Prehistoric Human Occupation

Sources: (Institute of Maritime History, 2015; Pauketat, 2012)

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

The Paleoindian Period represents the earliest 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 (Charpentier & Inizan, 2002). Archaeologists hypothesize that the people of this period ranged across West Virginia in small bands in pursuit of migratory game. Early Paleoindian settlers used the Clovis fluted-point technology to hunt large game, such as mastodon, horse, caribou, stag-moose, and giant beaver (Laub, 2000).

Paleoindian camps appear to have been occupied seasonally, with some sites that may have formed the basis for more permanent settlements. No skeletal remains of these people have been identified to date in the state, so the appearance of these nomadic wanderers is unknown. This group of hunters and gatherers were related to a population of inhabitants that spread into North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch) (Ritchie, 1969; Laub, 2000; Robinson, 2011; West Virginia Division of Culture and History, 2015c).

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

The Early Archaic Period was a time when climate was warming towards the end of the last ice age. As the temperatures rose and precipitation increased, deciduous forests spread, providing a greater variety edible food. The people of the Early Archaic people hunted deer, elk, and bear. As tool-making technology advanced, people were able to exploit their local environment with greater efficiency. Several Early Archaic Period sites have been discovered in the Appalachian Plateaus province of the state (McDonald, Lothrop, Cremeens, & Munford, 2006).

Mountain top archaeological sites are prevalent throughout the state. Archaeological surveys from 38 mountaintops in West Virginia extracted 539 flint projectile points that date to the Early Archaic period (Wilkins, 1978). Other Early Archaic Period sites have been found along or adjacent to streams and rivers throughout the state; additionally, other sites are likely to be under deep alluvial deposits (Neumann, 1992).

The people of this Early Archaic Period occupied temporary campsites, exploiting the resources that were available. There is no evidence of permanent occupational sites. The technology that went into their tool making was highly regionalized. The archeological record of this sub-period indicates that the populations were beginning to expand and cultures from other regions were starting to share technologies (Wilkins, 1978).

Evidence of the use of flint for manufacturing tools is present throughout the Middle Archaic Period. Archaeological surveys from 38 separate mountaintops in West Virginia extracted 86 Middle Archaic flint projectile points (Wilkins, 1978). Additionally several sites in the Appalachian Plateaus have been associated to the Middle Archaic period (McDonald, Lothrop, Cremeens, & Munford, 2006), as well as sites along streams and rivers (Neumann, 1992). Due to West Virginia's steep terrain, other sites are likely buried under deep alluvial deposits (Neumann, 1992).

Flint manufacturing continued to increase throughout the Late Archaic. From the 38 separate mountaintops surveyed in West Virginia, 447 flint projectile points were extracted. This is evidence that populations were increasing at a rapid pace during this period (Wilkins, 1978).

Woodland Period (3000 B.C. – A.D. 1600)

Similar to the Archaic Period, the Woodland Period is divided into three sequential sub-periods: Early, Middle, and Late. The sub-periods are defined by cultural differences that can be distinguished by their temporal (place in time) location and adaptive details that come from close scientific examination. The Woodland Period in West Virginia was a period of cultural change including mound building, preference for inhabiting elevated areas, and development of egalitarian societies. Evidence of the use of flint for manufacturing tools is present throughout the Woodland period (Wilkins, 1978). However, the main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which originated in the Southeastern United States during the late Archaic Period and spread northward to New York and elsewhere (Sassaman, 1998).

The Adena culture begin to flourish by this period in West Virginia. Adena people were known as mound building culture, who built great mounds where they buried their deceased along with other cultural materials. It is suspected that some Adena people sites from the Early Woodland Period are buried beneath deep alluvial deposits (6 to 8 feet below the surface) of West Virginia (Fowler, Hemmings, & Wilkins, 1976).

Although there is evidence of occupation in drainage basins, the people of this period were prone to living in a more elevated environment. Artifacts from higher-elevation sites indicate that social complexity was increasing during this period (Wilkins, 1978; Neumann, 1992). Artifacts found in low-lying areas are much less prevalent by this period (Wilkins, 1978).

Cultures were becoming more and more sedentary by the Late Woodland and larger communities developed. Egalitarian societies were the predominant form of culture, and there was very clear division of labor among their members (Church, 1995).

16.1.11.5. Federally Recognized Tribes of West Virginia

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are no federally recognized Tribes in West Virginia (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015). The location of federally recognized tribes are highlighted in bold in Figure 16.1.11-3. The other tribes depicted on the figure are general locations of tribes that were known to once exist in this region of the United States, but are either no longer present or are not federally recognized.

16.1.11.6. Significant Archaeological Sites of West Virginia

As previously mentioned in Section 16.1.11, there are 33 archaeological sites and archaeological districts in West Virginia listed on the NRHP.

Table 16.1.11-2 presents the names of the sites, the city they are closest to, and type of 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/ (NPS, 2014d).

West Virginia State Cultural Resources Database and Tools

West Virginia Division of Culture and History

The West Virginia Division of Culture and History's SHPO is responsible for identifying, preserving, and protecting the state prehistoric and historic structures, objects, and sites. The Office administers both the state- and federal-related historic preservation programs, and provides cultural resources information through its website (http://www.wvculture.org) (West Virginia Division of Culture and History, 2015a)

West Virginia Archeological Society (WVAS)

The West Virginia Archeological Society (WVAS) was organized in 1948 as a result of the emergency excavation of Natrium Mound in Marshall County, which was subsequently destroyed by industrial development. The Society publishes the West Virginia Archeologist and holds an annual meeting that presents the results of recent work in the state, and the opportunity to mix with other members and attendees. Copies of the West Virginia Archaeologist can be purchased from their website (http://wvarch.org/) (West Virginia Archeological Society, 2015)

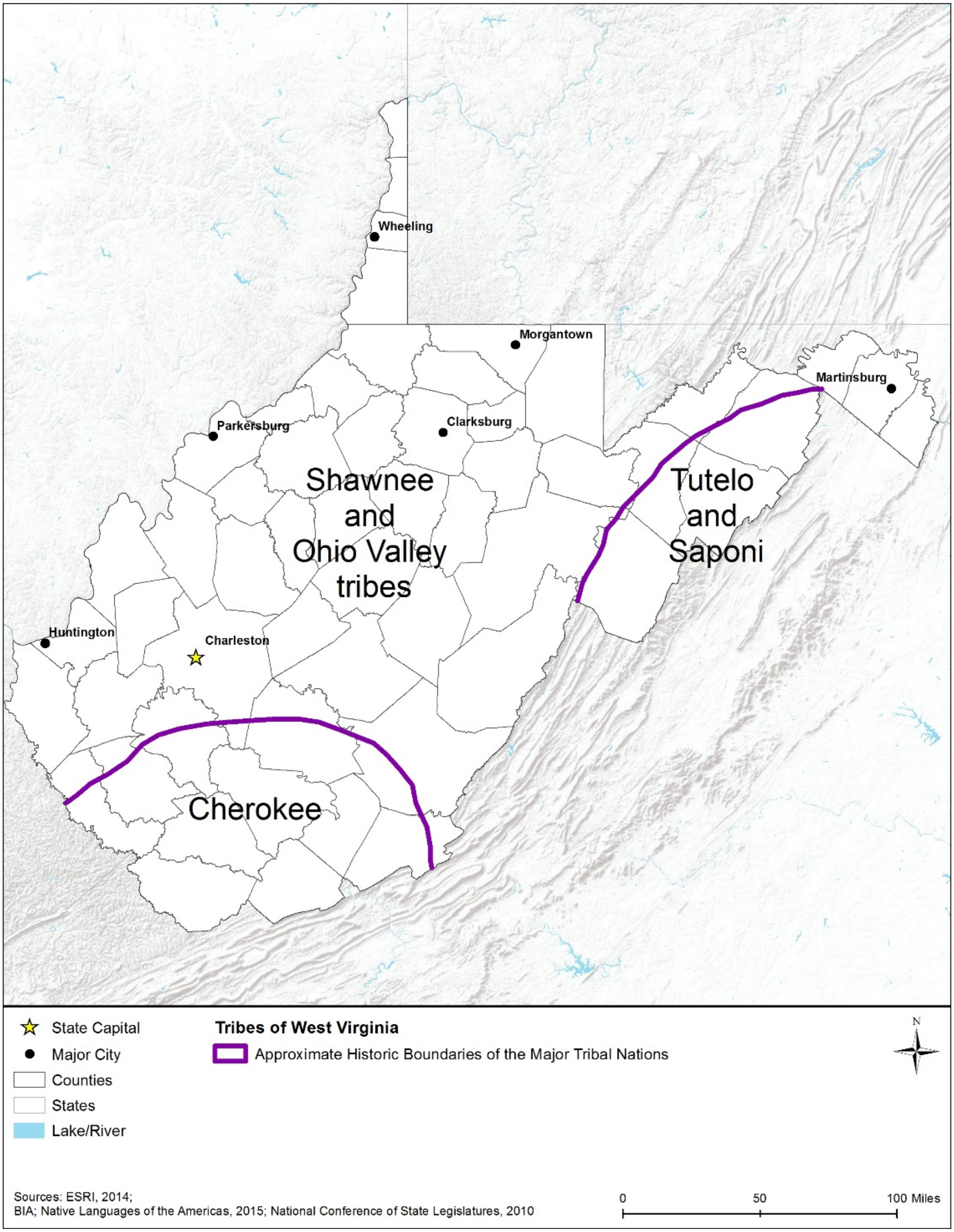

Figure 16.1.11-3: Historic Boundaries of Major Tribal Nations in West Virginia

Table 16.1.11-2: Archaeological Sites on the NRHP in West Virginia

Closest City	Site Name	Type of Site
Albright	Virginia Furnace	Historic
Alum Creek	Coal River Locks, Dams, and Log Booms Archeological District	Historic - Maritime
Bartow	Camp Allegheny	Historic, Military
Beverly	Rich Mountain Battlefield	Historic - Military
Buffalo	Buffalo Indian Village Site	Historic - Aboriginal
Charleston	Fort Scammon	Historic - Military
Coe	Laurel Run Rockshelter	Prehistoric
Darkesville	Union Bryarly's Mill	Historic
Fairmont	Prickett's Fort	Historic - Military
Fort Gay	Wildcat Branch Petroglyphs	Prehistoric
Good Hope	Indian Cave Petroglyphs	Prehistoric
Green Bank	GW Jeep Site	Prehistoric
Huttonsville	Cheat Summit Fort	Historic - Military
Huttonsville	Fort Marrow	Historic - Military
Lesage	Clover Site	Historic - Aboriginal
Martinsburg	Jones Mill Run Historic District	Historic
Mills Mountain	Craig Run East Fork Rockshelter	Prehistoric
Morgantown	Kern's Fort	Historic, Military
Moundsville	Grave Creek Mound	Prehistoric
Napier	Union Civil War Fortification	Historic - Military
Parkersburg	Fort Boreman	Historic - Military
Point Pleasant	Point Pleasant Battleground	Historic - Military
Ringgold	Hamilton Farm Petroglyphs	Prehistoric
Romney	Fort Mill Ridge Civil War Trenches	Historic - Military
Romney	Fort Van Meter	Historic - Military
Seneca Rocks	Sites Homestead	Historic
Shannondale	Shannondale Springs	Historic
South Charleston	South Charleston Mound	Prehistoric
Springfield	Washington Bottom Farm	Prehistoric
St. Albans	St. Albans Site	Prehistoric
Weirton	Tarr, Peter, Furnace Site	Historic
Wellsburg	Nicholls House and Woolen Mill Site	Historic

Source: (NPS, 2014d)

16.1.11.7. Historic Context

While European settlers began arriving in the colony of Virginia in the late 16th century, settlement of what is now West Virginia (originally known as "western Virginia") did not begin until the early 18th century. Fur trappers and explorers were the first to visit the area, followed by land speculators and settlers; the nationality of early colonists included Scotch-Irish, German, English, and others. Fortifications were built along major waterways and borders throughout the region during the French and Indian War (1754 to 1763) (Rice & Brown, 1993).

During the American Revolution, western Virginians were supportive and volunteers from the region participated in most major battles. Relations with the indigenous population were hostile, especially after natives allied themselves with the British. Following the war, westward immigration increased, with settlers pressing into present-day Kentucky, Tennessee, Ohio, and further west. Neighboring states industrialized, while western Virginia remained rural and involved in agriculture. This was due to an abundance of natural resources, but also a lack of access relating to transportation, which hampered development (Rice & Brown, 1993).

In 1859, abolitionist John Brown seized the federal arsenal at Harpers Ferry, hoping to start a slave uprising; however, Brown was captured and hanged. In addition to its notoriety associated with John Brown's Raid, Harpers Ferry is also the location of an early and important crossing point of the Potomac and Shenandoah Rivers, the former location of the United States Amory and Arsenal (built 1799 and destroyed during Civil War), and a strategic location that was hotly contested during the Civil War (NPS, 2015m). In 1861, on the eve of the Civil War, "western Virginia" broke away from Virginia because a majority of its representatives did not favor secession. During the Civil War, western Virginia was controlled by the Union, with few battles occurring in the state (Rice & Brown, 1993). On June 20, 1863, West Virginia became the 35th state admitted to the Union (Chambers Jr., 2004).

Transportation improvements, such as the Baltimore and Ohio (B&O) Railroad, began to appear preceding the Civil War, and continued to expand after the conflict ended. While West Virginia was rich in natural resources like coal and timber, there was a limited ability to extract available resources due to the lack of infrastructure (Rice & Brown, 1993). Once rail lines like the B&O Railroad and the Chesapeake and Ohio (C&O) Railway were completed, the economy of the state was able to pick up, making these resources significant to the history of the state (Chambers Jr., 2004).

During World War I (WWI) and World War II (WWII), West Virginia produced coal for the war, as well as supplied troops for the armed forces (Rice & Brown, 1993). West Virginia suffered during the Great Depression and several New Deal programs were attempted with mixed success (Thomas, 1998). One example was the Civilian Conservation Corps (CCC) construction projects, which left lasting marks on the landscape (Chambers Jr., 2004).

West Virginia has 1,029 NRHP listed sites, as well as 16 NHL (NPS, 2014c). West Virginia contains three NHAs, the Wheeling NHA, National Coal Heritage Area, and a portion of the Journey through Hallowed Ground NHA (NPS, 2015e). Figure 16.1.11-4 shows the locations of NHA and NRHP sites in West Virginia.[136]

[136] See Section 16.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

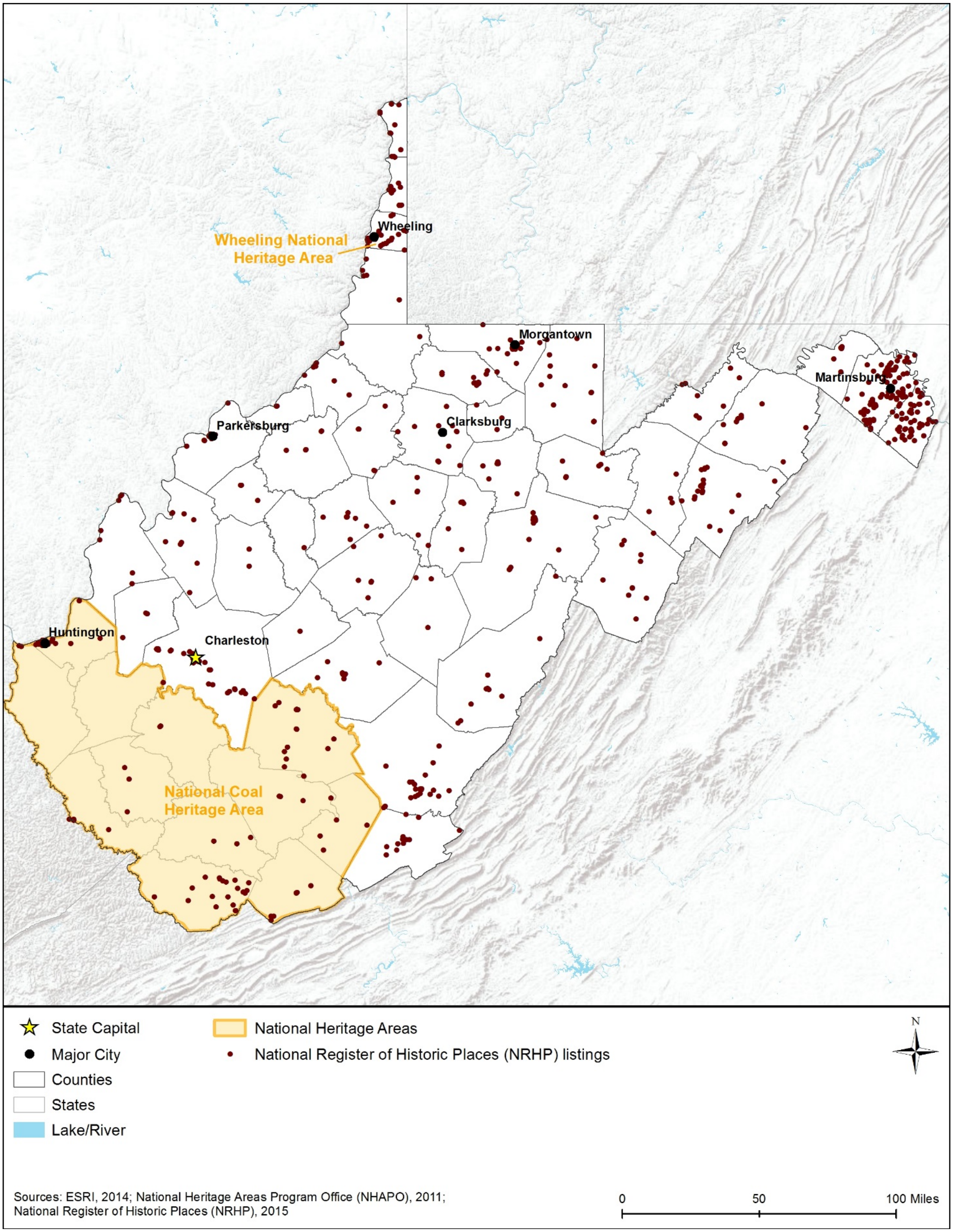

Figure 16.1.11-4: NRHP Sites in West Virginia

16.1.11.8. Architectural Context

European settlement in present-day West Virginia began in the Eastern Panhandle in the early 18th century. Early structures were almost exclusively of log construction. Settlers are also known to have lived inside the hollow trunks of massive trees (American sycamores being common) in the old growth forests, a tendency that lasted into the 19th century is rural areas. As conflict with France erupted over control of the Ohio River Valley, George Washington oversaw the construction of a series of forts to protect the territory, nine of which were located in present-day West Virginia. “A portion of one of the forts is thought to remain at Fort Ashby in Mineral County” (Chambers Jr., 2004).

Most log houses were small single pen dwellings, sometimes containing a garret (attic) for sleeping. “Dogtrot” houses were built as well, providing the residents with an outdoor living space during summer months.[137] Log houses remained the dominant house type in West Virginia well into the late 19th century. As a result, the state does not have as robust of a collection of early house types and styles as neighboring states. While impressive wood-framed or stone houses were built, they were concentrated largely around West Virginia’s borders. Popular housing styles began to appear in the late 19th century, as the coal and lumber industries brought wealth and increased population. Beginning in the early 20th century, “suburban enclaves in Charleston, Huntington, Parkersburg, Wheeling, and Bluefield sported period revival houses in a medley of styles: Georgian Revival, Tudor Revival, Mediterranean Revival, and in a few instances, a genre very appropriate to West Virginia: Log Cabin Revival” (Chambers Jr., 2004).

Beginning in the late 18th century, residents from neighboring states began to vacation in western Virginia to enjoy the state’s mineral springs, which were believed to have medicinal powers. White Sulphur Springs, Sweet Springs, and Salt Sulphur Springs are examples of resort communities (Chambers Jr., 2004). Large resorts were constructed to house wealthy visitors, especially in the 19th century. The Greenbrier in White Sulphur Springs is an example of one of the 19th century resorts, which is still in operation, and showcases high-style Classical Revival architecture (The Greenbrier, 2015).

In 1853, the track for the B&O Railroad was completed between Baltimore, MD, and Wheeling, WV, which connected the eastern seaboard to the Ohio River Valley. The construction of this line presented several engineering challenges, including construction of viaducts to carry the line over uneven terrain. The B&O Railroad spurred development in the southern portion of the state, which directly benefited the mining and timber industries. Beginning in the late 19th century, company towns were built to house workers, and while these towns were often bustling with activity at their height, most disappeared as soon as the resources were exhausted (Chambers Jr., 2004). The town of Cass, built for a former sawmill, is an example that has been restored as a state park. Former sawmill housing is now rented to visitors as vacation homes (Cass Scenic Railroad State Park, 2015).

[137] Dogtrots were essentially two log structures, with a single roof overhead, and an open breezeway space in between the two rooms. Later modifications to these houses often included the enclosure of this central space, resulting in a central passage house.

During the Great Depression, West Virginia benefitted from public works as a result of the CCC and other New Deal programs, many of which are located in state parks and other public areas (Chambers Jr., 2004). Additional examples of prominent architecture include the Trans-Allegheny Lunatic Asylum (built 1858 to 1881), later the Weston State Hospital, which is a massive stone structure located southwest of Morgantown. This NHL is an example of high style Gothic Revival, and operated as a mental hospital (as well as wartime hospital on several occasions) from 1864 to 1994 (Trans-Allegheny Lunatic Asylum, 2015). Charleston, after being chosen to serve as the capital in the 1870s, experienced growth, including the construction of a new state capitol and supporting civic buildings (Chambers Jr., 2004).

Figure 16.1.1-1: Representative Architectural Styles of West Virginia

- Top Left – Log Cabin (Charles Town, WV) – (Historic American Building Survey, 1933)
- Bottom Left – Woodburn Hall (West Virginia University) – (Highsmith, 2015)
- Middle – Coal Mine (Capels, WV) – (Wolcott, 1938)
- Top Right – Holliday-Schaefer House (Wheeling, WV) – (Library of Congress, 1933)
- Bottom Right – Railroad Viaduct (B&O Railroad, Marshall County, WV) – (Historic American Engineering Record, 1968)

16.1.12. Air Quality

16.1.12.1. 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[138] 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)[139] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[140] This section discusses the existing air quality in West Virginia. The USEPA designates areas within the United States as attainment,[141] nonattainment,[142] maintenance,[143] or unclassifiable[144] 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.

16.1.12.2. 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[145] or secondary,[146] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E. West Virginia has not established its own ambient air quality standards, but rather adopts the NAAQS (WVDEP, 2014a).

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

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

[140] 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, 2015a)

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

[142] 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, 2015i).

[143] 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, 2015i)

[144] 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, 2015i)

[145] 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)

[146] 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 HAPs (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

Title V Operating Permits/State Operating Permits

West Virginia 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. The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws." (USEPA, 2015j) West Virginia Title 45 Code of State Rules (CSR) Series 30, Section 3, describes the applicability of Title V operating permits. WVDEP 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 16.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 16.1.12-1: 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

Stationary sources that emit below the major source thresholds (see Table 16.1.12-1), and are not defined as a major source under 45 CSR 30, Section 2.26, are non-major stationary sources. These non-major sources will be exempt from obtaining a Title V operating permit. Included in these exempt sources are portable generators operating within a major stationary source. (WVDEP, 2015f)

For non-major source construction and modification, 45 CSR 13, Section 5.1, allows for the following actions prior to obtaining a permit to construct including:

- "Clear land;
- Grub stumps, roots and other natural impediments to site development;
- Excavate, grade and compact topsoil to establish temporary and final grade;
- Dig and construct foundations and/or caissons and grade beams;
- Demolish existing structures, provided that all activity must comply and comport with all existing state and federal regulations…;

- Upgrade the utility support facilities, provide that in no instance shall these upgrades cause or contribute to new or increased emissions unto themselves or increase emissions from any other unit; …" (WVDEP, 2009).

Temporary Emissions Sources Permits

For major stationary sources, under 45 CSR 30, Section 5.5, West Virginia DEP can issue a temporary operating permit as "a single permit authorizing emissions from similar operations by the same source owner or operator at multiple temporary locations. The operation must be temporary and involve at least one change of location during the term of the permit." (WVDEP, 2015f)

State Preconstruction Permits

West Virginia's preconstruction permit program applies to new major stationary sources or new major modifications of any existing major stationary source. For the purpose of the prevention of significant determination, 45 CSR 14 outlines the reporting and monitoring requirements for new or modified major sources in areas designated as attainment or unclassifiable. Sources in areas designated as nonattainment or maintenance must comply with the conditions and requirements of 45 CSR 19 to ensure there will be no significant impact to the surrounding air quality or exceedance of the NAAQS. Additionally, 45 CSR 13 requires new or modified non-major stationary sources to obtain a permit to construct and operate.

General Conformity

Established under Section 176(c)(4) of the CAA, the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality outlined in the state implementation plan (SIP) (USEPA, 2013b). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis*[147] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 16.1.12-2). Lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

[147] Small amount or minimal.

Table 16.1.12-2: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Other areas outside an OTR	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

Source: (U.S. Government Publishing Office, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 16.1.12-2, 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 16.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity,[148] 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, 2010a).

State Implementation Plan Requirements

West Virginia's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. West Virginia's SIP is a conglomeration of separate actions taken for each of the pollutants. All of West Virginia's SIP actions are codified under 40 CFR Part 52 Subpart XX. A list of all SIP actions are found on the West Virginia Secretary of State's at https://apps.sos.wv.gov/adlaw/csr/, under the CSR.

[148] Conformity: Compliance with the SIP.

16.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Area

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 16.1.12-1 and Table 16.1.12-3, below, present the current nonattainment areas in West Virginia as of January 30, 2015. Table 16.1.12-3 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 the date(s) when USEPA promulgated the ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g. $PM_{2.5}$ and O_3). Unlike Table 16.1.12-3, Figure 16.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ are merged in the figure and presented as a single pollutant.

Table 16.1.12-3: West Virginia 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
Berkeley						M					
Brooke					M	M	M	M			X-6
Cabell						M		M			
Hancock					M	M	M	M		M	
Kanawha						M	M	M			
Marshall						M		M			X-6
Mason						M					
Ohio						M		M			
Pleasants						M					
Putnam						M	M	M			
Wayne						M		M			
Wood						M		M			

Source: (USEPA, 2015k)

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

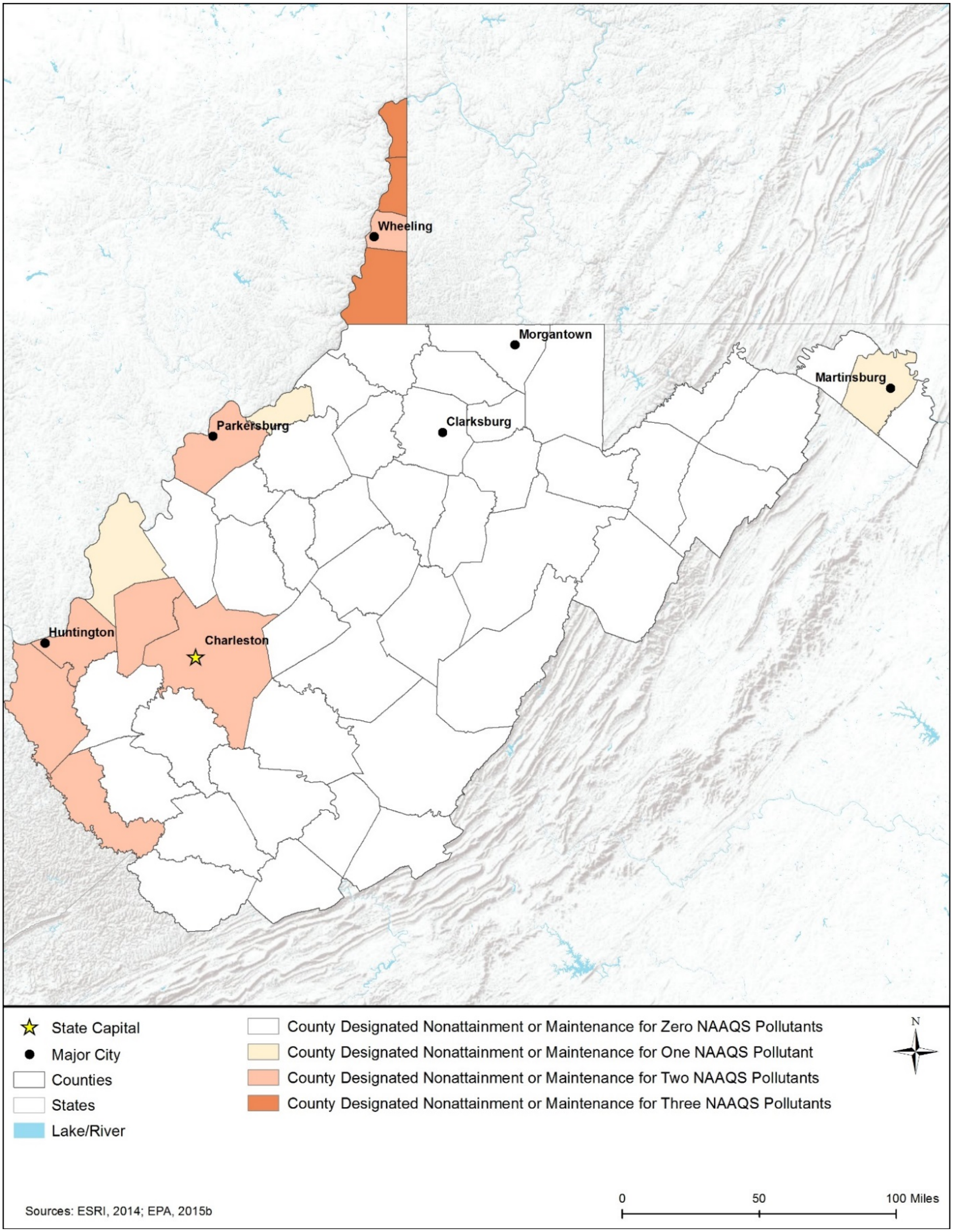

Figure 16.1.12-1: Nonattainment and Maintenance Counties in West Virginia

Air Quality Monitoring and Reporting

The West Virginia DEP measures air pollutants at 22 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Every five years the West Virginia DEP prepares an *Air Monitoring Network Assessment* report, containing pollutant data summarized by region. The most recent assessment published to the DEP webpage is from 2010. Additionally, West Virginia DEP reports real-time pollution levels of O_3 and $PM_{2.5}$ at http://www.dep.wv.gov/daq/air-monitoring/Pages/AirQualityIndex.aspx, as O_3 and $PM_{2.5}$ are pollutants of concern in West Virginia. Throughout 2014, no criteria pollutants exceed federal standards.

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[149] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (USEPA, 2012a). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[150] (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).

West Virginia contains two Federal Class I areas, and the reminder of the state is designated as a Class II area (WVDEP, 2015b). 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

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

air quality within 100 kilometers from the source (USDOT, 2015j). Virginia also has two Class I areas where the 100-kilometer buffer intersects West Virginia counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 16.1.12-2 provides a map of West Virginia 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 16.1.12-2 correspond to the numbers and Class I areas listed in Table 16.1.12-4.

Table 16.1.12-4: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	James River Face Wilderness	8,886	VA
2	Shenandoah National Park	211,904	VA
3	Otter Creek Wilderness	20,698	WV
4	Dolly Sods Wilderness	17,371	WV

Source: (USEPA, 2012b)

[a] The numbers correspond to the shaded regions in Figure 16.1.12-2.

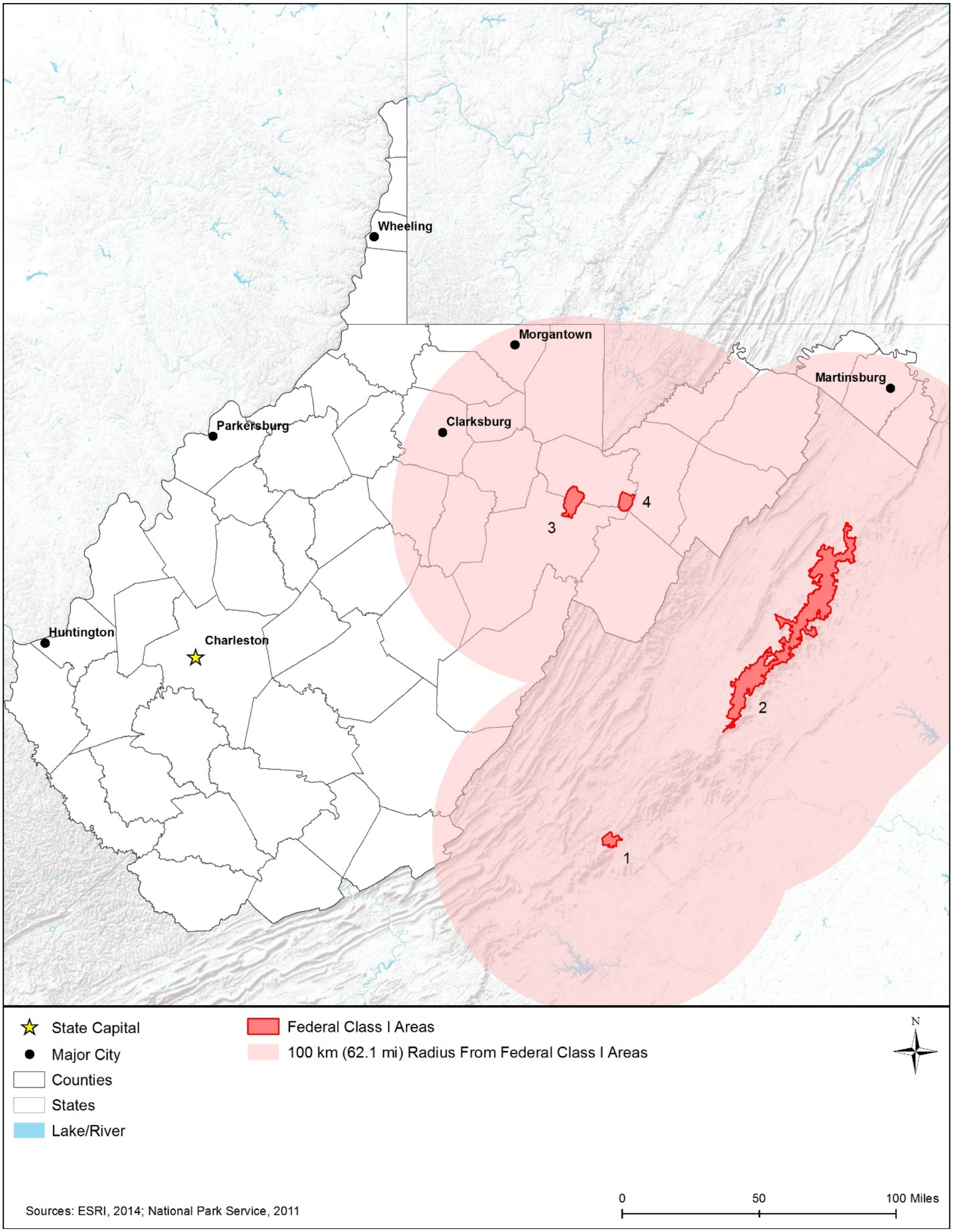

Figure 16.1.12-2: Federal Class I Areas with Implications for West Virginia

16.1.13. Noise

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

16.1.13.1. Definition of the Resource

Noise is a form of sound 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, 2015h). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2013).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 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 16.1.13-1 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.

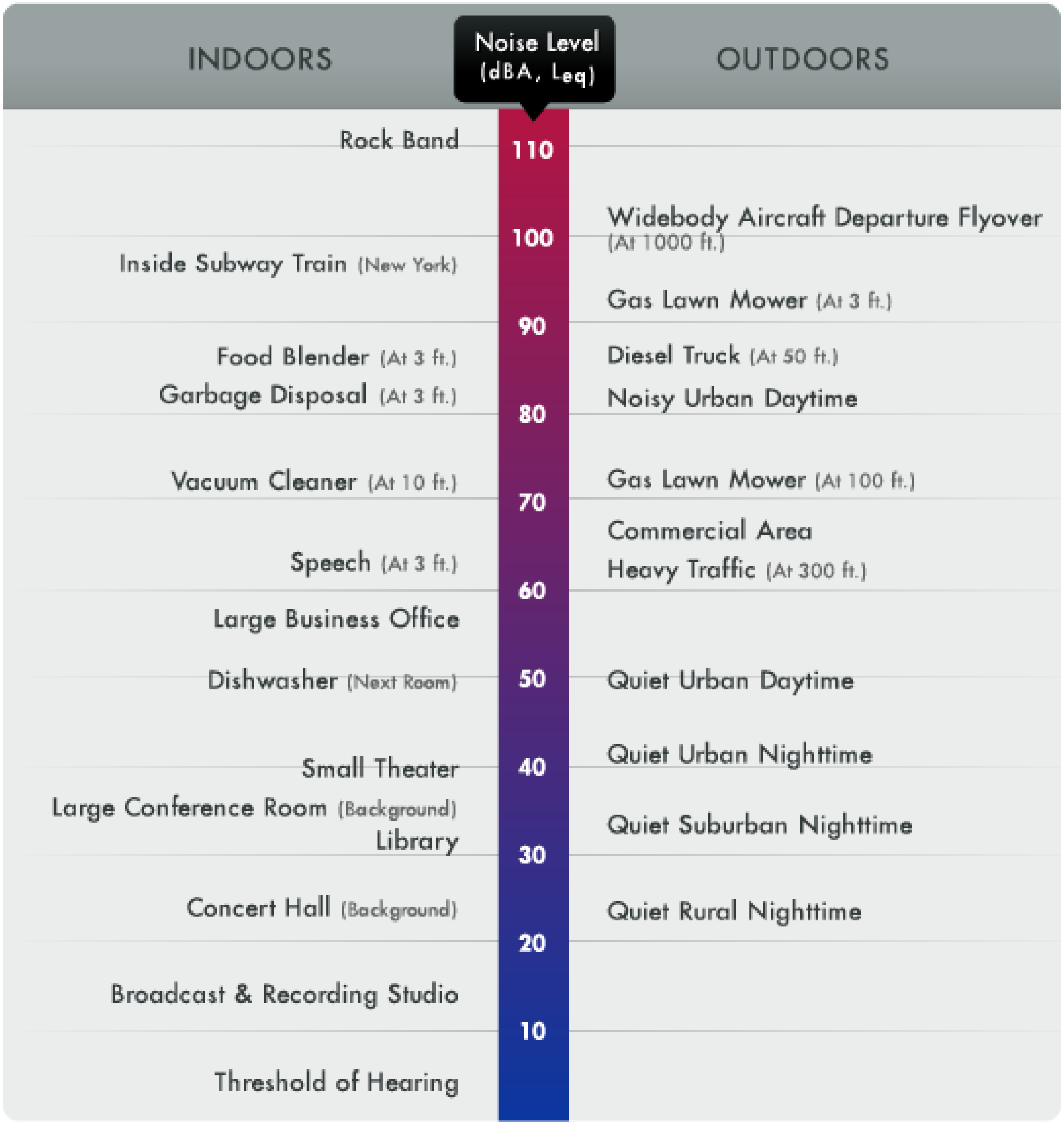

Figure 16.1.13-1: Sound Levels of Typical Sounds

Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton, 2005.

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 (FTA, 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 causes 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.

16.1.13.2. 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.

West Virginia has statewide laws that regulate noise from motor vehicles (West Virginia Legislature, 2015a). 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 are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (USDOT, 2011). Table 16.1.13-1 summarizes the state noise laws for West Virginia.

Table 16.1.13-1: Relevant West Virginia Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
17C-15-34	State of West Virginia	Established regulations for motor vehicle equipment to respect not-to-exceed noise limits.

Source: (West Virginia Legislature, 2015a)

16.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in West Virginia varies widely based on the area and environment of the area. The population of West Virginia can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 16.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of West Virginia may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to West Virginia. As such, this section describes the areas where the population of West Virginia 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) (USDOI, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Charleston, Huntington, Parkersburg, and Morgantown.

- **Airports:** Areas surrounding airports tend to have higher noise levels 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 is in proximity to urban communities, resulting in noise exposure from aircraft operations (arrivals/departures) to the surrounding areas at higher levels and 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 West Virginia, CRW, HTS, North Central West Virginia Airport (CKB), and Morgantown Municipal-Walter L Bill Hart Field (MGW) have combined annual operations of more than 132,000 flights, with CRW and MGW accounting for approximately 47,000 and 45,000 annual flights, respectively (FAA, 2015i). These operations result in increased ambient noise levels in the surrounding communities. See Section 16.1.1, Infrastructure, 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 (USDOT, 2015j). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (USDOT, 2015j). See Section 16.1.1, Infrastructure, 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 (FTA, 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 (USDOT, 2015k). West Virginia has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Washington, DC and Chicago, IL through the West Virginia cities of Harpers Ferry and Martinsburg, or through the West Virginia cities of White Sulphur Springs, Alderson, Hinton, Prince, Thurmond, Montgomery, Charleston, and Huntington. There are also a number of other rail corridors that join these major rail lines and connect with other cities (WVDOT, 2013). See Section 16.1.1, Infrastructure, 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" (Freimund 2009), which are regions that are given legal safeguards in order to maintain biological diversity and natural resources (NPS, 2013). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014e). West Virginia has six national parks and 15 National Natural Landmarks (National

Parks Conservation Association, 2015) (NPS, 2014c). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 16.1.8, Visual Resources, and Section 16.1.7, Land Use, Airspace, and Recreation, for more information about national and state parks for West Virginia.

16.1.13.4. 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 (USDOI, 2014). Most cities and towns in West Virginia 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 throughout the State of West Virginia.

16.1.14. Climate Change

16.1.14.1. Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (IPCC, 2007).

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012d). 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), 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[151]), 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 tons (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

[151] 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, 2015l)

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 16.2.14, 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).

16.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. West Virginia has not established goals and regulations to reduce GHG emissions to combat climate change.

"The West Virginia Division of Air Quality (DAQ) does not currently require sources to report their GHG emissions directly to DAQ. The DAQ will obtain the federal GHG data being collected rather than requiring sources to report GHG data to the State as well as to EPA" (WVDEP, 2015g).

16.1.14.3. West Virginia Greenhouse Gas Emissions

Estimates of West Virginia's total GHG emissions vary. The U.S. Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as CH_4 and N_2O, but not at the state level (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015m). Individual states have developed their own GHG inventories, which are updated with different frequencies and trace GHG in a variety of ways.

For the purposes of this PEIS, the EIA data on CO_2 emissions from fossil fuels will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH_4, they will be described and cited.

According to the EIA, West Virginia emitted a total of 93.3 MMT of CO_2 in 2013 from fossil fuels, most which came from coal used in the electric power sector (Table 16.1.14-1) (EIA, 2015e). Annual emissions between 1980 and 2013 are displayed in Figure 16.1.14-1 (EIA, 2015e). Between 1980 and 2013 West Virginia's GHG emissions increased to a maximum of 115.8 MMT in 2002, albeit with periodic drops in 1982, 1991, 2001, and 2008. Emissions in 2012 were the lowest they have been since EIA started collecting and reporting data for West Virginia. The decline was dominated by reductions in emissions from coal, with emissions from natural gas and petroleum products remaining constant, even in the years when total emissions experienced significant decreases. CO_2 emissions increased slightly in 2013. In 2013 West Virginia ranked 22nd among the fifty states and the District of Columbia for total CO_2 emissions, and 3rd for per-capita CO_2 emissions (EIA, 2015f) after Wyoming and North Dakota, both of which are large coal-producing and burning states.

Table 16.1.14-1: West Virginia CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	72.8	Residential	1.9
Petroleum Products	12.5	Commercial	1.6
Natural Gas	8.0	Industrial	10.4
		Transportation	10.7
		Electric Power	68.7
TOTAL	**93.3**	**TOTAL**	**93.3**

Source (EIA, 2015e)

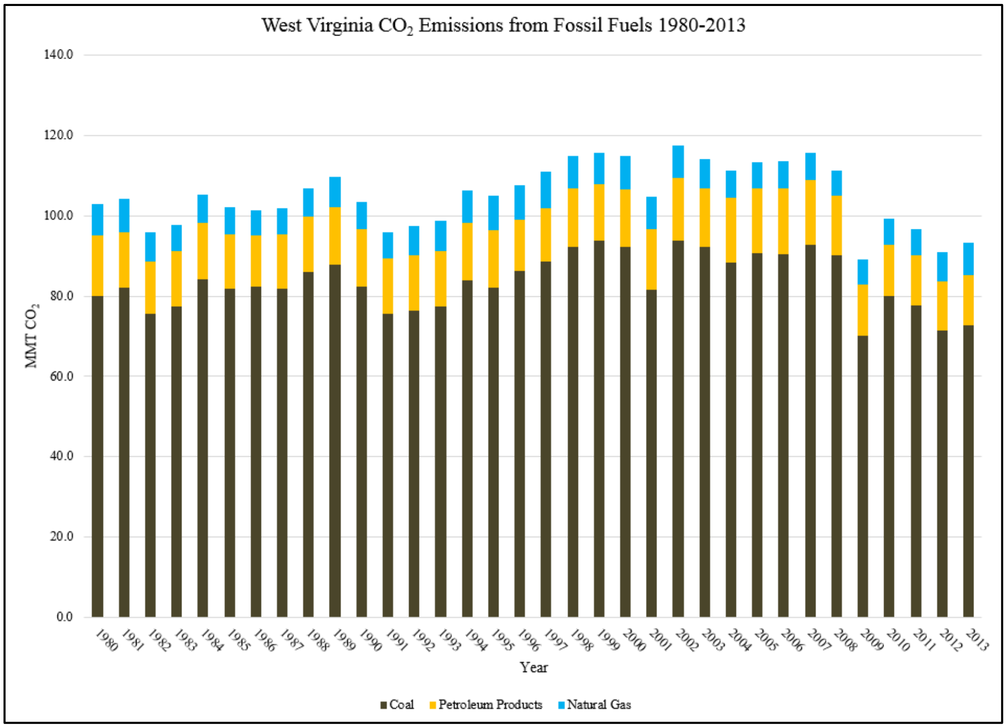

Figure 16.1.14-1: West Virginia CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015e)

The State of West Virginia does not maintain a GHG inventory so there is limited state-level data on emissions other than CO_2 (WVDEP, 2016). The only GHG inventory available in West Virginia is in Morgantown, which also is home to the University of West Virginia. According to this inventory, GHG emissions for Morgantown total approximately 0.8 million MMT, which is less than 1 percent of the state total (Downstream Strategies, 2014). West Virginia is the second-largest coal producer in the U.S. and provides roughly 5 percent of the United States energy (EIA, 2015g).

Total U.S. GHG emissions were 6,673 MMT (14.7 trillion pounds) in 2013. Emissions came from energy related activities across all sectors such residential, commercial, industrial, transportation, agriculture and, forestry and waste (EIA, 2014). The majority of West Virginia's GHG emissions (82 percent) is CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing electricity. Other GHGs emitted in West Virginia are methane, nitrous oxide, and fluorinated gases such as hydrofluorocarbons sulfur hexafluoride and, perfluorocarbons (EIA, 2014).

West Virginia was ranked the second highest state in 2010 for total coal production with roughly 96 percent of its electricity being produced from coal-fired power plants (Downstream Strategies, 2014). Less than five percent of the electricity in West Virginia comes from wind, hydropower, or natural gas (EIA, 2014).

16.1.14.4. Environmental Setting: Existing Climate

The National Weather Service 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).

The majority of West Virginia falls into climate group (C) (see Figure 16.1.14-2). Climates classified as (C) are generally warm, with humid summers and mild winters. During summer months, thunderstorms are the dominant form of precipitation. Whereas the majority of West Virginia falls into climate group (C), a small area of the state is classified within climate group (D). Climates classified as (D) are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011a). In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (ºF), while the coldest month is less than negative 22 °F" (NWS, 2011a). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011a) (NWS, 2011b).

Although West Virginia is small, the state possesses many distinct climate characteristics due to its two "panhandles" (Law K. , 2015). The northern panhandle "extends north of Pittsburgh, PA and the eastern panhandle that extends approximately 50 miles from Washington, D.C." (Law K. , 2015). The southernmost point in West Virginia is an approximate 70 miles from North Carolina's border, while the "westernmost point extends further west than Port Huron, MI" (Law K. , 2015). The large stretch of Allegheny Mountains also contributes to distinct climates throughout the state (Law K. , 2015).

West Virginia has three sub-climate categories, which are described in the following paragraphs.

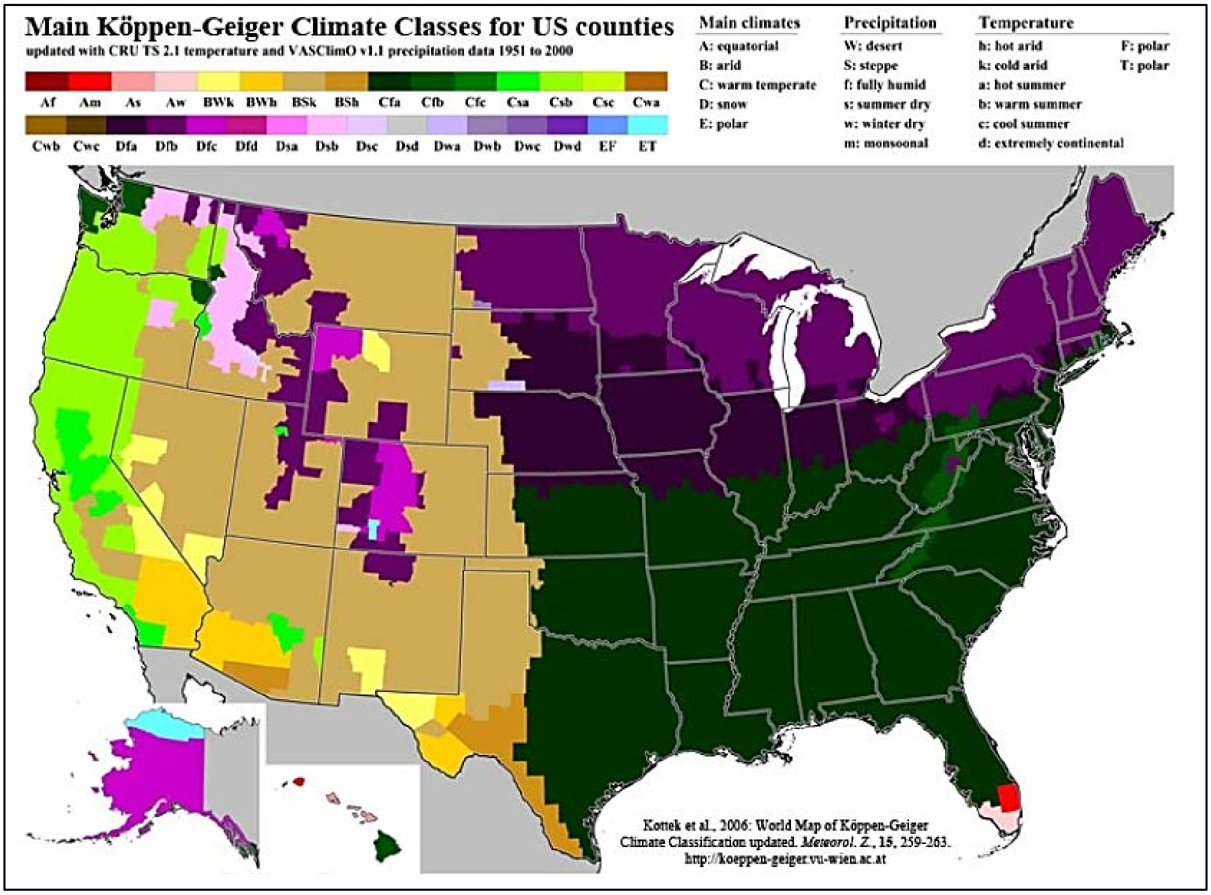

Figure 16.1.14-2: Köppen-Geiger Climate Classes for US Counties

Source: (Kottek, 2006)

Cfa – The Köppen-Geiger climate classification system classifies a little over half of West Virginia, as Cfa. Cfa climates are generally mild, with no dry seasons and hot summers. West Virginia’s secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. 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 (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011a) (NWS, 2011b).

Cfb – Portions of eastern, central, and southeastern areas of the state, such as Morgantown, Summerville, and Fayetteville are classified as Cfb. Climates classified as Cfb are generally mild, with no dry seasons and warm summers. West Virginia’s secondary classification indicates “year around equally spread rainfall” (NWS, 2011b). Virginia’s tertiary classification indicates that at least four months out of the year averaging above 50 °F (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011a) (NWS, 2011b).

Dfb – A small portion of northeastern West Virginia, such as Elkins and the Monongahela National Forest, classified as Dfb. Climates classified as Dfb are characterized as humid, with warm summers and severe winters. As with the other climates in West Virginia, there is no dry season in this climate classification zone (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011a) (NWS, 2011b).

This section discusses the current state of West Virginia's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in West Virginia's three climate regions, Cfa, Cfb, and Dfb.

Air Temperature

Temperatures in West Virginia average 51.6 °F, with a natural increase in temperature as you move southward in the state (NOAA, 2015b). Average temperatures in West Virginia range from "the upper 50's in the southern coalfields to the mid-40's in the mountains," as elevation changes lead to "a decrease of approximately 5 to 10 °F" (Law K. , 2015). Winters in West Virginia average approximately 32 °F, while the summers average approximately 70 °F. The highest temperature to occur in West Virginia was on August 4, 1930 and July 10, 1936 with a record high of 112 °F (NOAA, 2015c). The coldest temperature to occur in West Virginia was on December 30, 1917 with a record low of negative 37 °F (NOAA, 2015c).

Cfa – Charleston, the state capital, is located within the climate classification zone (Cfa). The average annual mean temperature for this area is approximately 51.6 °F; 34.5 °F during winter months; 72.6 °F during summer months; 53.2 °F during spring months; and 55.1 °F during autumn months. The average temperature throughout the entire eastern piedmont region is approximately 56.5 °F (NOAA, 2015b) (NOAA, 2015d).

Cfb – Portions of eastern, central, and southeastern areas of the state, such as Morgantown and Summersville, are classified as Cfb. The average annual mean temperature for Morgantown is 52.3 °F; 32.1 °F during winter months; 71.4 °F during summer months; 50.8 °F during spring months; and 54.4 °F during autumn months. The average annual mean temperature for Summerville is 50.8 °F; 31.8 °F during winter months; 68.6 °F during summer months; 49.6 °F during spring months; and 52.7 °F during autumn months (NOAA, 2015b) (NOAA, 2015d).

Dfb – A small portion of northeastern West Virginia, such as Elkins and the Monongahela National Forest, classified as Dfb. The average annual mean temperature for Elkins is 46.1 °F; 27.0 °F during winter months; 64.6 °F during summer months; 45.2 °F during spring months; and 48.3 °F during autumn months (NOAA, 2015b) (NOAA, 2015d).

Precipitation

On average, the state of West Virginia receives approximately 44 inches of precipitation annually (Law & Mogil, 2011). However, the topography within West Virginia varies substantially, thereby influencing statewide precipitation patterns. "Beginning at westernmost points near Huntington and along the Ohio River, where the elevation is approximately 500 feet, precipitation values average near 40 inches per year" (Law & Mogil, 2011). Areas with higher elevations, such as the Ohio River watershed, experience annual precipitation values up to 50 inches, "with a major contribution linked to the orographic uplift" (Law & Mogil, 2011). Moving farther eastward, elevation continues to increase dramatically, "reaching altitudes of up to 3,500 feet across the Allegheny Plateau" (Law & Mogil, 2011). This ridge-and-valley region of West Virginia receives the highest annual precipitation values of the state. The driest area of the state, the South Branch Valley, receives “less than 36 inches of precipitation” annually (Law & Mogil, 2011). The greatest 24-hour precipitation accumulation to occur in West Virginia was on June 18, 1949 with a total accumulation of 12.02 inches (NOAA, 2015c).

In addition to rainfall, West Virginia’s cool mountain temperatures have led to “some of the highest snowfall totals east of the Mississippi River” (Law K. , 2015). Annual snowfall in West Virginia ranges from 12 to 24 inches in southwestern lowland areas, while reaching “greater than 72 inches in the mountains” (Law & Mogil, 2011). “West Virginia is the southernmost state in the east that experiences snowfall amounts this great” (Law & Mogil, 2011). During a particularly snowy winter in 2009, over 200 inches fell in the mountains of West Virginia, with over 100 inches falling during the month of February alone. During another large snowfall event, approximately 301.4 inches of snowfall was recorded in Kumbrabow State Forest during the winter of 1959 to 1960. The greatest 24-hour snowfall accumulation to occur in West Virginia was on January 27 through January 28, 1998 with a total accumulation of 35 inches (NOAA, 2015c) (Law & Mogil, 2011).

“Other state snowfall records include the single storm accumulation of 57 inches at Pickens, during the infamous Great Appalachian Storm of 1950 and the 24-hour snowfall of 35 inches that fell in Flat Top in 1998” (Law K. , 2015). However, although abundant snowfall is common in the mountainous areas of West Virginia, these examples are “not representative of much of the state as the lowlands have mild winters when it comes to snowfall” (Law K. , 2015).

Cfa – Charleston, the state capital, is located within the climate classification zone (Cfa). The average annual precipitation accumulation for this area is 46.22 inches; 10.15 inches during winter months; 13.05 inches during summer months; 13.28 inches during spring months; and 9.74 inches during autumn months. In lower, southwest areas of the state, such as Huntington, snowfall averages are approximately 12 to 24 inches. “Snowfall totals gradually increase toward the northeast due to the orographic uplift of the mountains” (Law K. , 2015) (NOAA, 2015b) (NOAA, 2015d).

Cfb – Portions of eastern, central, and southeastern areas of the state, such as Morgantown and Summersville are classified as Cfb. The average annual precipitation accumulation for Morgantown is 41.83 inches; 8.31 inches during winter months; 12.28 inches during summer months; 11.78 inches during spring months; and 9.45 inches during autumn months. The average annual precipitation accumulation for Summersville is 47.85 inches; 10.04 inches during winter months; 14.90 inches during summer months; 12.84 inches during spring months; and 10.07 inches during autumn months (NOAA, 2015b) (NOAA, 2015d).

Dfb – A small portion of northeastern West Virginia, such as Elkins and the Monongahela National Forest, classified as Dfb. The average annual precipitation accumulation for Elkins is 45.93 inches; 9.59 inches during winter months; 13.60 inches during summer months; 12.88 inches during spring months; and 9.86 inches during autumn months. Concerning snowfall, Elkins is located “on the western slopes of the Alleghenies” and receives an approximate 60 inches of snowfall annually. In addition to snowfall and precipitation, Elkins also reports an average of 212 days of heavy cloud cover. “Elkins is the second cloudiest location east of the

Mississippi River," directly following Mount Washington (Law K. , 2015). Elkins also compares with other "notoriously cloudy locations such as Seattle and Portland" (Law K. , 2015) (NOAA, 2015b) (NOAA, 2015d).

Severe Weather Events

West Virginia experiences "a wide array of severe weather including thunderstorms and snowstorms" (Law & Mogil, 2011). Tornadoes in West Virginia are rare due to varying topography, with an average of only two per year. Flooding is by far "the deadliest and costliest" severe weather event that occurs within the state of West Virginia (Law & Mogil, 2011). Annually, heavy precipitation over the steep, rocky topography leads to severe flooding or flash flooding events throughout the state (Law & Mogil, 2011). Two of the state's most historic and catastrophic flooding events occurred in 1937 and 1985 (Law & Mogil, 2011).

In 1937, the Great Ohio River Flood devastated southwestern West Virginia. At the peak of the flooding event, the Huntington River crested at 69 feet (19-feet above flood stage). In addition, heavy rainfall occurred between January 13 and 25, leading to an addition 6 to 12 inch accumulation throughout the region. This flood left an estimated 6,000 people homeless, five dead, and resulted in over $18 million (in 1937 dollars) in damages (Law & Mogil, 2011).

In 1985, "the remnants of Hurricane Juan" led to continuous rainfall throughout much of the state. On November 5, five inches of rain was recorded in West Virginia's mountainous areas. "The resulting flash flooding was intensified as water was channeled through relatively narrow valleys and canyons" (Law & Mogil, 2011). During this flood, the "Cheat and Greenbrier rivers crested at record levels" (NOAA, 2015e). In Parsons, the Cheat River "crested 10 feet above flood stages and 4 feet higher than the previous record from July 1888" (NOAA, 2015e). This flood resulted in the severe damage of several towns, the destruction of 3,500 homes, 47 deaths, and an estimated $570 million in damages (NOAA, 2015e) (Law & Mogil, 2011).

Severe snowstorms are also common throughout West Virginia's history. For example, during the Great Appalachian Storm of 1950, "most of the state reported at least 24 inches of snow" (Law & Mogil, 2011). Cities such as Elkins reported almost 30 inches; Parkersburg 34 inches; Pickens 57 inches; and Coburn Creek 62 inches. Another historical event, the 24-hour March Super storm of 1993, left the majority of West Virginia under at least 12 inches of snow; western areas of the state reported as much as 24 to 48 inches. As temperatures began to rise, heavy snowpack and snowmelt lead to more flooding throughout the state (Law & Mogil, 2011).

16.1.15. Human Health and Safety

16.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety; (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation, vehicular traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 16.1.15, Human Health and Safety.

16.1.15.2. 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 West Virginia, occupational safety is regulated by the WVDOC, Division of Labor Safety Section (WVDOL), and the WVDEP regulates waste and environmental pollution, as well as Abandoned Mine Lands (AML) reclamation. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. West Virginia does not have an OSHA-approved “State Plan,” so private and OSHA enforces public sector occupational safety and health regulations. However, West Virginia’s Occupational Safety and Health Act adopts federal standards for the state. The West Virginia Department of Health and Human Resources (WVDHHR), Bureau regulate health and safety of the public for Public Health (WVBPH) and the Office of Environmental Health Services (WVOEHS).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 16.1.15-1 below summarizes the major West Virginia laws relevant to the state’s occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 16.1.15-1: Relevant West Virginia Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Code §64-3-1(g); Title 33-20	West Virginia Department of Environmental Protection (WVDEP), Division of Water and Waste Management	Describes the state program for regulating the generation, treatment, storage, and disposal of hazardous waste to protect the public safety and environment.
West Virginia Code §22-18 and §22-11; Title 33-23	WVDEP, Division of Water and Waste Management	Provides a standard for the protection of groundwater that applies to hazardous waste management facilities.
West Virginia Code §64-3-1(n); Title 38-02	WVDEP, Office of Mining and Reclamation	Describes rules for the permit application process, land use, subsidence control, and designation of unsuitable areas for surface mine reclamation.

State Law/Regulation	Regulatory Agency	Applicability
West Virginia Code §64-3-1(k); Title 60-03	WVDEP, Secretary's Office	Details eligibility standards and procedures required for state voluntary cleanups and brownfield cleanups.
West Virginia Code §64-10-03; Title 42-15	West Virginia Department of Commerce, Division of Labor Safety Section (WVDOL)	Established workplace safety and health standards adopted from federal standards, and provides for state safety inspections and investigations.
West Virginia Code §64-8-2; Title 157-7	West Virginia Department of Transportation, Division of Highways	Rule that applies to transporters of hazardous waste, requiring a manifest.

16.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks are often performed at dangerous heights or confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slip, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights exceeding 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, and the 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[152] 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. (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

[152] 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.

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 and splicing activities, and can penetrate exposed skin. (International Finance Corporation, 2007) Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation (e.g., manholes) presents risk of fire or explosion (Fiber Optic Association, 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 16.1.13, 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. 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

The BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), and telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

As of May 2014, West Virginia employed 730 telecommunication line installation and repair workers, and 720 telecommunication equipment installers and repairers (14,270 employees) in the United States (Figure 16.1.15-1) (BLS, 2015c). In 2013, the most recent year that data are available, West Virginia had no reportable cases of nonfatal occupational injuries or illnesses in the telecommunications industry (BLS, 2013). However, the year before, West Virginia had 2.7 reportable cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2012). By comparison, there were 2.1 nonfatal occupational injuries or illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014a).

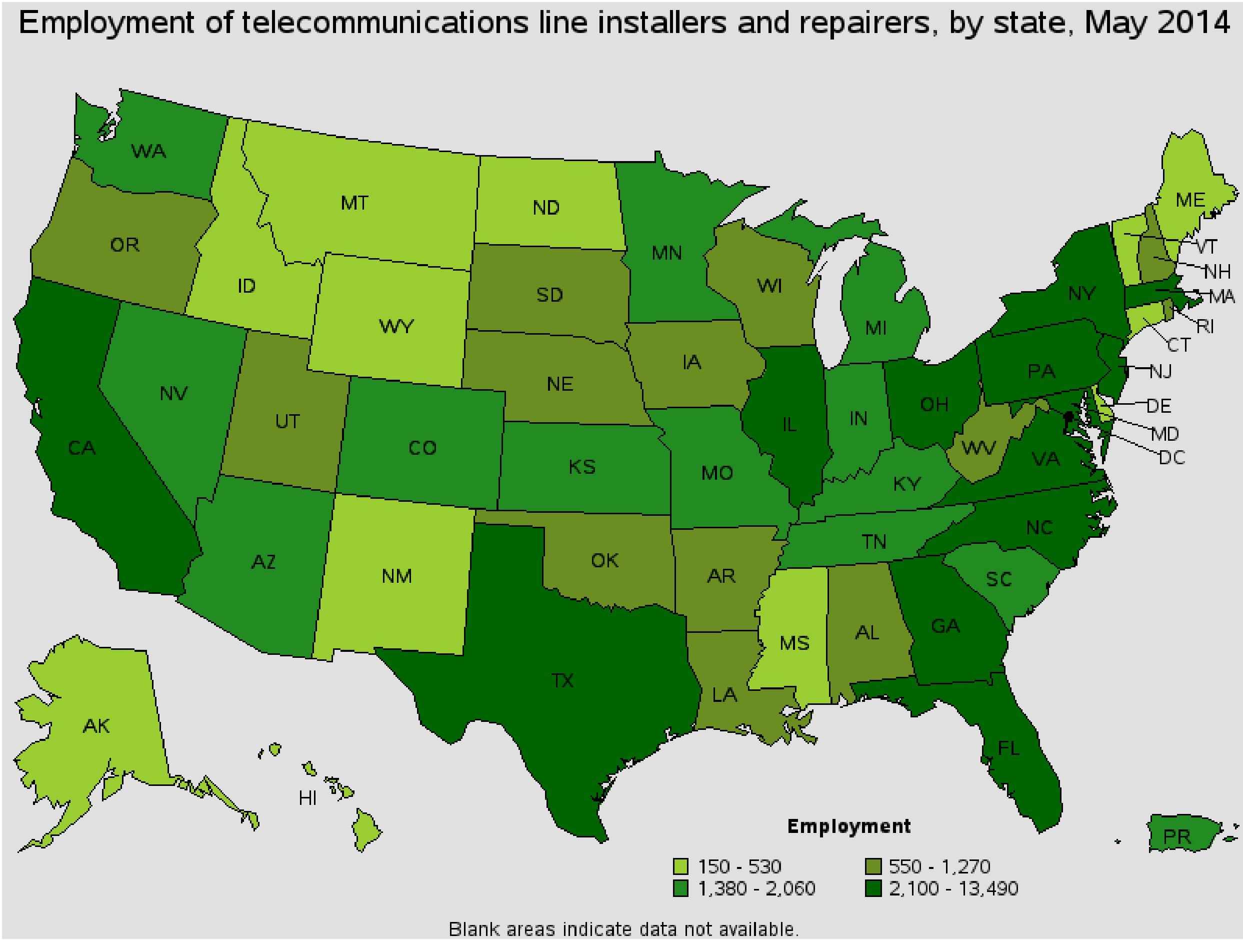

Figure 16.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015d)

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (five due to violence and other injuries by persons or animals; three due to transportation incidents; and seven due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2015e). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Since 2003, when data are first available, West Virginia had one occupational fatality in the telecommunications line installers and repairers occupation (a subset of the industry) in 2011 (BLS, 2011). By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 67 total fatalities in West Virginia between 2003 and 2013, with the highest being 11 fatalities in 2007 (BLS, 2015f).

Public Health and Safety

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

16.1.15.4. Environmental Setting: Contaminated Properties at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of site occupants at telecommunication sites, prior to creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program 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 West Virginia, State Superfund Program assists the USEPA with Superfund sites within West Virginia (WVDEP, 2015h). The West Virginia Division of Land Restoration, Office of Environmental Remediation is responsible for contaminated sites in the state. As of September 2015, West Virginia has 41 RCRA Corrective Action sites[153], 227 brownfield sites, and 9 proposed or final Superfund/NPL sites (USEPA, 2015n). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, West Virginia has no Superfund/NPL or RCRA Corrective Action sites where human exposure is not under control. However, West Virginia has one Superfund/NPL site (Big John Salvage Incorporated) where groundwater contamination mitigation is not under control (USEPA, 2015o). The Voluntary Remediation Program was created by the Voluntary Remediation and Redevelopment Act and follows the Voluntary Remediation and Redevelopment Rule described in West Virginia Administrative Code Title 60, Series 3, which encourages voluntary cleanup and redevelopment of contaminated sites to promote economic development (WVDEP, 2015i).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the

[153] Data gathered using EPA's CIMC search on September 24, 2015, for all sites in West Virginia, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active). (USEPA, 2015n)

majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of September 2015, West Virginia had 181 TRI reporting facilities. According to the USEPA, in 2013, the most recent data available, West Virginia released 37,999,593 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the electric utilities industry. This accounted for 0.92 percent of total nationwide TRI releases, ranking West Virginia 13 of 56 states and territories (USEPA, 2014c).

Another USEPA program is the NPDES, which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment.

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015). Figure 16.1.15-2 provides an overview of potentially hazardous sites in West Virginia.

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, West Virginia had one occupational fatality in 2011 within the telecommunications line installers and repairers occupation from exposure to "harmful substances or environments," representing 16.6 percent of the total six exposure-related occupational fatalities that year (BLS, 2011). By comparison, the Bureau of Labor Statistics reported three fatalities in 2011 and three preliminary fatalities[154] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015g). In 2014, BLS also reported four preliminary fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) nationwide due to exposure to harmful substances or environments (BLS, 2014b).

[154] 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, 2015h).

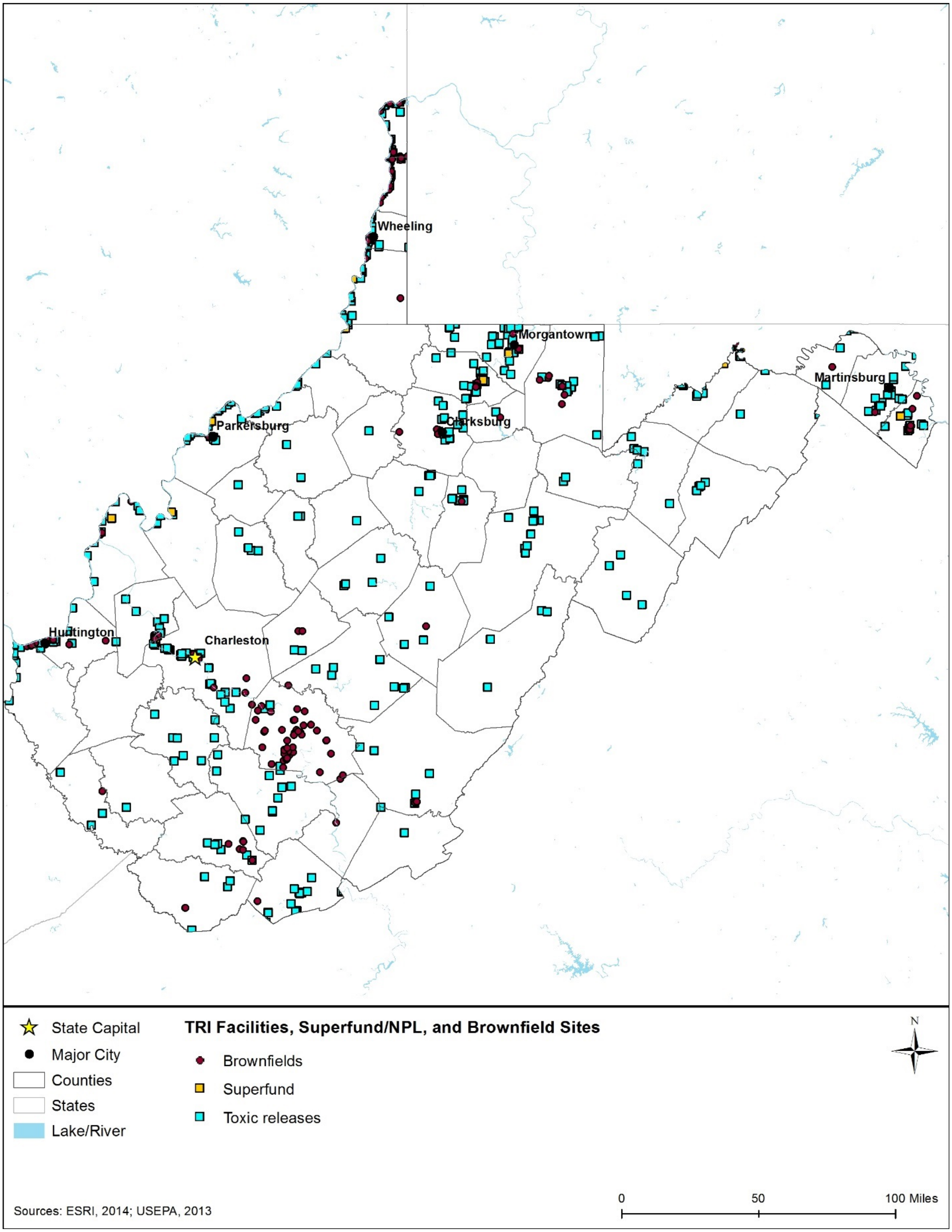

Figure 16.1.15-2: Superfund/NPL Brownfield Sites, and TRI Facilities in West Virginia

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 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 WVBPH and WVOEHS are responsible for collecting public health data resulting from exposure to environmental contamination, and provide publicly available health assessments and consultations for documented hazardous waste sites (WVDHHR, 2006).

Spotlight on West Virginia Superfund Sites: Sharon Steel Corp (Fairmont Coke Works)

The Fairmont Coke Works site in Fairmont, WV, is a 107-acre site located near the Monongahela River, about 57 acres of which were used for fuel processing, water treatment, and waste disposal. The facility was originally constructed in 1918 by the Standard Oil Company to produce coke, a fuel derived from coal. Operational wastes such as tars and sludge were disposed of in ponds and pits throughout the site. The Sharon Steel Corporation began cleanup of the site in 1990 by removing 2.2 million pounds of waste tar from on-site sludge disposal areas. U.S. EPA began a cleanup effort in 1993 by removing additional sludge and 330,000 gallons of wastewaters. (USEPA, 2008)

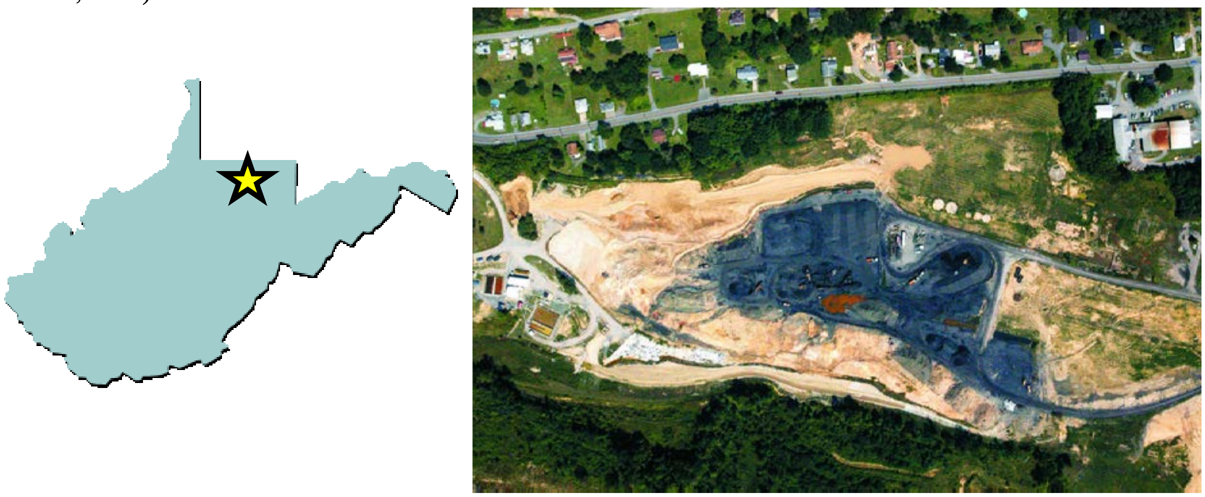

Figure 16.1.15-3: Aerial Photo of Fairmont Coke Works Cleanup

Source: (USEPA, 2010b)

Currently, major sources of contamination have been removed from the site, and studies are underway to determine if mitigation measures are needed to address residual and groundwater contamination at the site. In addition, responsible parties from the Fairmont Coke Works, and west adjacent Big John's Salvage Superfund site, are attempting to address waste materials that have reached the Monongahela River. The proximity of the site to residential areas, as well as the Monongahela River, presents a hazard to the public in the City of Fairmont and is detrimental to the use of the river. (USEPA, 2015p)

16.1.15.5. Environmental Setting: Abandoned Mine Lands at or near Telecommunications Sites

Another health and safety hazard in West Virginia includes surface and subterranean mines. In 2015, the West Virginia mining industry ranked 37th for non-fuel minerals (primarily crushed stone, cement, lime, sand and gravel), generating a value of $395M (USGS, 2016). In 2013, the most recent data available, coal production in West Virginia ranked 2nd in the United States, behind Kentucky, with 325 coalmining operations (188 underground and 137 surface) (EIA, 2013).

Health and safety hazards at active mines and AMLs 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 (BLM, 2015). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 16.1.3, Geology.

The WVDEP, Office of Abandoned Mine Lands and Reclamation, created by the Surface Mining and Control Act in 1981, administers the Abandoned Mine Reclamation Program, and is responsible for managing AML health and safety hazards resulting from pre-1977 mining operations (WVDEP, 2015j). Figure 16.1.15-4 shows the distribution of AMLs in West Virginia.

Telecommunication Worker Occupational Health and Safety

AMLs and coalmine fires near telecommunications sites present 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. As of September 22, 2015, West Virginia has reported a total of 121 coal mining fatalities since 2004, with the highest number of fatalities reported in 2010 (35 total) (MSHA, 2015a). Between January 1 and September 24, 2015, MHSA 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.

Public Health and Safety

West Virginia has a healthy historical and current coalmining industry which could have influence on proposed FirstNet activities. In particular, coalmine fires generate toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, a 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. According to WVDEP, West Virginia promotes a “Stay Out – Stay Alive” program to warn the general public of the hazards associated with AMLs (WVDEP, 2015k). This phenomenon could influence the geographic siting of FirstNet infrastructure deployment, and could be a type of event on which first responder personnel could engage.

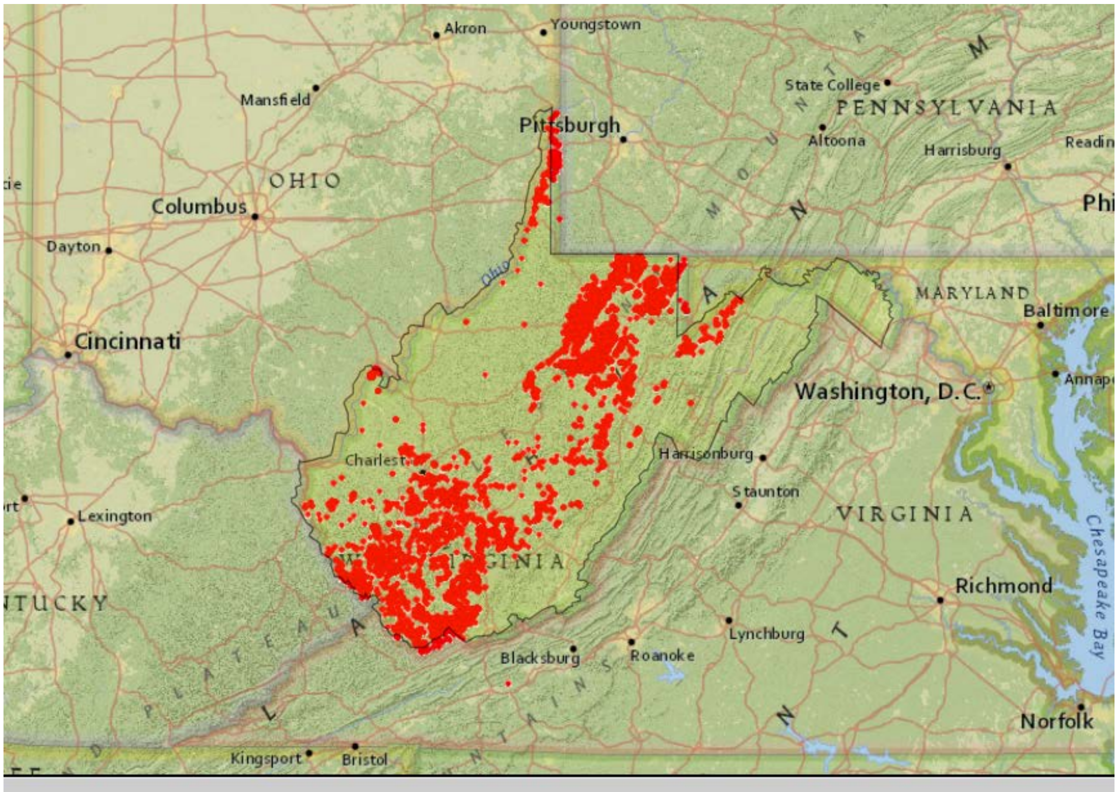

Figure 16.1.15-4: Abandoned Mine Lands in West Virginia (2015)

Source: (USDOI, 2015)

16.1.15.6. Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003).

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, or falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Spotlight on West Virginia Natural Disaster Sites: 1996 Statewide Flooding

Following a major blizzard and subsequent rain in January 1996, there was widespread flooding across West Virginia. Up to 12 inches of snow had accumulated throughout much of the state. This was followed by rapid rises of temperature and the dew point, winds up to 30 knots, and then up to 3 inches of rain. The precipitation and snowmelt runoff caused widespread flooding across the state. (NOAA, 2015e)

Runoff from steep terrain in parts of West Virginia flows into narrow valleys and streams, which readily overflows riverbanks, destroys bridges and roads, and creates myriad of hazards to both the public and workers responding to the damage. The January 1996 flooding and infrastructure damage endangered both first responders and utility workers attempting to rescue people and restore essential services.

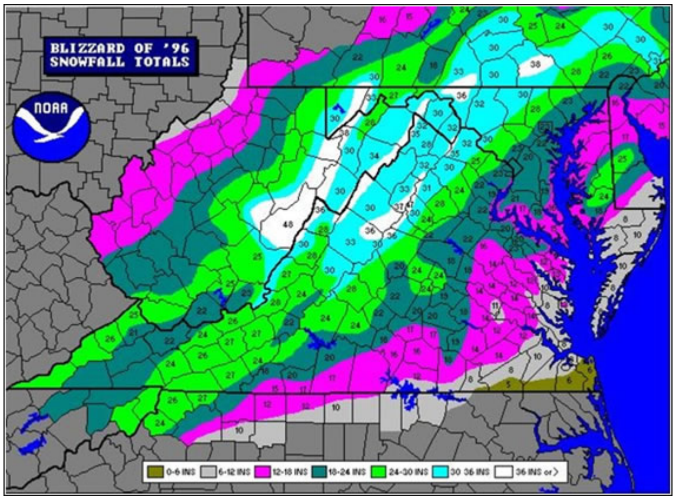

Figure 16.1.15-5: Blizzard of 1996 Snowfall Totals

Source: (NOAA, 1996)

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards might not have been fully identified or assessed. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response and repair operations, their rescue and treatment might over-extend staff and medical facilities that are delivering care to victims of the initial incident.

Currently, WVDOL and U.S. Bureau of Labor do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. For example, during winter storms near West Union, WV, in February 2015, a tree fell and ruptured a 2-inch fuel line, which discharged approximately 40-gallons of crude oil, some of which reached a stream (U.S. Coast Guard, 2015a). Response operations to incidences such as this present unique, hazardous challenges to telecommunication workers during natural disasters, should telecommunication assets be deployed near existing utility rights-of-way or infrastructure. Of the 205 NRC-reported incidents for West Virginia in 2015 with known causes, 13 incidents were attributed to natural disaster (e.g., earthquake, flood, hurricane, tornado, or other natural phenomenon), while 195 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, suicide, transport accident, or trespasser) or other indeterminate causes (U.S. Coast Guard, 2015b).

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the 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.

In 2014, West Virginia experienced one weather-related fatality and six injuries (NWS, 2015). For comparison, in 2010, during a period of severe storms and flooding in West Virginia, there were five weather-related fatalities and twelve weather-related injuries (NWS, 2011c).

16.2. 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.

16.2.1. Infrastructure

16.2.1.1. Introduction

This section describes potential impacts to infrastructure in West Virginia associated with construction, deployment, and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 16.2.1-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

16.2.1.3. 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 16.2.1-1, 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.

Table 16.2.1-1: 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: 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

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of first responders through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 16.2.1-1, such potential negative and positive impacts would be less than significant.

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 16.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to compliment such practices and SOPs in a positive manner; therefore, only beneficial or complimentary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhance communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[155] 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 16.2.1-1.

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 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.

16.2.1.4. 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

[155] 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.

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 could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on 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)[156], huts, or other associated facilities or hand-holes[157] 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: Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or replacement of existing telecommunications poles.

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

  - 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 or near 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 and/or facilities on shores or the banks of water bodies that accept the 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 telecommunications 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 COWs, COLTs, and 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 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 further 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.1.5. 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated 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 4.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

16.2.2. Soils

16.2.2.1. Introduction

This section describes potential impacts to soil resources in West Virginia associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 16.2.2-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

16.2.2.3. 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 West Virginia 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 West Virginia that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aqualfs, Aquepts, Orthents, Psamments, Udalfs, Udepts, Udolls, and Udults (see Section 16.1.2.3, Soil Suborders).

Based on the impact significance criteria presented in Table 16.2.2-1, 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.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 17).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 16.2.2-1, 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.

Table 16.2.2-1: Impact Significance Rating Criteria for Soils

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
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

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Heavy equipment can cause perceptible compaction and rutting of susceptible soils, particularly if BMPs and mitigation measures are not implemented.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 16.1.2.3, Soil Suborders). The most compaction susceptible soils in West Virginia are hydric soils with poor drainage conditions, which include Aquepts. Aquepts are found in approximately three percent of West Virginia, particularly in southeastern areas of the state. 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 16.2.2-1, the risk of soil compaction and rutting resulting from construction of the Preferred Alternative in West Virginia would be low, due to the small extent of susceptible soils in the state, as well as implementation of standard construction BMPs and mitigation measures (see below) to avoid and minimize impacts.

16.2.2.4. 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 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 paved, 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. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.

  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if 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 Unmanned Aircraft Vehicles (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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant due to the temporary nature and small-scale of operations activities with the potential to create impacts. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.2.5. 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 16.1.2, Soils.

16.2.3. Geology

16.2.3.1. Introduction

This section describes potential impacts to West Virginia geology resources associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 16.2.3-1. As described in Section 16.2, 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.

16.2.3.3. 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 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 16.1.3, West Virginia is not at risk to significant earthquake events. As shown in Figure 16.1.3-, southern West Virginia is at greatest risk to earthquakes throughout the state, though no earthquake over magnitude 4.5 on the Richter scale has ever occurred in the state. Based on the impact significance criteria presented in Table 16.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor to moderate earthquakes in parts of West Virginia, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanoes were not analyzed for West Virginia since they do not occur in the state.

Table 16.2.3-1: 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

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	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain)	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an area with a hazard for subsidence	Project activity located outside an area with a hazard for subsidence
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory		Areas with a high hazard for subsidence occur within the state/territory, 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/territory		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable	Mineral or fossil fuel extraction areas do not occur within the state/territory
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources		Temporary degradation or depletion of mineral and fossil fuel resources	NA
Paleontological Resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources	Effect that is potentially significant, but with mitigation is less than significant	Limited impacts to paleontological and/or fossil resources	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory		Areas with known paleontological resources occur within the state/territory, but may be avoidable	Areas with known paleontological resources do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
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

As discussed in Section 16.1.3, the majority (more than 75 percent) of West Virginia is at high risk of experiencing landslide events. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. Based on the impact significance criteria presented in Table 16.2.3-1, 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 West Virginia's major cities, including Charleston, Wheeling, and Huntington, are in areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 16.1.3, portions of West Virginia are vulnerable to land subsidence due to karst topography and mine collapse. Based on the impact significance criteria presented in Table 16.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts; however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography, mine collapse, or inundation due to long-term land subsidence. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography is subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss. While much of the mine locations are unknown, to the extent practicable, FirstNet would avoid deployment in known areas of karst topography, or where mine collapse is possible. 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 deployment is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 16.2.3-1, impacts to mineral and fossil fuel resources are 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 16.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 16.1.11, fossils are abundant throughout parts of West Virginia. 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 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 16.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

16.2.3.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact 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 POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to 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 or near bodies of water is not expected to impact geologic resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or perturbation of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if 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 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 geologic hazards including seismic 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.3.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to geology as a result of implementation of this alternative could be as described below.

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant, as the deployment would be temporary and likely would attempt to avoid locations that were subject to increased seismic activity, landslides, and land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to 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 16.1.3, Geology.

16.2.4. Water Resources

16.2.4.1. Introduction

This section describes potential impacts to water resources in West Virginia associated with construction/deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 16.2.4-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

16.2.4.3. 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 TMDL or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Generally, West Virginia’s surface waters are in fair condition. More than 50 percent of West Virginia’s assessed rivers, streams, lakes, reservoirs, and ponds are impaired. Main sources of impairment include PCBs, sediment, nutrients, metals, and oxygen depletion (see Table 16.1.4-2, Figure 16.1.4-2) (USEPA, 2015b). State water quality monitoring reports that while waters previously impacted by acid rain are improving, agriculture, and mining continue to be main sources of pollutants for West Virginia waters (WVDEP, 2015d). Groundwater quality within the state is generally good. West Virginia's groundwater is susceptible to surface water contamination from the state's chemical industry, agricultural practices, and coal mining (USGS, 2012d).

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 one 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 stormwater pollution prevention plan 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 could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, Safe Drinking Water Act), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 16.2.4-1, water quality impacts would likely be less than significant particularly, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

Table 16.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, 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
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.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		The impact is temporary, lasting no more than six months.	NA
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

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 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

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 West Virginia dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

The thickness and permeability of West Virginia's aquifers is variable. In most of the states, there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 16.2.4-1, 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 16.2.5-1, 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 occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events 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.

Examples of activities that would have less than significant impacts include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.

[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." (USGS, 2015i)

- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures would reduce any 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 16.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited storm water runoff.
- Where storm water is contained on site and does not flow to or impact surface waterbodies off-site on other properties.
- Activities designed so that the amount of storm water generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for storm water.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to 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 16.2.4-1 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 16.1.4, approximately 42 percent of West Virginia residents rely on groundwater resources for their domestic water supply, withdrawing approximately 70 million gallons of groundwater are withdrawn per day. Generally, the water quality of West Virginia's aquifers is suitable for drinking and daily water needs. (USGS, 2012d) 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 safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.
- Use of pesticides, herbicides, or insecticides during or after construction of a commercial, industrial, or recreational use.

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 16.2.4-1, 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.

16.2.4.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to water resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, and the use of portable devices that use

satellite technology would not impact water resources because those activities would not require ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact 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 or near bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected,

installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance.

Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. BMPs to help mitigate or reduce any potential impacts are described in Chapter 17.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts, as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.4.5. 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 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. The amount of impact depends on the land area affected, installation technique, and location. Implementing the BMPs and mitigation measures identified in Chapter 17 could further avoid or reduce potential impacts. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be less than significant impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small-scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 16.1.4, Water Resources.

16.2.5. Wetlands

16.2.5.1. Introduction

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

16.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 16.2.5-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

16.2.5.3. Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Table 16.2.5-1: 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/context	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level.	Na
	Duration or frequency	Chronic and long term changes not likely to be reversed over several years or seasons		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	Na
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	Na

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

NA – Not Applicable

[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, T/E species habitat, biodiversity, recreational/social value.

There are approximately 63,500 acres of wetlands throughout West Virginia (USFWS, 2014a). Palustrine (freshwater) wetlands are the main type of wetlands found throughout the state, as shown in Section 16.1.5.

Based on the impact significance criteria presented in Table 16.2.5-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, deployment activities would not violate applicable federal (e.g., CWA Section 404), state, and local regulations.

As discussed in Wetlands, Section 16.1.5, there are no regulated high quality wetlands (or wetlands of special value) in West Virginia. Considering how few wetlands exist within the state, BMPs and mitigation measures would be implemented to help mitigate impacts to all 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 16.2.5-1, 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 West Virginia 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 West Virginia).
- *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 West Virginia 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.

[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, T/E species habitat, biodiversity, recreational/social value.

- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 16.2.5-1, 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 63,500 acres of wetlands in West Virginia are not considered rare or unique, 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 of the state with high quality wetlands, 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.

16.2.5.4. 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, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being 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 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 or near 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.
    - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
    - Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, additional power units, structural hardening, and physical security measures require 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, weather 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, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are 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.

16.2.5.5. 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, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland’s quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.5, Wetlands.

16.2.6. Biological Resources

16.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in West Virginia associated with deployment and operation of the Proposed Action and its alternatives. BMPs and mitigation measures that could be implemented, as appropriate, to further avoid or minimize those potential impacts are identified in Chapter 17.

16.2.6.2. 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 16.2.6-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 16.2.6.3, 16.2.6.4, and 16.6.2.5, respectively, are presented as a range of possible impacts.

Refer to Section 16.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in West Virginia.

16.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in West Virginia’s 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 16.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Table 16.2.6-1: 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: 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 West Virginia 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: 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: 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 West Virginia 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 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: 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 West Virginia for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity.		Effects realized at one location.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**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: 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 West Virginia 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: 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: 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 West Virginia for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances, 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

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 breeding/spawning seasons for at least one species.		Temporary, isolated or short-term effects that are reversed within one breeding season.	NA
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with mitigation is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout West Virginia.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

NA – Not Applicable

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs 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[b]). Indirect injury/mortality can include stress related to disturbance. The alteration of soils or hydrology within a localized area can result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing or decreasing hydrology in an area as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs 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.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

The potential to introduce invasive plants within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and 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 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.

[162] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public right-of-ways (ROWs) or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

- New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 shores or the banks of water bodies that 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 partners 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 no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant due to the small-scale of expected activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Therefore, potential impacts to terrestrial vegetation as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain less than significant due to the relatively small-scale of FirstNet activities at individual locations. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small-scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

No Action Alternative

Under the No Action Alternative, the 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 because of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.6.3, Terrestrial Vegetation.

16.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in West Virginia 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 16.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in West Virginia. West Virginia's 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 (USDOT FHA 2015). 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 associated with the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

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 associated with the amount of tree removal and if maternity colonies are present. Direct injury/mortality are not anticipated to be widespread or affect populations of bat species if BMPs and mitigation measures are followed to avoid or minimize these effects.

Birds

Mortalities from collisions or electrocutions with man-made cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to night-migrating birds, "poor" fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & and Manville, 2011). Avian mortalities or injuries can also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds can occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for nesting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of West Virginia are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. If siting considerations and BMPs and mitigation measures are implemented (Chapter 17), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA can be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

The majority of West Virginia's amphibian and reptile species are widely distributed throughout West Virginia. However, some species occur in a restricted variety of habitats such as rivers, creeks, springs, and moist forested hillsides. West Virginia is home to a large number of reptiles and amphibians, including 35 salamanders. The state is considered a "hotspot" for salamanders and contains nearly 15 percent of the world's species (NPS, 2010). 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.

Terrestrial Invertebrates

The terrestrial invertebrate populations of West Virginia 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.

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 West Virginia's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout West Virginia and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear, white-tailed deer) 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 and medium-sized mammals (e.g., bats, fisher, bobcat) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas would be avoided or minimized by BMPs and mitigation measures.

Birds

The direct removal of most bird nests is prohibited under the MBTA. The USFWS can provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact 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 avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians and Reptiles

Important habitats for West Virginia's amphibians and reptiles typically consist of wetlands and, in some cases as with the timber rattlesnake (*Crotalus horridus*), the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 16.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to West Virginia's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[164]

[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 17.2.5, Wetlands, for a discussion of BMPs for wetlands.

<u>Terrestrial Invertebrates</u>

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 16.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

<u>Terrestrial Mammals</u>

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 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.

<u>Birds</u>

Repeated disturbance, especially during the breeding and nesting season, can cause stress to individuals lowering fitness and productivity. These impacts could be 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.

<u>Reptiles and Amphibians</u>

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

<u>Terrestrial Invertebrates</u>

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 West Virginia's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

<u>Terrestrial Mammals</u>

Some mammals (e.g., bats) have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula. Route knowledge is passed on from one generation to the next. 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>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 West Virginia undertake some of the longest-distance migrations of all animals. West Virginia is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. West Virginia has 20 IBAs, with the northwest portion of the state along the Ohio River valley serving as an important breeding area for migratory birds requiring intact forest interiors (National Audubon Society, 2015b). 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.

<u>Reptiles and Amphibians</u>

Several species of mole salamanders and the wood frog are known to seasonally migrate in West Virginia. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor. Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, Berven 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. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of West Virginia'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 dens for large mammals, such as bear, has the potential to negatively affect body condition and reproductive success of mammals in West Virginia. For example, elk use certain types of habitats that allow for more effective defense of their calves from predators.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature. BMPs and mitigation measures as defined through consultation with USFWS, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spotted turtle (*Clemmys guttata*) leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs 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; 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.

Potential invasive species effects to West Virginia’s wildlife are described below.

Terrestrial Mammals

In West Virginia, Eurasian boars (*Sus scrofa*) adversely impact several native large and small mammals, including bear (*Ursus americanus*), turkey (*Meleagris gallopavo*), waterfowl and deer. They feed on young mammals, destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and humans. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. Invasive species effects to terrestrial mammals could be minimized following BMPs in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for an invasive species, and less favorable for native species and their habitats. For example, in West Virginia, mute swans (*Cygnus olor*) can impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior. Further, this invasive bird can lead to declines in water quality from increased fecal coliform loading in the water, and declines in submerged aquatic vegetation that support native fish and other wildlife (Swift, Clarke, Holevinski, & Cooper, 2013). FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in West Virginia; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and also spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects in particular pose a large threat to West Virginia's forest and agricultural resources (USFS, 2015e). 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 West Virginia and are known to cause irreversible damage to native forests. 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 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. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to

migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs 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, but could include direct injury/mortality 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 or near bodies of water and construction of landings and/or facilities on the shores or the banks of water bodies that accept submarine cables could potentially impact wildlife (see Section 16.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to wildlife. However, if new power

units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners 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 than 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 avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this alternative could be as described below.

<u>Deployment Impacts</u>

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts 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 partners 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 16.1.6.4, Terrestrial Wildlife.

16.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in West Virginia 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, 2012e).

Based on the impact significance criteria presented in Table 16.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but minimal for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats can be addressed through BMPs and mitigation measures.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be less than significant, and BMPs and mitigation measures to protect water resources (see Section 16.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be less than significant, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be less than significant, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and 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 deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources, 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 or near bodies of water and construction of landings and/or facilities on the shores or the banks of water bodies that accept the submarine cable 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 partners 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 partners 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.

<u>Deployment Impacts</u>

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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Operational Impacts</u>

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 partners 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 16.1.6.5, Fisheries and Aquatic Habitats.

16.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in West Virginia associated with deployment and operation of the Proposed Action and alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 16.2.6-2. 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 16.2.6-2, 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, amphibians, fish, invertebrates, and plants with known occurrence in West Virginia are described below.

<u>Terrestrial Mammals</u>

Direct mortality or injury to the federally listed Indiana bat (*Myotis sodalis*) and 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 Virginia big-eared bat (*Corynorhinus townsendii virginianus*) roosts during both the summer and winter in caves. 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 as well. 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.

Table 16.2.6-2: 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.	

Birds

One federally listed bird, the red knot (*Calidris canutus rufa*), is known to occur within West Virginia during migration. Depending on the project types and location, direct mortality or injury to these birds could occur from collisions or electrocutions with man-made cables and wires, or 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

The diamond darter (*Crystallaria cincotta*) is found in the Elk River and its tributaries. Direct mortality or injury to the diamond darter species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action are unlikely as the majority of FirstNet deployment projects would not occur in the 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

There are no federally listed reptiles in West Virginia.

The federally listed threatened Cheat Mountain salamander (*Plethodon nettingi*) occurs within cool and moist forest in the Cheat Mountains dominated by red spruce and yellow birch. Direct mortality to amphibians could occur in construction zones either by excavation activities or by vehicle strikes. Impacts would likely be isolated, individual events.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Six federally listed mussels, one snail, and one aquatic invertebrate occur in West Virginia. Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. For the most part, distribution of these species is very limited throughout the state. For example, the Madison cave isopod (*Antrolana lira*) is found in only two locations in Jefferson County, West Virginia. In addition, due to the flat-spired three-toothed snail's (*Triodopsis platysayoides*) very restricted range, human disturbance that results in direct crushing is a major threat to 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.

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 very limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which can affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, amphibians, fish, invertebrates, and plants with known occurrence in West Virginia are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

No federally listed birds nest in West Virginia; therefore, no effects are anticipated to result from the Proposed Action in West Virginia.

Reptiles and Amphibians

There are no federally listed reptiles in West Virginia. For the federally listed Cheat Mountain salamander, changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity. Land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Fish

Deployment activities in the Elk River and its tributaries 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 16.2.4, Water Resources, for a discussion of potential impacts to water resources). Impacts to reproduction for the endangered diamond darter (*Crystallaria cincotta*) species 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 and quantity can cause stress resulting in lower productivity for federally listed invertebrates known to occur in West Virginia. In addition, introduction of invasive aquatic species can indirectly affect the fanshell (*Cyprogenia stegaria*) as result of fish populations that they rely on for their reproductive cycle being altered (USFWS, 2015s).

Impacts to the flat-spired three-toothed snail is unknown as very little information on their reproductive cycle exists, but it is known that they tend to lay eggs in the spring and summer (WVDNR, 2009a). Impacts associated with deployment activities are expected to result in less than significant changes to water quality. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, birds, amphibians, fish, invertebrates, and plants with known occurrence in West Virginia are described below.

Mammals

Noise associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

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, the red knot, having one of the longest migrations of any bird, has been found to fly up to 9,300 miles from their breeding and wintering sites. They often return to the same stopover sites year and after year in West Virginia. 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 West Virginia's only federally listed bird. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed reptiles in West Virginia. Habitat loss or alteration, particularly from fragmentation or invasive species, could adversely affect nesting and foraging sites of the Cheat Mountain salamander, resulting in reduced survival and productivity, should impacts occur in or near the limited range of that species. Disturbances during deployment activities are not anticipated to stress the federally listed salamander. 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 the Elk River's water quality and quantity as a result of ground disturbing activities could impact food sources for the diamond darter. Further, increased human disturbance, noise, and vessel traffic could cause stress to diamond darters causing them to abandon spawning locations. Behavioral changes to the diamond darter 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 invertebrates resulting in lower productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

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 extent. FirstNet activities are generally expected to be small-scale in nature, therefore large-scale impacts are not expected; however, it is possible that small-scale changes could lead to potentially significant adverse effects for certain species. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. However, the threatened and endangered species that occur in West Virginia do not have critical habitat in the state.

Terrestrial Mammals

Five caves in West Virginia have been identified as critical habitat for the Virginia big-eared bat. This bat roosts in caves year-round; human disturbance in and around these caves could affect this species. 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. BMPs and mitigation measures to help mitigate or reduce these impacts are described further below.

Birds

No critical habitat has been designated for birds in West Virginia. 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

There are no federally listed reptiles in West Virginia. No designated critical habitat occurs for the Cheat Mountain salamander in West Virginia. 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 for the diamond darter occurs within approximately 123 miles of the Elk River and its tributaries. Alternation or fragmentation of this habitat as a result of the Proposed Action could lead to changes in water quality and quantity that could impact food sources for the diamond darter. Further, increased human disturbance, noise, and vessel traffic could cause stress to diamond darters causing them to abandon spawning areas. BMPs and mitigation measures to help mitigate or reduce these impacts are described further below.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in West Virginia. 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 West Virginia. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and 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 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 effect to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are

already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Have Impacts

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., reptiles, mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs 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 or near bodies of water and construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 16.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely adversely affect protected species; BMPs and mitigation measures identified in Chapter 17 and as defined through consultation with the appropriate resource agency, could help to mitigate or reduce potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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.

Deployment Impacts

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.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

16.2.7. Land Use, Airspace, and Recreation

16.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in West Virginia associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.7.2. 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 16.2.7-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

16.2.7.3. Description of Environmental Concerns

Direct Land Use Change

The deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement could influence changes in land use. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of rights-of-way or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the ROW, 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.

Table 16.2.7-1: 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

Based on the impact significance criteria presented in Table 16.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of 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 16.2.7-1, 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

The deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement could influence access to public or private recreation land or activities. 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 above ground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 16.2.7-1, 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 above ground 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 16.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 16.2.7-1, are not likely to change or alter flight patterns or airspace usage, as drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period of time, FirstNet would not impact airspace resources.

16.2.7.4. 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 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 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 with the Potential to Have Impacts below.
  - Recreation: See Activities with the Potential 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 16.1.7, 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 with the Potential 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 16.1.7 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 with the Potential to Have Impacts below.
  - Recreation: See Activities with the Potential to Have Impacts below.
  - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.

        - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
        - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
        - Airspace: Lighting of dark fiber would have no impacts to airspace.
    - New Build – Submarine Fiber Optic Plant: Installing cables in or near inland bodies of water and constructing landings and/or facilities on shores or the banks of water bodies that accept the submarine cable.
        - Land Use: See Activities with the Potential to Have Impacts below.
        - Recreation: See Activities with the Potential to Have Impacts below.
        - Airspace: The installation of cables in or near 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 16.1.7 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 with the Potential to Have Impacts below.
        - Recreation: See Activities with the Potential 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 16.1.7, 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 with the Potential to Have Impacts below.
        - Airspace: See Activities with the Potential 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 16.1.7 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 to 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 rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: No impacts are anticipated – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.

        - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
        - Airspace: No impacts are anticipated – see previous section.

- Wireless Projects
    - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
        - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
        - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
        - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets the other criteria listed in Section 16.1.7 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 aerial fiber optic plant is located in proximity to one of West Virginia'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 West Virginia airports (See obstruction criteria in Section 16.10.5.3 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above. Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. The degree of change in the visual environment (see Section 16.2.8, 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall these potential impacts would be less than significant due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 16.1.7, Land Use, Airspace, and Recreation.

16.2.8. Visual Resources

16.2.8.1. Introduction

This section describes potential impacts to visual resources in West Virginia associated with construction/deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 16.2.8-1. As described in Section 16.2, 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.

16.2.8.3. 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 West Virginia, residents and visitors travel to many national and state parks, such as Monongahela National Forest to view its deep forests and meadows. 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. West Virginia 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 16.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small-scale of likely FirstNet activities, impacts are expected to be less than significant.

Table 16.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character	Effect that is potentially significant, but with mitigation is less than significant	Intermittently noticeable change in aesthetic character that is marginally negative	No visible effects
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase	Transient or no visible effects
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions	Effect that is potentially significant, but with mitigation is less than significant	Lighting alters night-sky conditions to a degree that is only intermittently noticeable	Lighting does not noticeably alter night-sky conditions
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase	Transient or no visible effects

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 16.2.8-1, lighting that illuminates the night sky on a regional basis, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies.

16.2.8.4. 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 development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no

ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources as long as those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of 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 and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 shores or the banks of water bodies that accept the submarine cable.

   - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
   - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.
   - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
   - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

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 partners 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 mitigation 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

16.2.8.5. 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 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 16.1.8, Visual Resources.

16.2.9. Socioeconomics

16.2.9.1. Introduction

This section describes potential impacts to socioeconomics in West Virginia associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 16.2.9-1. As described in Section 16.2, 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.

16.2.9.3. 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
- Changes in Population Number or Composition

Table 16.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible impact 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 Economic benefits or adverse impacts related to changes in tax revenues, wages, major industries, or direct spending (could be positive or negative)	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

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	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 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

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary considerably across West Virginia. Median values of owner-occupied housing units in the 2009–2013 period ranged from $170,000 in the Morgantown area, to $83,000 in the Bluefield area (West Virginia portion). These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may impact 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 Tax Revenues, Wages, Major Industries, Or Direct Spending

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and Internet services (Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's 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) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment games are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across West Virginia. The average unemployment rate in 2014 was 6.5 percent, higher than the national rate of 6.2 percent. Counties with unemployment rates below the national average (that is, better employment performance) were distributed throughout the state. The lowest unemployment rates were generally in the counties around the top 10 populations, with the exception of the Beckley and Bluefield areas. Many West Virginia counties had very high unemployment rates compared to the national average.

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 16.2.9-1 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.

16.2.9.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 16.2.9-1.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact 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 discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation Impacts

Activities with the Potential to Have Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. All operational activities would be conducted by public or private sector employees, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.

- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and West Virginia. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.9.5. 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 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and West Virginia. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated 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 16.1.9, Socioeconomics.

16.2.10. Environmental Justice

16.2.10.1. Introduction

This section describes potential impacts to environmental justice in West Virginia associated with construction/deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 16.2.10-1. As described in Section 16.2, 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.

16.2.10.3. 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 16.2.10-1: 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 EMS; 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 16.1.10) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 16.1.10, West Virginia’s population has very low percentages of minorities compared to the region and the nation, and a higher poverty rate than the region or nation. Much of West Virginia has high potential for environmental justice populations. The distribution of high potential areas and of moderate potential areas is fairly even across the state. Given West Virginia’s very low rates of minority populations, it is likely that these areas mostly reflect relative prevalence of low-income populations. Further analysis using the data developed for the screening analysis in Section 16.1.10 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, 2015h) (USEPA, 2014d).

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.

16.2.10.4. 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 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.
- Wireless Projects
  - 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. Impacts associated with collocation requiring construction for additional power units or other equipment are addressed below.
- 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 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 or near 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 on shores or the banks of water bodies that accept the 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 partners 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.10.5. 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 generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation 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 16.1.10, Environmental Justice.

16.2.11. Cultural Resources

16.2.11.1. Introduction

This section describes potential impacts to cultural resources in West Virginia associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.11.2. 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 16.2.11-1. As described in Section 16.2, 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 16.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type Of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, But Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[2]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects APE		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties
	Geographic Extent	Direct and/or indirect effects APE		Direct and/or indirect effects APE	Direct and/or indirect effects APE

Type Of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[1]	Effect, But Not Adverse	No Effect
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties	No direct or indirect effects to historic properties
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

[1] Whereas mitigation measures for other resources discussed in this 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/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's 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.

16.2.11.3. 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 16.2.11-1, 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 West Virginia, 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.

16.2.11.4. 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 development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources, such as riverine areas along the Shenandoah or Potomac Rivers that have the potential to contain prehistoric or historic sites associated with the use of those rivers' resources. Impacts to cultural resources could also potentially occur as result of the construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable, which could result in the disturbance of archaeological and historical sites, such as canal walls or mills (archaeological deposits tend to be located in association with bodies of water, and West Virginia, for example, has numerous riverine archaeological and historical sites), 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, especially in areas in upper elevations with larger viewsheds.
- 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 impacts to archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, expecially in downtown historic district areas, such as in Harpers Ferry, 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small-scale of expected activities, these actions could affect but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.11.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 16.1.11, Cultural Resources.

16.2.12. Air Quality

16.2.12.1. Introduction

This section describes potential impacts to West Virginia's air quality from construction/deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on West Virginia's air quality were evaluated using the significance criteria presented in Table 16.2.12-1. As described in Section 16.2, 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 West Virginia's air quality addressed in this section are presented as a range of possible impacts.

16.2.12.3. 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 West Virginia that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone and $PM_{2.5}$ are state-wide issues (see Section 16.1.12, Air Quality and Figure 16.1.12-1). The majority of the counties in West Virginia are designated as nonattainment or maintenance areas for zero NAAQS pollutants (Figure 16.1.12-1). Counties in western West Virginia are designated nonattainment or maintenance areas for one or more of the following pollutants: PM, ozone, and SO_x (Table 16.1.12-3). Air quality in West Virginia is already impacted by industrial operations, such as widespread coal mining, and project-specific location siting may need to take this into account.

Based on the significance criteria presented in Table 16.1.12-3, 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 West Virginia; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present in western West (Figure 16.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

Table 16.2.12-1: Impact Significance Rating Criteria for West Virginia

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

16.2.12.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Impact Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or 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, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
    - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 shores or the banks of water bodies that accept the 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 the on-site delivery of 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 partners 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.12.5. 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.

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.

16.2.13. Noise

16.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in West Virginia. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 16.2.13-1. As described in Section 16.2, 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 West Virginia addressed in this section are presented as a range of possible impacts.

16.2.13.3. 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 16.2.13-1, 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 concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

Table 16.2.13-1: 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

16.2.13.4. 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 development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
    - FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or 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 high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 shores or the banks of water bodies that accept the submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.

- Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
- Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.13.5. 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 Noise 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 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 partners 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 partners 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.

16.2.14. Climate Change

16.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in West Virginia associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.14.2. 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 16.2.14-1. As described in Section 16.2, 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, 2015q), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 16.2.14-1: Impact Significance Rating Criteria for Climate

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 GHG 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

16.2.14.3. 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 (U.S. Global Change Research Group, 2014a).

Air Temperature

Figure 16.2.14-1 and Figure 16.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for West Virginia from a 1969 to 1971 baseline.

Cfa – Figure 16.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the entire state of West Virginia under a low emissions scenario will increase by approximately 4 °F. By the end of the century (2080 to 2099) under a low emissions scenario in the Cfa region of West Virginia temperatures will increase by approximately 5° F in the majority of the region and the top portion of the Cfa region will increase by approximately 6° F (U.S. Global Change Research Group, 2009).

Figure 16.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures will increase by approximately 5 °F in the entire state of West Virginia. Under a high emissions scenario for the period (2080 to 2099) in the Cfa region of West Virginia, temperatures will increase by approximately 9° F for the majority of the region and will increase by approximately 8° F for a very small southernmost portion of the state (U.S. Global Change Research Group, 2009).

Cfb – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080) to 2099) under a low emissions scenario at the same rate as the Cfa region.

Temperatures in the Cfb region of West Virginia by mid-century and by the end of the century under a high emissions scenario are expected to increase at the same rate as the Cfa region.

Dfb – Temperatures in this region are expected to increase by mid-century (2040 to 2059) under a low emissions scenario at the same rate as the Cfa and the Cfb regions. By the end of the century (2080 to 2099), temperatures will increase by approximately 5° under a low emissions scenario in the (Dfb) region of West Virginia (U.S. Global Change Research Group, 2009).

Temperatures in this region are expected to increase by mid-century (2040 to 2059) at the same rate as the Cfa and Cfb region in a high emissions scenario. By the end of the century (2080 to 2099, temperatures will increase by approximately 9° F in a high emissions scenario (U.S. Global Change Research Group, 2009).

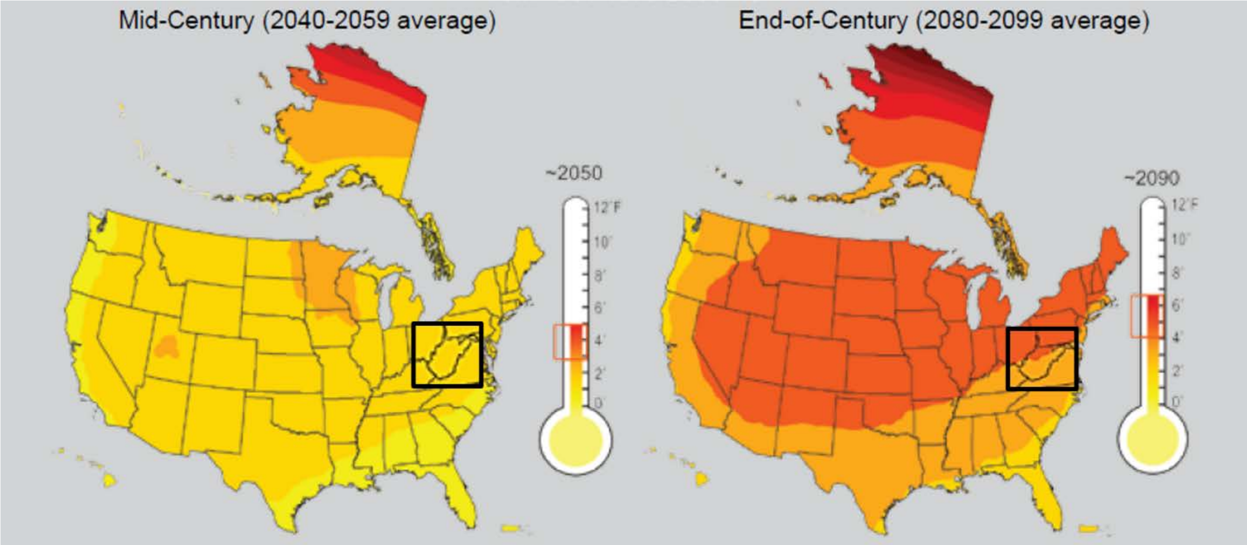

Figure 16.2.14-1: West Virginia Low Emission Scenario Projected Temperature Change

Source: (U.S. Global Change Research Group, 2009)

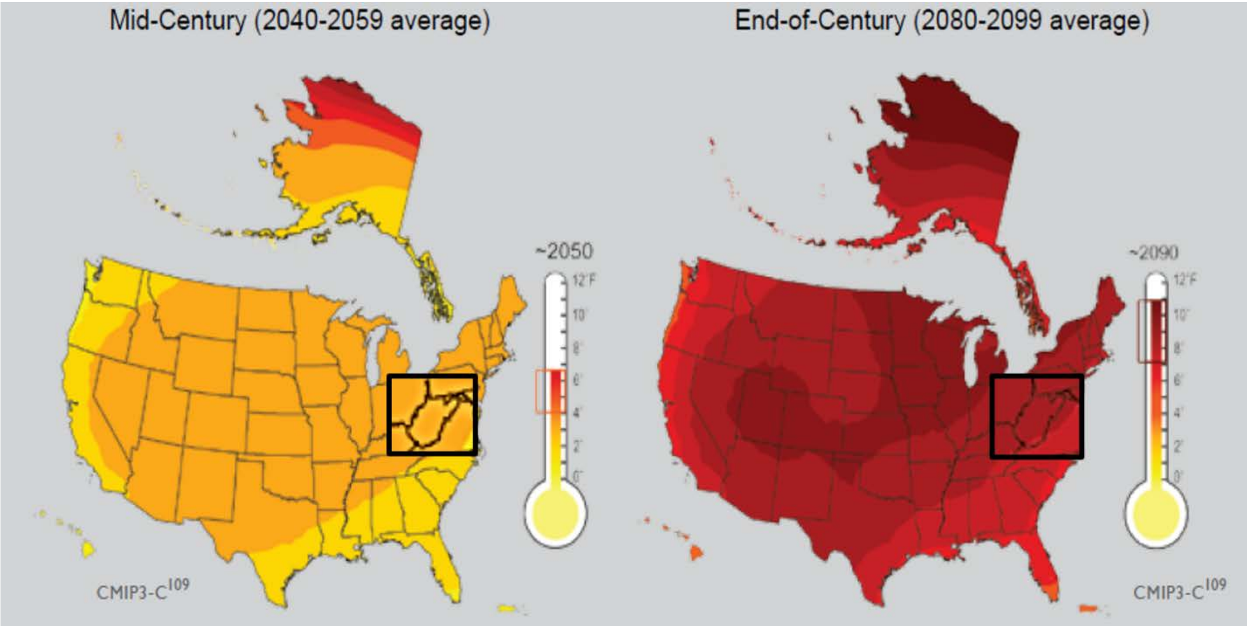

Figure 16.2.14-2: West Virginia High Emission Scenario Projected Temperature Change

Source: (U.S. Global Change Research Group, 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 (U.S. Global Change Research Group, 2009).

Figure 16.2.14-3 and Figure 16.2.14-4 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 16.1.14-5 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (U.S. Global Change Research Group, 2014b).

Figure 16.2.14-4 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.) (U.S. Global Change Research Group, 2014b).

Cfa – Figure 16.2.14-3 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 West Virginia. In summer, precipitation for the majority of the Cfa region will increase up to 10 percent while precipitation in the upper most portion of the state is not expected to increase other than natural fluctuation. There are no expected increases in precipitation in fall other than fluctuations due to natural variability (U.S. Global Change Research Group, 2014b).

Figure 16.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 20 percent over the period 2071 to 2099. In summer, precipitation in this scenario could increase as much as 10 percent for the majority of the state, however the northwestern most portion of the state is not expected to increase other than natural fluctuation. No significant change to fall and summer rainfall is anticipated over the same period (U.S. Global Change Research Group, 2014b).

Cfb – Precipitation changes for the Cfb region are consistent with projected changes for the Cfa region of West Virginia in both low and high GHG emissions scenarios.

Dfb – Precipitation changes for the Dfb region are consistent with projected changes for the Cfa and Dfa regions of West Virginia in winter, spring and fall under a low emissions scenario. However, in summer precipitation will increase up to 10 percent in the Dfb region.

Precipitation changes for the Dfb region are consistent with projected changes for the Cfa and Dfa regions of West Virginia in winter and spring under a high emissions scenario. In the Dfb region, precipitation is expected to increase up to 10 percent in summer and fall.

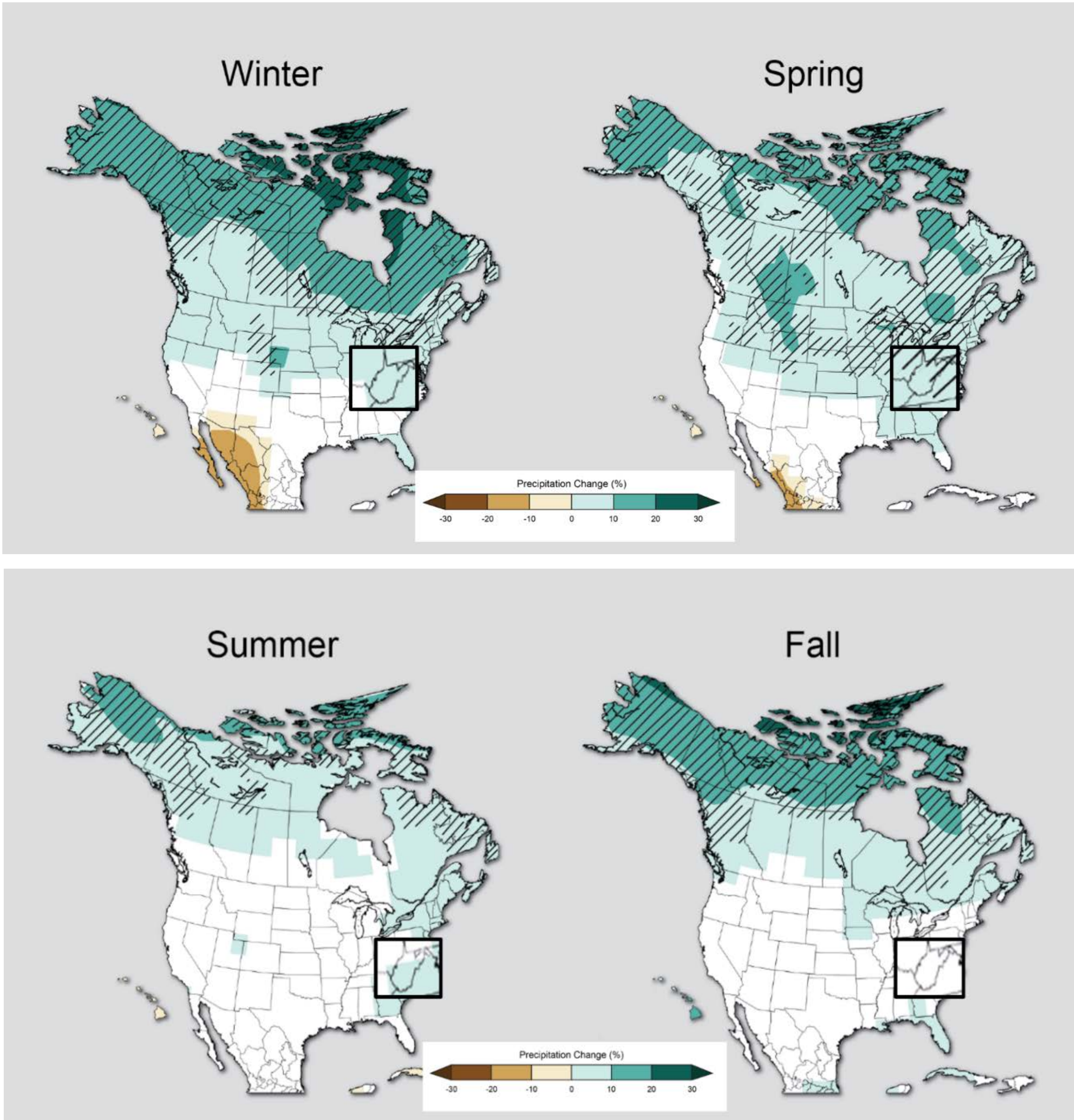

Figure 16.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (U.S. Global Change Research Group, 2014b)

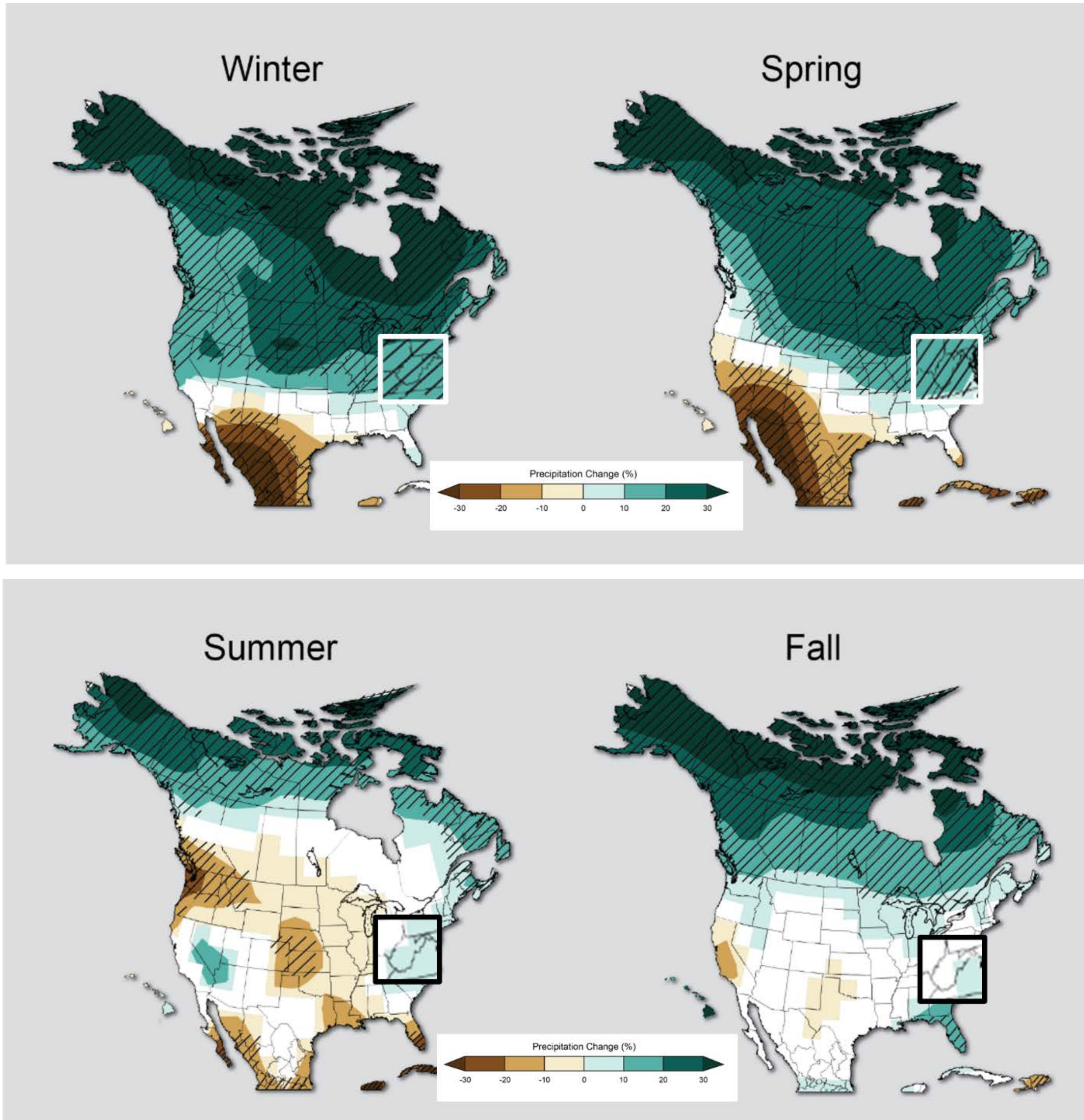

Figure 16.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (U.S. Global Change Research Group, 2014b)

<u>Severe Weather Events</u>

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. While West Virginia is not as impacted by hurricanes as coastal states, the state is still impacted by high winds and heavy rainfall from such storms (Southwestern West

Virginia Preparedness Partnership, 2011). 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 increasing altitude associated with warmer temperatures may lead to more and larger 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 (U.S. Global Change Research Group, 2014c).

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) (U.S. Global Change Research Group, 2014c). 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 (U.S. Global Change Research Group, 2009).

16.2.14.4. 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 Figure 16.2.14-1, 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, 2015h). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the U.S. where the electricity was generated (USEPA, 2014e). Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a “worst-case” for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

In West Virginia, changes in the water cycle and temperature are expected to have a significant effect on both species of concern as well as those that are currently abundant, as ecosystems shift to different hydrological and temperature regimes (WVDNR, 2011). More frequent and severe torrential downpours are anticipated in the Northeast and Central U.S., and will have negative consequences for both natural and built environments in West Virginia (U.S. Global Change Research Group, 2014d). For natural ecosystems, it would result in increased nutrient and sediment inputs to already stressed receiving waters, and negative impacts on both aquatic flora and fauna (WVDNR, 2011)

Rising temperatures, heat, are expected to increase the frequency and intensity of summer heat waves, particularly in southwest West Virginia, with negative consequences for human health both through direct heat, and also through deteriorating air quality (U.S. Global Change Research Group, 2014d).

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.

With West Virginia at increasing risk of flooding under warming scenarios, the growing frequency and severity of torrential downpours, with increased incidences of flash flooding particularly in areas with inadequate stormwater infrastructure (U.S. Global Change Research Group, 2014d) may impact FirstNet Installations and Infrastructure. Rising summer temperatures and the increased intensity and duration of heat waves may raise electricity demand for air conditioning and may strain electrical grid operations in the Northeast region (U.S. Department of Energy, 2015) while sustained high temperatures may overwhelm the capacity on-site equipment needed to keep microwave and other transmitters cool.

16.2.14.5. 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 West Virginia, 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 development scenarios described in Section 2.1.2, Proposed Action Infrastructure, 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.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with

construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.

- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or UA 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 partners 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 mitigation incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

16.2.14.6. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Potential Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations would dictate the concentrations and associated impacts.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be few GHG emissions associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Emissions would arise from use of power generators as the main power source. Emissions from the use of one fossil-fuel-powered generator would not be significant based on the defined significance criteria, since activities would be temporary and short-term. These potential impacts could be further reduced through implementation of the required BMPs and mitigation measures. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.14.

16.2.15. Human Health and Safety

16.2.15.1. Introduction

This section describes potential impacts to human health and safety in West Virginia associated with deployment of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

16.2.15.2. 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 16.2.15-1. As described in Section 16.2, 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 16.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

<table>
<tr><th rowspan="2">Type of Effect</th><th rowspan="2">Effect Characteristics</th><th colspan="4">Impact Level</th></tr>
<tr><th>Potentially Significant</th><th>Less than Significant with BMPs and Mitigation Measures Incorporated</th><th>Less than Significant</th><th>No Impact</th></tr>
<tr><td rowspan="3">Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites</td><td>Magnitude or Intensity</td><td>Exposure to concentrations of chemicals above occupational regulatory limits and 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, TSCA, EPCRA</td><td rowspan="3">Effect is potentially significant, but with mitigation is less than significant.</td><td>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.</td><td>No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.</td></tr>
<tr><td>Geographic Extent</td><td>Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)</td><td>Impacts only at a local/neighborhood level.</td><td>NA</td></tr>
<tr><td>Duration or Frequency</td><td>Occasional frequency during the life of the project.</td><td>Rare event</td><td>NA</td></tr>
</table>

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 public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Man-Made Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the 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

16.2.15.3. 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 16.2.15-1, 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 like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. For example, if fuel is spilled from an onsite fuel tank, the spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015b).

- Engineering controls;
- Work practice controls;
- Administrative controls; and then
- 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, SOPs 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 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 WVDOL is not authorized by OSHA to administer a state program for public or private sector employers. Therefore, WVDOL 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 16.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned or active 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 CIMC database and U.S. Department of Interior’s Abandoned Mine Lands inventory, through the WVDEP, 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. Propose FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, Superfund, and applicable West Virginia state laws in order to protect workers and the 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 WVDEP may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

FirstNet is intended to improve connectivity among public safety entities during disasters, thereby improving their ability to respond more safely and effectively during such events. The addition of towers, structures, facilities, equipment, and other deployment activities is expected to allow for expedited responses during natural and manmade disasters. The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 16.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

16.2.15.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and maintenance activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to human health and safety under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential 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 could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore 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 the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would

require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no

construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROW, work over water, environmental contamination, and mine lands), 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, and 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 were 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.

16.2.15.5. 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 partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 16.1.15, Human Health and Safety.

WV APPENDIX A – WATER RESOURCES

Table A-1: Characteristics of West Virginia's Watershed Regions, as Defined by WVDEP

Watershed Region/Size Land Area within WV (square miles)	Major Watersheds	Major Water Quality Concerns
Region 1 (4,654)	Little Kanawha Middle Ohio North Middle Ohio South Upper Ohio North Upper Ohio South	• Pathogens • Iron • Sediment • Manganese • Aluminum • PCBs • Chloride • Dixon
Region 2 (6,067)	Cheat River Youghiogheny River Dunkard Creek Monongahela River Tygart Valley River West Fork River	• Iron • Aluminum • Manganese • Pathogens • Zinc
Region 3 (4,273)	Cacapon River Potomac Direct Drains Shenandoah Hardy Shenandoah Jefferson North Branch Potomac River South Branch Potomac River	• PCBs • Pathogens • Sediment • Aluminum • Iron • Manganese
Region 4 (8,494)	Coal River Elk River Gauley River Greenbrier River James River Lower Kanawha River Lower New River Upper Kanawha River River Upper New	• Iron • Pathogens • Aluminum • Selenium • Sediment • Dioxin • Phosphorous • PCBs
Region 5 (3,352)	Big Sandy River Twelvepole Creek Lower Guyandotte Lower Ohio Tug Fork Upper Guyandotte River	• Aluminum • Iron • Manganese • Pathogens • Chloride • PCBs • Manganese

Source: (WVDEP, 2013c)(USEPA, 2015b)

ACRONYMS

Acronym	Definition
ACS	American Community Survey
AGL	Above Ground Level
AML	Abandoned Mine Lands
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act of 1979
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BTOP	Broadband Technology Opportunities Program
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CEQ	Council On Environmental Quality
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Methane
CIMC	Cleanups In My Community
CKB	North Central West Virginia Airport
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRS	Community Rating System
CRW	Yeager Airport
CSR	Code of State Rules
CWA	Clean Water Act
DAQ	Division of Air Quality
DOC	U.S. Department of Commerce
DoD	Department of Defense
DOT	Department of Transportation
EED	Environmental Engineering Division
EIA	Energy Information Agency
EMS	Emergency Medical Services
EPCRA	Emergency Planning and Community Right to Know Act
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager

Acronym	Definition
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HSEMA	Homeland Security and Emergency Management
HTS	Tri-State/Milton J. Ferguson Field
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
LBS	Locations-Based Services
LMR	Land Mobile Radio
LTE	Long-Term Evolution
MARC	Maryland Area Regional Commuter
MBTA	Migratory Bird Treaty Act
MGW	Morgantown Municipal-Walter L Bill Hart Field
MHI	Median Household Income
MLRA	Major Land Resource Area
MMT	Million Metric Tons
MSHA	Mine Safety and Health Administration
MSL	Mean Sea Level
MYA	Million Years Ago
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHA	National Heritage Area
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NM	Nautical Miles
NOX	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTIA	National Telecommunications Information

Acronym	Definition
NWI	National Wetlands Inventory
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OSHA	Occupational Safety and Health Administration
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PPE	Personal Protective Equipment
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetlands
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
SAA	Sense and Avoid
SASP	State Aviation System Plan
SCIP	Statewide Communications Interoperability Plan
SDS	Safety Data Sheets
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIEC	Statewide Interoperable Executive Committee
SIP	State Implementation Plan
SIRN	Statewide Interoperability Radio Network
SOC	Standard Occupational Classification
SOP	Standard Operating Procedure
SO_X	oxides of Sulfur
SUA	Special Use Airspace
SWA	Solid Waste Authorities
SWMB	Solid Waste Management Board
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UHF	Ultra-High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
WMA	Wildlife Management Area
WVAC	West Virginia Aeronautics Commission
WVBPH	West Virginia Bureau For Public Health

Acronym	Definition
WVDA	West Virginia Department of Agriculture
WVDEP	West Virginia Department of Environmental Protection
WVDHHR	West Virginia Department of Health and Human Resources
WVDHSEM	West Virginia Division of Homeland Security and Emergency Management
WVDNR	West Virginia Division of Natural Resources
WVDOC	West Virginia Department of Commerce
WVDOL	West Virginia Division of Labor Safety Section
WVDOT	West Virginia Department of Transportation
WVGES	West Virginia Geological and Economic Survey
WVOEHS	West Virginia Office of Environmental Health Services

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The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

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