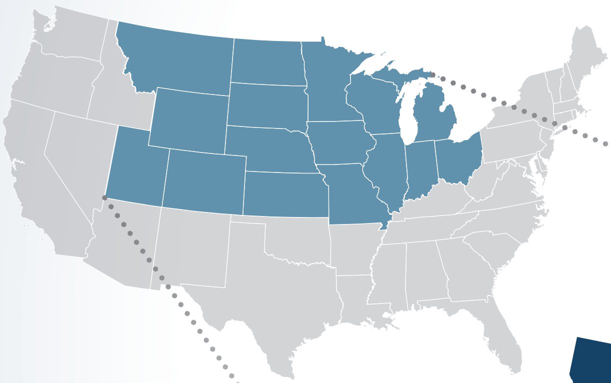
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 11 - CHAPTER 13



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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 11 - CHAPTER 13

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

August 2016

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13. NORTH DAKOTA

North Dakota was populated for centuries by American Indian tribes with a rich cultural history. The first recorded European visitor to North Dakota was a French explorer named La Verendrye in 1738, who traveled there while searching for a water route to the Pacific Ocean. La Verendrye encountered an American Indian village whose residents were referred to as "the Mantannes" (NPS, 2000a). Lewis and Clark also visited North Dakota during their 1804 expedition up the Missouri River. Settlement in North Dakota started in earnest in the 1870s when the Northern Pacific Railway reached the Missouri River. In 1889, North Dakota achieved statehood (State Historical Society of North Dakota, 2016a). North Dakota is bordered by Canada to the north, Montana to the west, South Dakota to the south, and Minnesota to the east. This chapter provides details about the existing environment of North Dakota as it relates to the Proposed Action.

General facts about North Dakota are provided below:

- **State Nickname**: The Peace Garden State
- **Area:** 70,698 square miles; **U.S. Rank**: 19 (U.S. Census Bureau, 2010)
- **Capital:** Bismarck
- **Counties:** 53 (U.S. Census Bureau, 2015a)
- **2015 Estimated Population:** 756,927 people; **U.S. Rank:** 47 (U.S. Census Bureau, 2015b)
- **Most Populated Cites:** Fargo, Bismarck, and Grand Forks (U.S. Census Bureau, 2015a)
- **Main Rivers:** Missouri River, Sheyenne River, Little Missouri River, and Red River of the North
- **Bordering Waterbodies:** Red River of the North
- **Mountain Ranges:** Badlands, Killdeer Mountains, and Turtle Mountains
- **Highest Point:** White Butte (3,506 ft) (USGS, 2001)

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13.1. AFFECTED ENVIRONMENT

13.1.1. Infrastructure

13.1.1.1. Definition of the Resource

This section provides information on key North Dakota 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, and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications). North Dakota is a typical U.S. state with developed population centers that demand high levels of infrastructure, connected by various levels of transportation infrastructure, most notably highly developed road, rail, and air travel systems.

Section 13.1.1.3 provides an overview of the traffic and transportation infrastructure in North Dakota, including road and rail networks and airport facilities. North Dakota public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 et seq.) (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 North Dakota are presented in more detail in Section 13.1.1.4. Section 13.1.1.5 presents details on public safety communications infrastructure and commercial telecommunications infrastructure in North Dakota. An overview of utilities in North Dakota, such as power, water, and sewer, is presented in Section 13.1.1.6.

13.1.1.2. Specific Regulatory Considerations

Multiple North Dakota laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 13.1.1-1 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.

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

Table 13.1.1-1: Relevant North Dakota Infrastructure Laws and Regulations

State Law/ Regulation	Agency	Applicability
NDCC: Title 23 Health and Safety; Title 37 Military; Title 54 State Government: NDAC: Title 33 State Department of Health	North Dakota Department of Emergency Services (NDDES)	Coordinates the state's emergency management functions and manages the state's emergency communications systems.
NDCC: Chapter 49 Public Utilities: NDAC: Title 69 Public Service Commission	North Dakota Public Service Commission	Regulates common carrier, telecommunications, pipeline, electric, gas, and heating companies and other public utilities.
NDCC: Title 24 Highways, Bridges, and Ferries: NDAC: Title 37 Department of Transportation	North Dakota Department of Transportation	Oversees the development and operation of the state's transportation systems.

13.1.1.3. Transportation

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

The North Dakota Department of Transportation (NDDOT) has jurisdiction over freeways and major roads, airports, and railroads in the state; local counties have jurisdiction for smaller streets and roads. The responsibilities of the NDDOT are to "oversee the development of surface transportation (highways, bridges, rail, transit, pedestrian and bicycle paths, and safe routes to schools) in the state" (NDDOT, 2014).

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

- 87,078 miles of public roads (FHWA, 2014) and 4,429 bridges (FHWA, 2015a);
- 3,667 miles of rail network that includes passenger rail and freight (NDDOT, 2007);
- 276 aviation facilities, including airstrips and heliports (FAA, 2015a);
- No harbors (U.S. Harbors, 2015); and
- No major ports.

Road Networks

As identified in Figure 13.1.1-1, the major urban center of the state is Fargo in the east. North Dakota has two major interstates connecting its metropolitan areas to one another, as well as to other states. Travel outside the major metropolitan areas conducted on interstates, state, and county roads. Table 13.1.1-2 lists the interstates and their start/end points in North Dakota. 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 (FHWA, 2015b).

Table 13.1.1-2: North Dakota Interstates

Interstate	Southern or western terminus in ND	Northern or eastern terminus in ND
I-29	SD line in Greendale	Canada line in Pembina
I-94	MT line near Beach	MN line in Fargo

In addition to the Interstate System, North Dakota has both National Scenic Byways and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA 2013). Figure 13.1.1-1 illustrates the major transportation networks, including roadways, in North Dakota. Section 13.1.8, Visual Resources, describes the National and State Scenic Byways found in North Dakota from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's (USDOT) Federal Highway Administration (FHWA). North Dakota has two National Scenic Byways:

- Native American Scenic Byway, also known as the Standing Rock National Native American Scenic Byway: 250 miles through North Dakota and South Dakota (FHWA, 2015c) (North Dakota Parks and Recreation, 2016).
- Sheyenne River Valley Scenic Byway: 63 miles in southeastern North Dakota (FHWA, 2015d).

North Dakota State Scenic Byways and Backways are roads with statewide interest; State Scenic Byways and Backways are designated and managed by NDDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. North Dakota has eight State Scenic Byways and Backways that crisscross the entire state (NDPRD, 2015a):[2]

- Chan SanSan Scenic Backway,
- Des Lacs National Wildlife Refuge Backway,
- Killdeer Mountain Four Bears Scenic Byway,
- Old Red Old Ten Scenic Byway,
- Rendezvous Region Scenic Backway,
- Sakakawea Scenic Byway,
- Theodore Roosevelt National Park North Unit Scenic Byway, and
- Turtle Mountain Scenic Byway.

[2] The total number of State Scenic Byways may not include those segments of National Scenic Byways that are also designated as State Scenic.

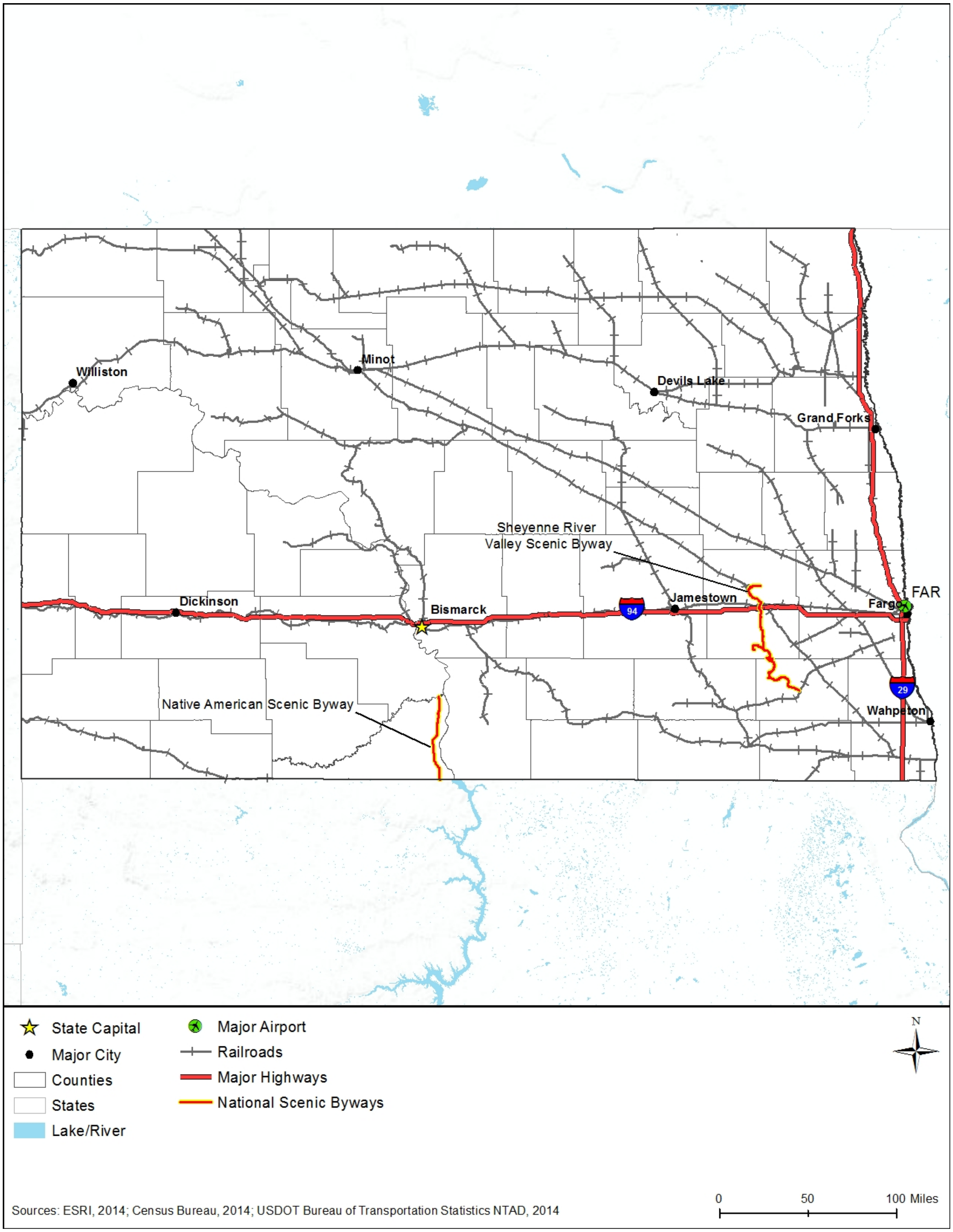


Figure 13.1.1-1: North Dakota Transportation Networks

Airports

Air service to the state is primarily provided by Hector International Airport (FAR) in Fargo, which is the largest airport in North Dakota. FAR is operated by the Municipal Airport Authority (FAR, 2015). In 2015, the airport served 858,982 passengers and facilitated an average of 2,413 passengers per day. The airport facilitated 7,151 plane departures in 2015 (FAR, 2016). Figure 13.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 13.1.7, Airspace, provides greater detail on airports and airspace in North Dakota.

Rail Networks

North Dakota is connected to a network of passenger rail (Amtrak) and freight rail. Figure 13.1.1-1 illustrates the major transportation networks, including rail lines, in North Dakota. Amtrak runs one line through North Dakota, the Empire Builder. This line stops at seven stations in North Dakota, on its route from Chicago to Seattle. In 2013, Amtrak served 154,800 passengers in North Dakota; the majority of riders utilized the Minot station (NDDOT, 2014). Table 13.1.1-3 provides a complete list of Amtrak lines that run through North Dakota.

Table 13.1.1-3: Amtrak Train Routes Serving North Dakota

Route	Starting Point	Ending Point	Length of Trip	Cities Served in North Dakota
Empire Builder	Chicago, IL	Seattle, WA	46 hours	Fargo, Grand Forks, Devils Lake, Rugby, Minot, Stanley, Williston

Source: (Amtrak, 2015)

The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA, 2015a). Seven railroad companies own and operate on all of North Dakota's 3,667 miles of track (NDDOT, 2007). Two Class I freight railroad companies operate in the state, BNSF railway and the Canadian Pacific Railway, as well as three regional railroads and two local railroads (NDDOT, 2007). As of 2014, North Dakota ranked 16th in the nation for the amount of freight rail originating in the state, with 39.8 million tons, and 36th in the nation for the amount of freight rail terminating in the state, with 12.4 million tons (NDDOT, 2014).

Harbors and Ports

North Dakota has no harbors or ports.

13.1.1.4. Public Safety Services

North Dakota 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 13.1.1-4 presents North Dakota's key 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 13.1.9, Socioeconomics.

Table 13.1.1-4: Key North Dakota Indicators

North Dakota Indicators	
Estimated Population (2014)	739,482
Land Area (square miles) (2010)	69,000.80
Population Density (persons per sq. mile) (2010)	9.7
Municipal Governments (2013)	357

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

Table 13.1.1-5 presents North Dakota's public safety infrastructure, including fire and police stations. Table 13.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 13.1.1-5: Public Safety Infrastructure in North Dakota by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	367
Law Enforcement Agencies [b]	114
Fire Departments [c]	325

[a] Data collected by the U.S. Fire Administration in 2015.
[b] Number of agencies from state and local law enforcement include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[c] Data collected by the U.S. Fire Administration in 2015.

Sources: (USFA, 2015) (U.S. Bureau of Justice Statistics, 2011)

Table 13.1.1-6: First Responder Personnel in North Dakota by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	110
Fire and Rescue Personnel [b]	8,479
Law Enforcement Personnel [c]	1,859
Emergency Medical Technicians and Paramedics [d e]	1,050

[a] BLS Occupation Code: 43-5031.
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 53-3011 (Ambulance Drivers and Attendants, Except Emergency Medical Technicians). Volunteer firefighters reported by the U.S. Fire Administration.
[c] Full-time employees from state and local law enforcement agencies which include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[d] BLS Occupation Code: 29-2041.
[e] All BLS data collected in 2015.

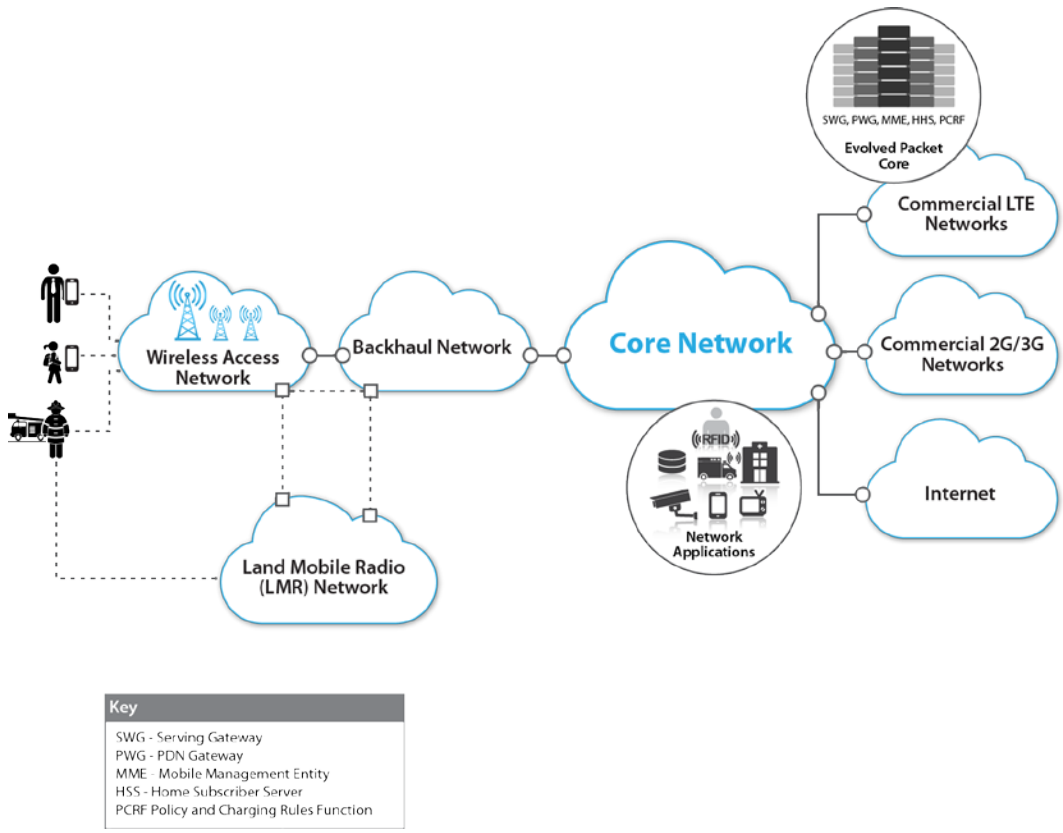
Sources: (USFA, 2015) (U.S. Bureau of Justice Statistics, 2011) (BLS, 2015a)

13.1.1.5. *Telecommunications Resources*

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure; therefore, the following information and data are combined from a variety of sources, as referenced.

In general, the deployment of telecommunications resources in North Dakota 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.

Figure 13.1.1-2 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 a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications. (FCC, 2016a)



Prepared by: Booz Allen Hamilton

Figure 13.1.1-2: Wireless Network Configuration

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as

LTE (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has also 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 in North Dakota.

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

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

To help enable the public safety community to incorporate disparate Land Mobile Radio networks with a nationwide public safety LTE broadband network, the U.S. Department of Commerce Public Safety Communications Research (PSCR) 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 to better inform investment decisions. (PSCR, 2015)

North Dakota operates a statewide, multipurpose network, which supports public safety, state agencies, and education called the North Dakota Statewide Technology Access for Government and Education Network (STAGEnet). North Dakota's Information Technology Department (ITD) summarizes STAGEnet as follows, "STAGEnet provides data, voice, and video services for state government, higher education, K12 education, political subdivisions, public safety entities, public health units, and libraries" (North Dakota ITD, 2014). Operational responsibility for STAGEnet is housed within the Network Services Division of North Dakota's ITD.

Governance and operational responsibilities for public safety and emergency communications, according to the North Dakota Department of Emergency Services (NDDES), began in 2003 and was formalized in 2004. The DES' website summarizes: "The Division of Emergency Management and State Radio Communications were combined in 2003 to establish an integrated State Operations Center. Two years later, action during the 59th Legislative Assembly created North Dakota DES comprised of the Division of Homeland Security and State Radio Communications" (North Dakota DES, 2015). Responsibility for the state's 9-1-1 system resides with DES, which also coordinates disaster and emergency communications with 50+ agencies and support entities.

Like most states, North Dakota's Public Safety LMR network environment is facing transition and reflects the challenges of the need for greater system capabilities, broader coverage, and technology modernization to broadband and fuller data capability delivery.

Statewide/Multi-County Networks

The wireless communications system supporting public safety within STAGEnet operates predominately on Very High Frequency (VHF) [3] with supplemental use of Ultra High Frequency (UHF) [4] for data services and for extended coverage (i.e., mobile repeaters). The system supports a broad mix of public safety police users as well as North Dakota's statewide Civil Defense interoperability communications for police, fire, EMS, and emergency communications—all of which occur on VHF (RadioReference.com, 2015a). Figure 13.1.1-3 depicts a tower location and coverage map for North Dakota's STAGEnet indicating breadth of network coverage currently provided by the network (North Dakota ITD, 2015).

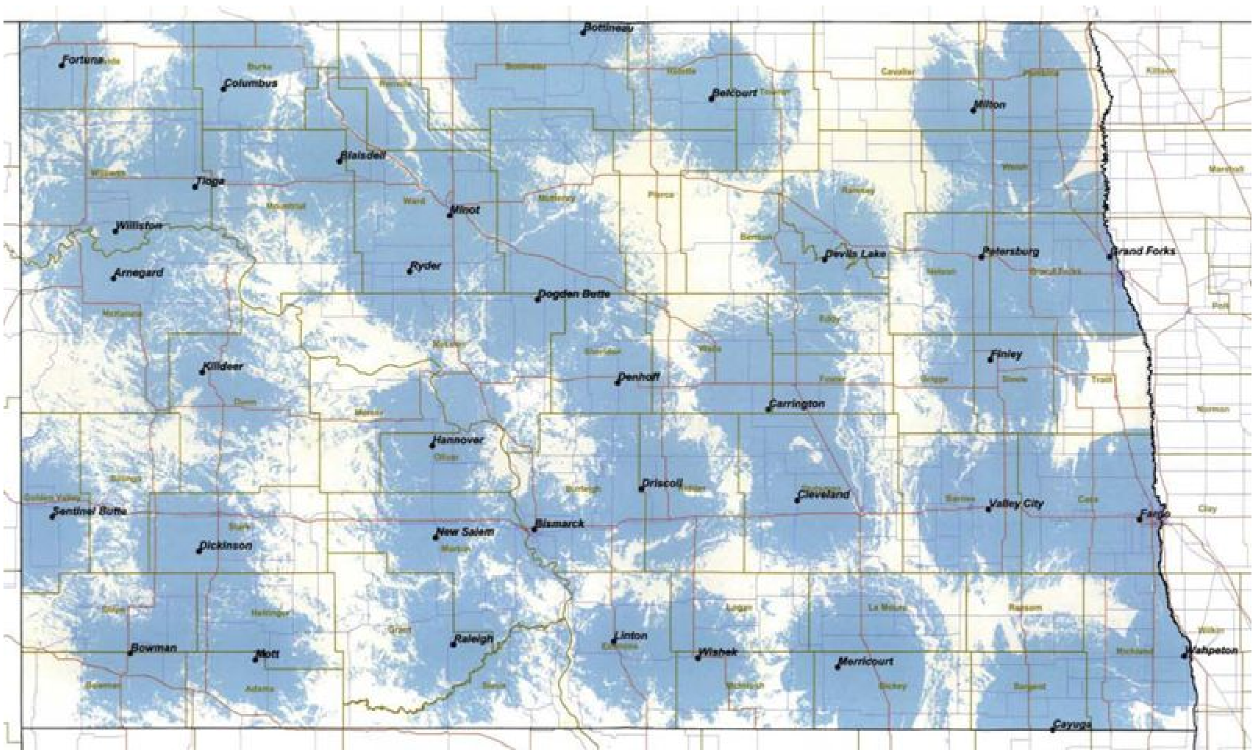
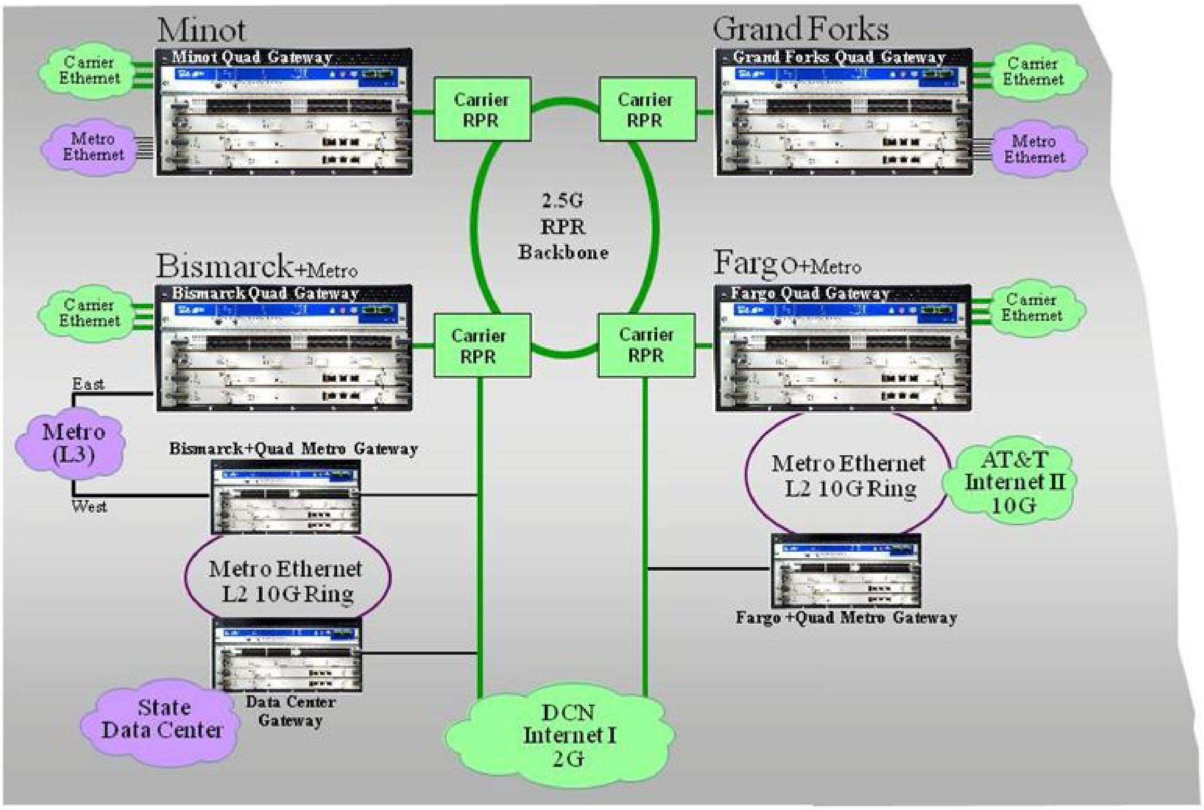


Figure 13.1.1-3: North Dakota's STAGEnet Tower Location and Coverage Map

Supporting North Dakota's STAGEnet is its six-gateway backbone network, located in its major cities. Figure 13.1.1-4 shows the use of a core fiber backbone as well as the use of Carrier-based Ethernet Transport (North Dakota ITD, 2009).

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



Source: (North Dakota ITD, 2009)

Figure 13.1.1-4: North Dakota's STAGEnet Backbone Network and Gateways

County/City Networks

Counties and cities in North Dakota are dependent on VHF and UHF networks for public safety communications in local and adjacent geographic areas. Three counties and their respective cities are representative of this current situation in the North Dakota Public safety LMR current environment: Cass County (Fargo), Burleigh County (Bismarck), and Ward County (Minot).

In Cass County Sheriff, Fire, and EMS County communications operate on VHF while County Jail and Court Security are on UHF. In Minot all public safety communications (with the exception of one Volunteer UHF channel) is on VHF. Rural fire departments operate on VHF exclusively and EMS and hospitals use a mix of VHF and UHF frequencies (RadioReference.com, 2015b). In Burleigh County where Bismarck (the capital of North Dakota) is located, all County Public Safety communications occurs on VHF as is the case for the city of Bismarck's Police, Fire, and EMS LMR communications (RadioReference.com, 2015c). In Ward County all Public Safety communications occurs on VHF. Whereas in the city of Minot, the Minot Police use both UHF and VHF while Fire and EMS organizations communicate via VHF systems exclusively (RadioReference.com, 2015d).

According to the Federal Communications Commission's (FCC) Master Public Safety Answering Points (PSAPs) registry there are 33 PSAPs in North Dakota serving North Dakota's 53 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

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

North Dakota'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 13.1.1-7 presents the number of providers of switched access[5] lines, Internet access[6], and mobile wireless services including coverage.

Table 13.1.1-7: Telecommunications Access Providers and Coverage (2013)

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines	99	97.8% of households
Internet access	0	58.0% of households
Mobile wireless	6	95.0% of population

[a] Switched access lines are a service connection between an end user and the local telephone company's switch (the basis of older telephone services); this number of service providers was reported by the FCC as of December 31, 2013 in Table 17 in "Local Telephone Competition: Status as of December 31, 2013" as the total of ILEC and non-ILEC providers (FCC, 2014b).
[b] Internet access providers are presented in Table 21 in "Internet Access Services: Status as of December 31, 2013" by technology provided; number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers (FCC, 2014a).
[c] Mobile wireless provider data is provided by the FCC in the sources identified. However, NTIA's National Broadband Map provides newer data, so FirstNet is using NTIA's GIS-based data from the National Broadband Map instead of the data reported by the FCC. The process for retrieving the National Broadband Map data is explained in detail in a subsequent footnote in Section 13.1.1.5, Last Mile Fiber Assets.

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

Table 13.1.1-8 shows the wireless providers in North Dakota along with their geographic coverage. The following four maps Figures 13.1.1-5 to 13.1.1-8 show: the combined coverage

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

for the top two providers; Sprint and SRT Communication Inc.'s coverage; UTMA, InvisiMax Inc., Consolidated Telecom, and Turtle Mountain Communication's coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.

Table 13.1.1-8: Wireless Telecommunications Coverage by Providers in North Dakota

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	99.08%
Verizon Wireless	93.44%
SRT Communications, Inc.	14.96%
Sprint	7.24%
UTMA	6.69%
Turtle Mountain Communications	6.66%
Consolidated Telcom	5.94%
InvisiMax Inc.	5.49%
Other[a]	13.82%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Polar Communications Mutual Aid Corporation; West River Telecommunications Cooperative; Dakota Central Telecommunications Cooperative; Northwest Communications Cooperative, Inc.; Enventis; Bakken Wireless, LLC; Red River Rural Telephone Association, Inc.; Midnight Solutions Technologies; Northern Skies Wireless; Nemont Telephone Cooperative, Inc.; 702 Communications.

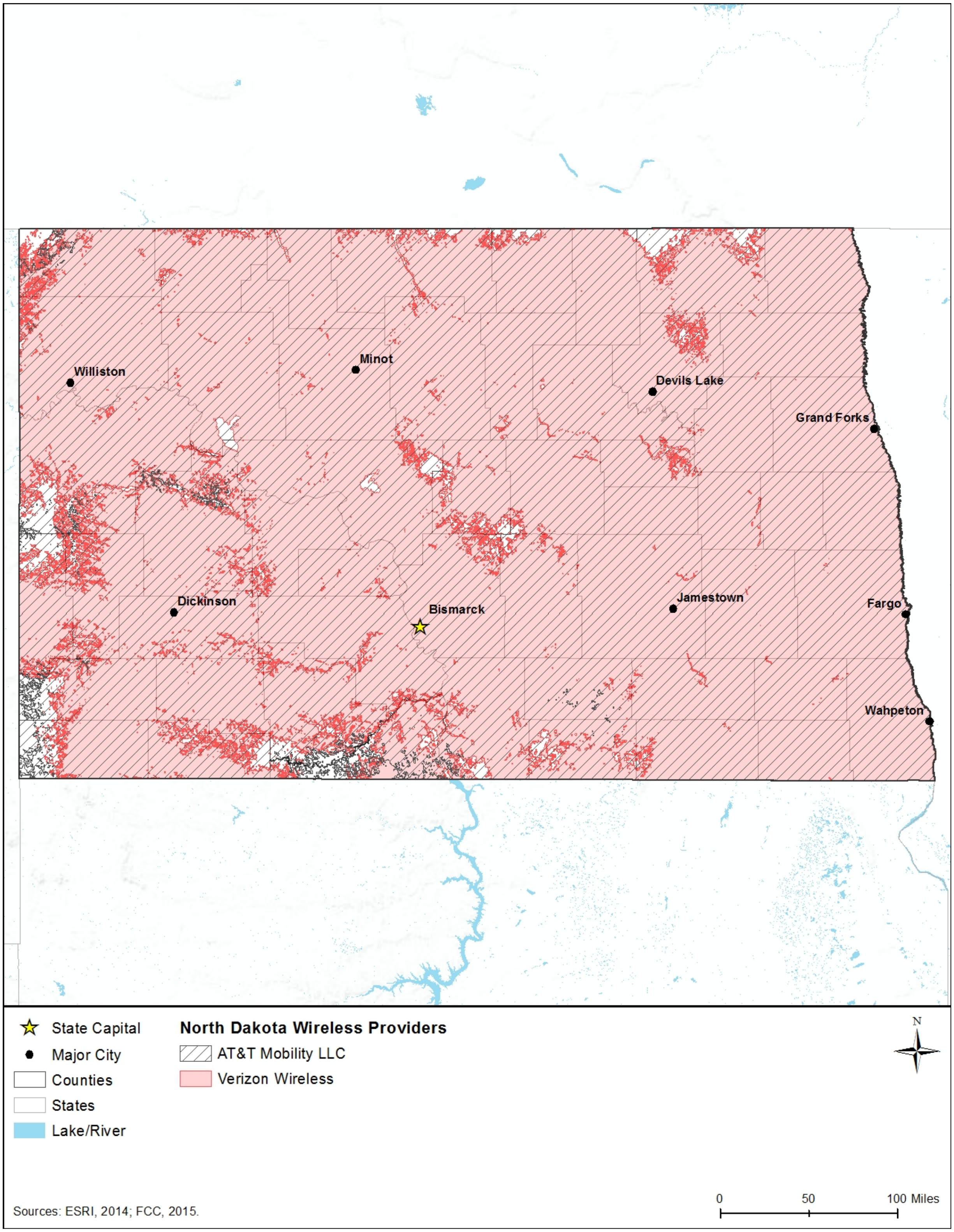


Figure 13.1.1-5: AT&T and Verizon Wireless Availability in North Dakota

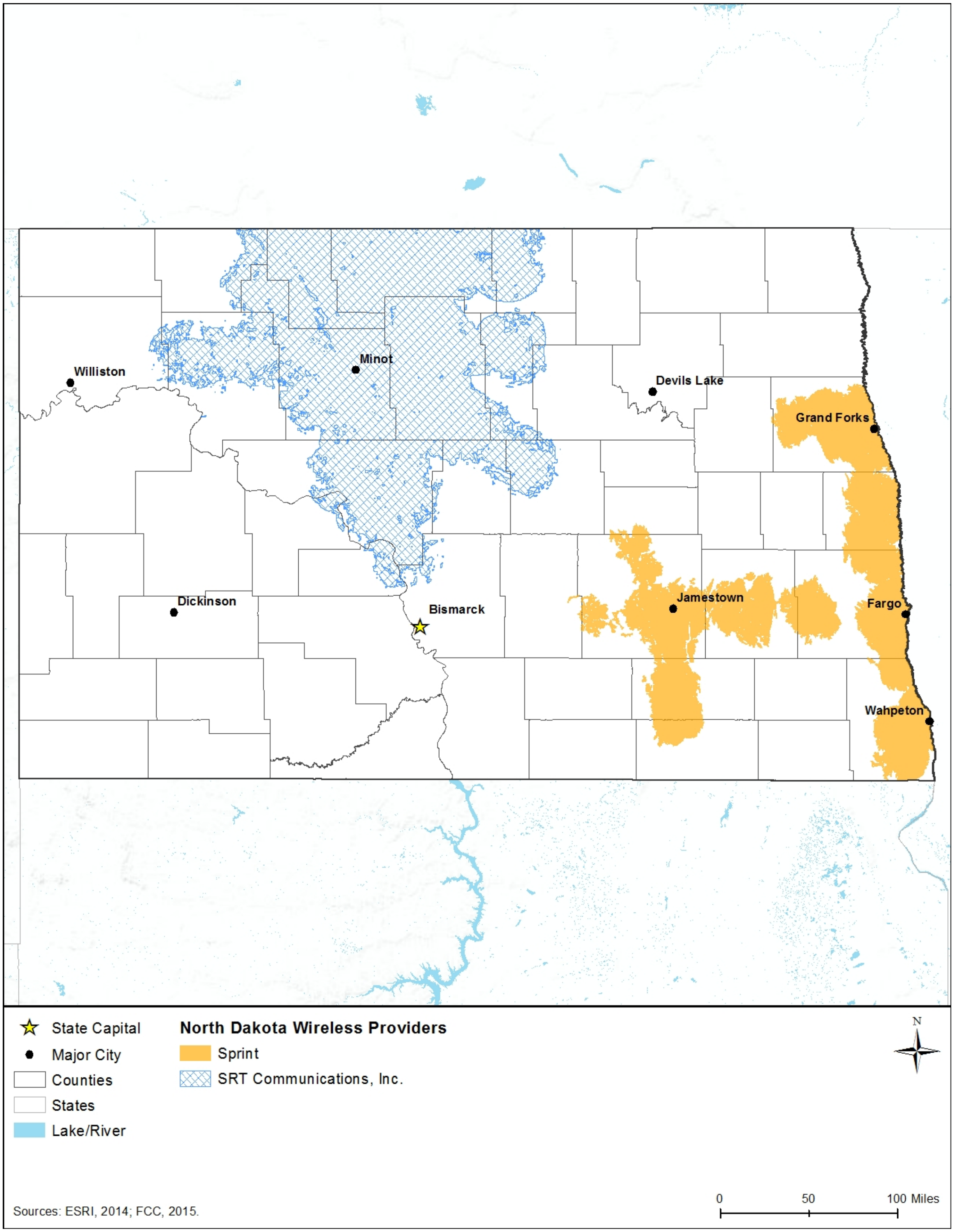


Figure 13.1.1-6: Sprint and SRT Communications Inc. Wireless Availability in North Dakota

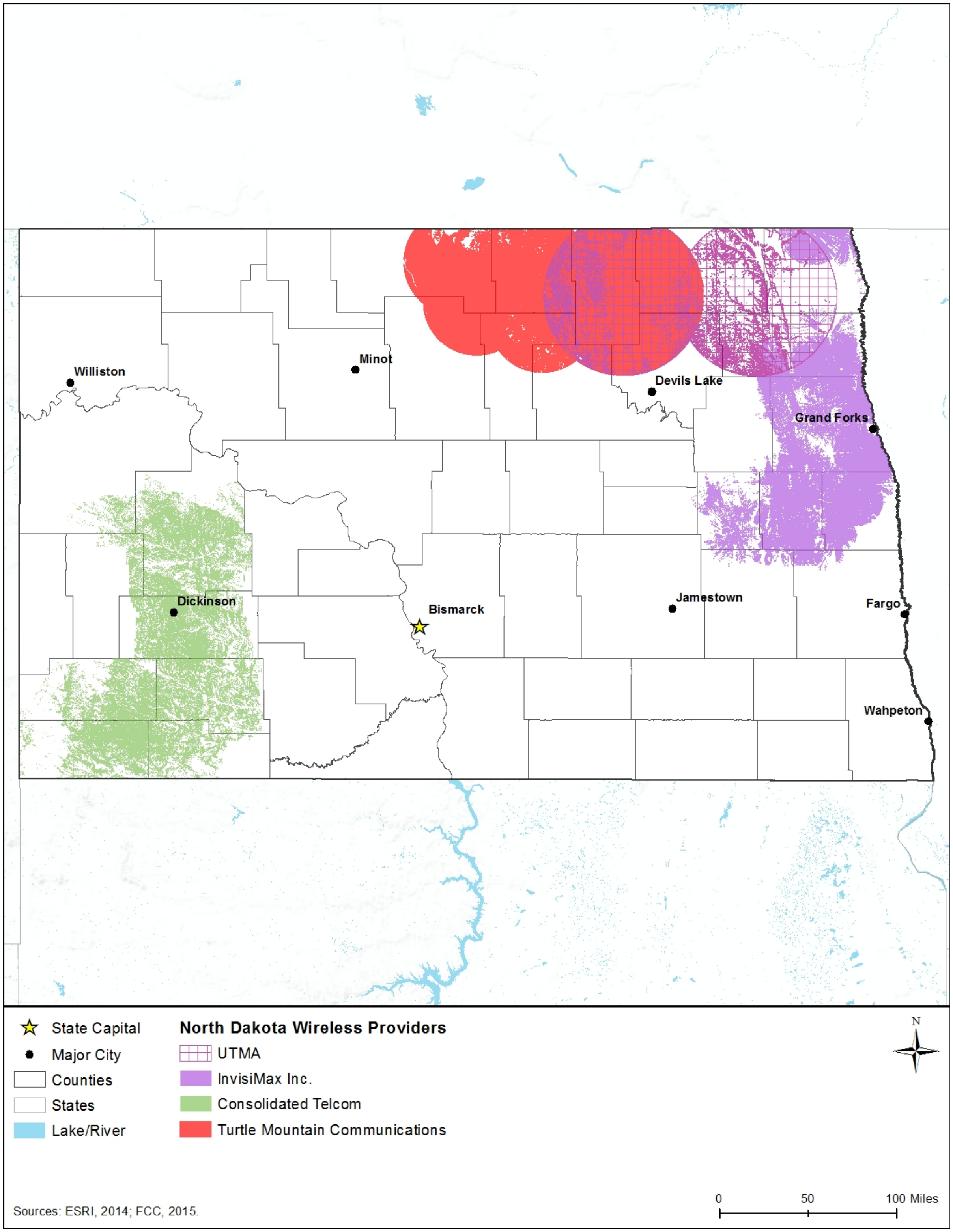


Figure 13.1.1-7: UTMA, InvisiMax Inc., Consolidated Telcom, and Turtle Mountain Communications Wireless Availability in North Dakota

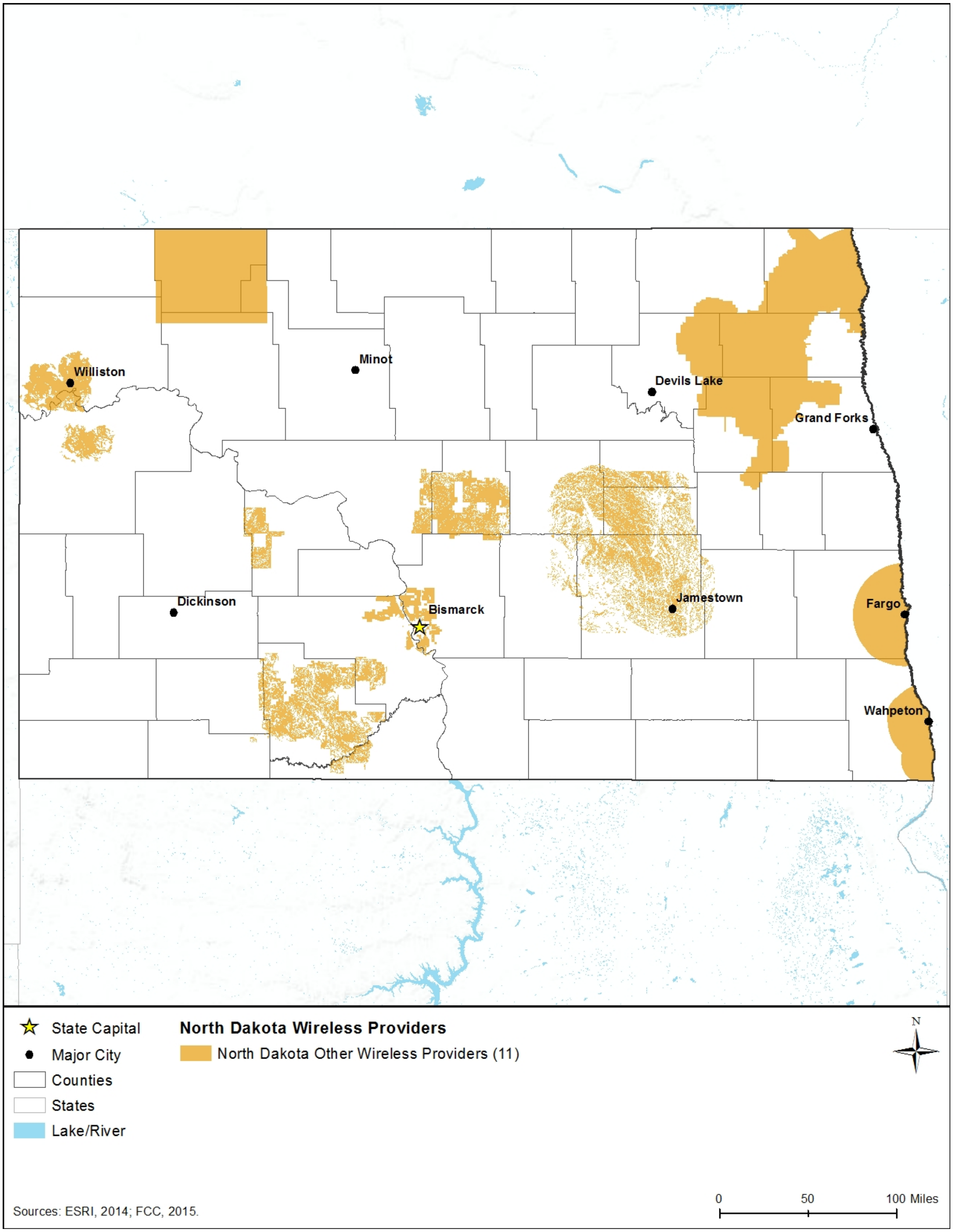


Figure 13.1.1-8: Other Providers Wireless Availability in North Dakota

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 13.1.1-9 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/

Prepared by Booz Allen Hamilton

Figure 13.1.1-9: Types of Towers

Telecommunications tower infrastructure proliferates throughout North Dakota, although tower infrastructure is concentrated in the higher and more densely populated areas of North Dakota; Fargo, Bismarck, Grand Forks, and Minot. Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016i).[7] Table 13.1.1-9 presents the number of towers (including broadcast

[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 (FCC, 2016b).

towers) registered with the FCC in North Dakota and Figure 13.1.1-10 presents the location of those structures, as of July 2016.

Table 13.1.1-9: Number of Commercial Towers in North Dakota by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	217	100ft and over	0
75ft – 100ft	223	75ft – 100ft	1
50ft – 75ft	160	50ft – 75ft	3
25ft – 50ft	75	25ft – 50ft	31
25ft and below	64	25ft and below	15
Subtotal	**739**	**Subtotal**	**50**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	46	100ft and over	1
75ft – 100ft	38	75ft – 100ft	0
50ft – 75ft	18	50ft – 75ft	0
25ft – 50ft	0	25ft – 50ft	2
25ft and below	1	25ft and below	1
Subtotal	**103**	**Subtotal**	**4**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	3	100ft and over	0
75ft – 100ft	53	75ft – 100ft	0
50ft – 75ft	22	50ft – 75ft	0
25ft – 50ft	16	25ft – 50ft	0
25ft and below	3	25ft and below	1
Subtotal	**97**	**Subtotal**	**1**
Constructed Tanks[d]			
Tanks	4		
Subtotal	**4**		
Total All Tower Structures		**998**	

Source: (FCC, 2015b)

[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, 2015b).
[b] Self standing or guyed (anchored) structure used for communication purposes (FCC, 2012).
[c] Multiple constructed structures per antenna registration (FCC, 2016c).
[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016c).

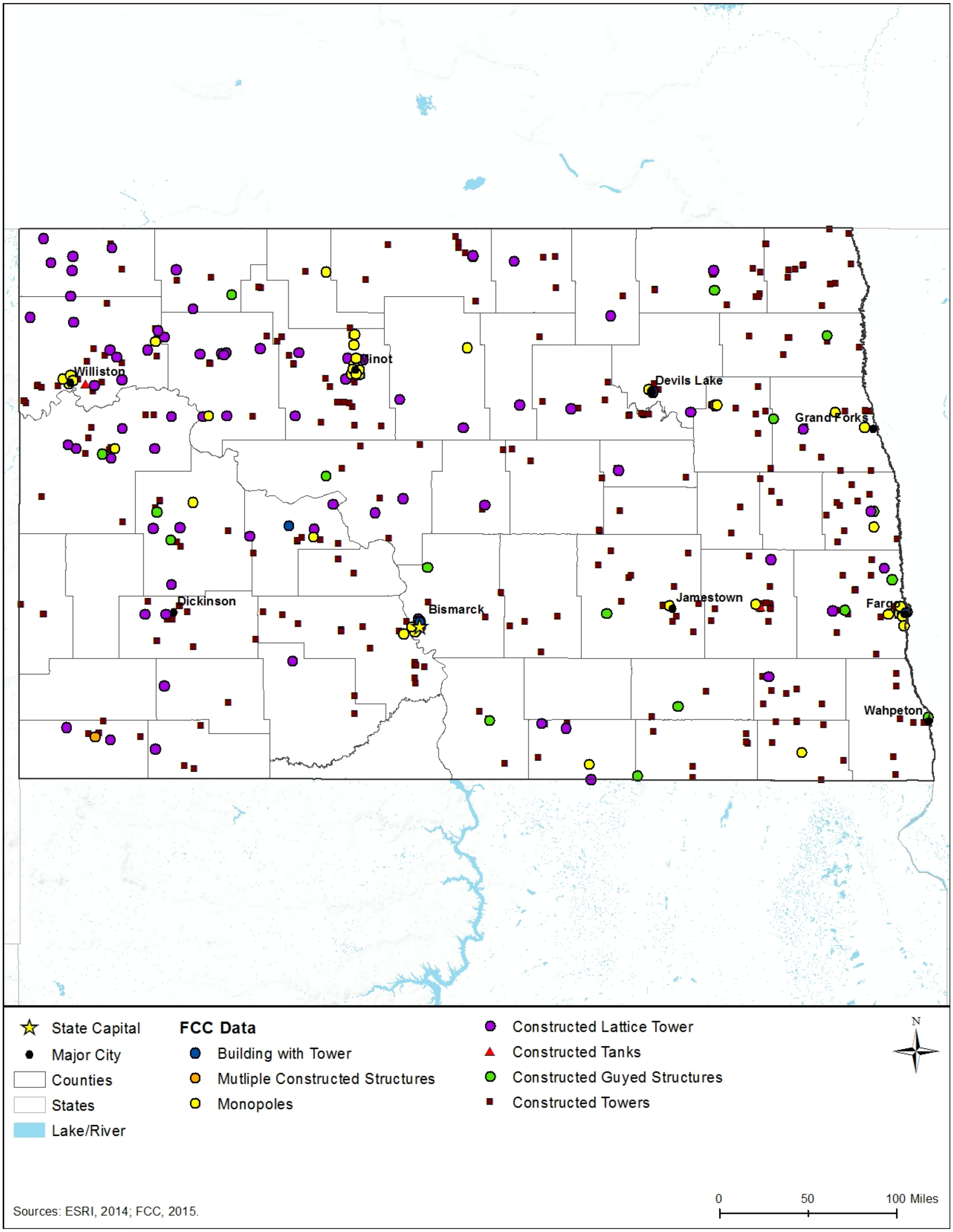
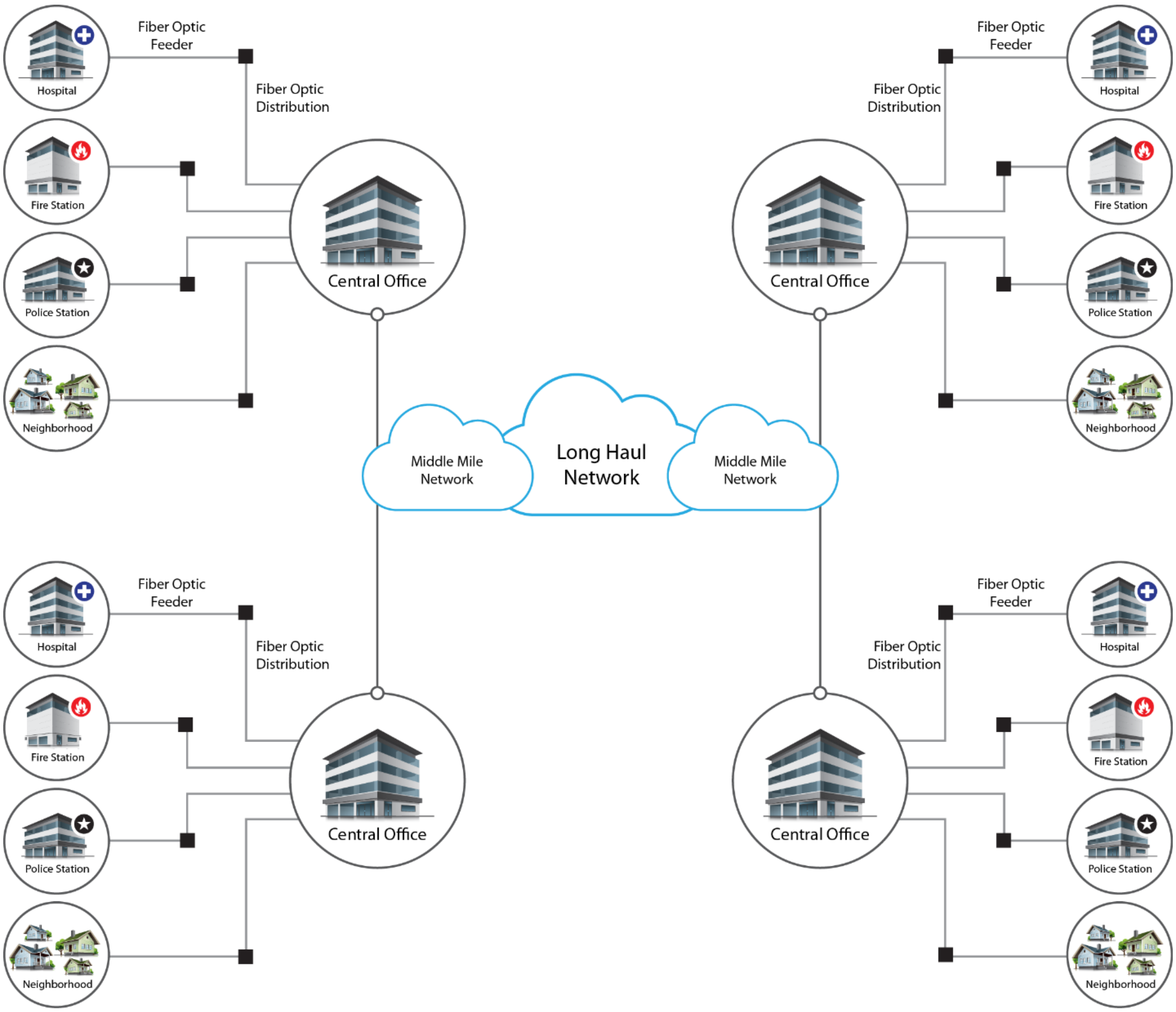


Figure 13.1.1-10: FCC Tower Structure Locations in North Dakota

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 13.1.1-11. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Prepared by: Booz Allen Hamilton

Source: (ITU-T 2012)

Figure 13.1.1-11: Typical Fiber Optic Network in North Dakota

Last Mile Fiber Assets

In North Dakota, fiber access networks are concentrated in the highest population centers as shown in the figures below. In North Dakota there are 32 fiber providers that offer service in the state, as listed in Table 13.1.1-10. Figure 13.1.1-12 shows coverage for Dakota Carrier Network, North Dakota Telephone Company, and Consolidated Telcom, and Figure 13.1.1-13 shows other providers with less than 5 percent coverage area.[8]

Table 13.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Dakota Carrier Network	48.32%
North Dakota Telephone Company	5.82%
Consolidated Telcom	5.34%
Other[a]	39.50%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: West River Telecommunications Cooperative; BEK; Communications Cooperative; Polar Communications Mutual Aid Corporation; Dickey Rural Telephone Cooperative; Northwest Communications Cooperative, Inc.; SRT Communications, Inc.; Reservation Telephone Cooperative; Dakota Central Telecommunications Cooperative; Red River Rural Telephone Association, Inc.; Griggs County Telephone Company; Midcontinent Communications; CenturyLink; UTMA; Turtle Mountain Communications; Nemont Telephone Cooperative, Inc.; Halstad Telephone Company; Inter-Community Telephone Company; West River Cooperative Telephone Company; Midstate Communications Inc.; Wolverton Telephone Company; Cable One Inc.; 702 Communications; Roberts County Telephone Cooperative Association; Arvig; Cable Services Inc.; Absaraka Cooperative Telephone Co., Inc.; MLGC, LLC; OrbitCom, Inc.; Mid-Rivers Telephone Cooperative, Inc.

[8] The broadband map utilized data collected as part of the broadband American Recovery and Reinvestment Act initiative. The data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). Each state's broadband data was downloaded accordingly. The data pertaining to broadband data/coverage for census blocks, streets, addresses, and wireless were used. Census blocks, roads, and addresses were merged into one file and dissolved by similar business and provider names. Square miles were calculated for each provider. The maps show all providers over 5% on separate maps; providers with areas under 5% were merged and mapped as "[State Name] Other Fiber Providers". All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "[State Name] Other Wireless Providers". Providers under 5% were denoted in their respective tables.

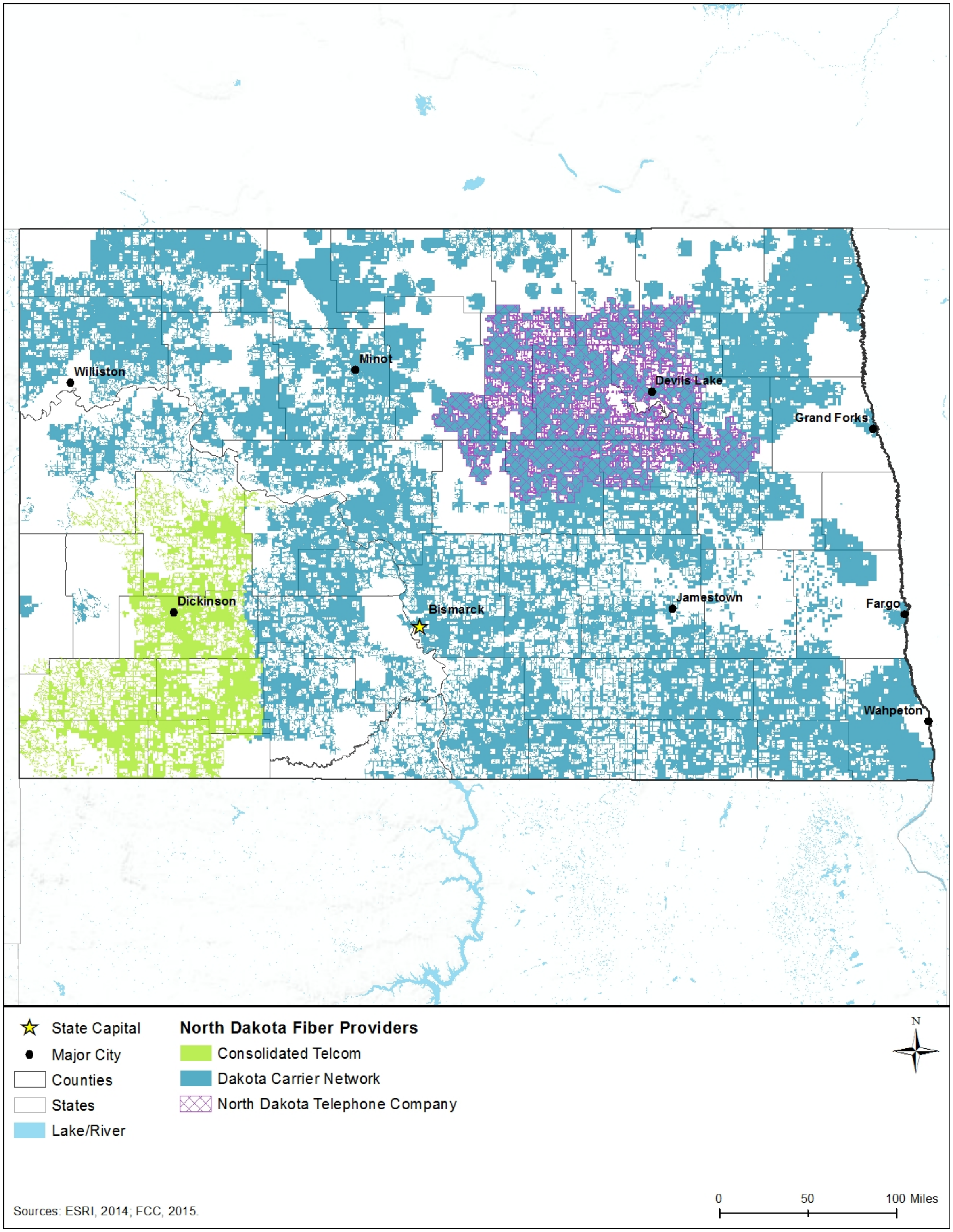


Figure 13.1.1-12: Fiber Availability in North Dakota for Consolidated Telcom, Dakota Carrier Network, and North Dakota Telephone Company

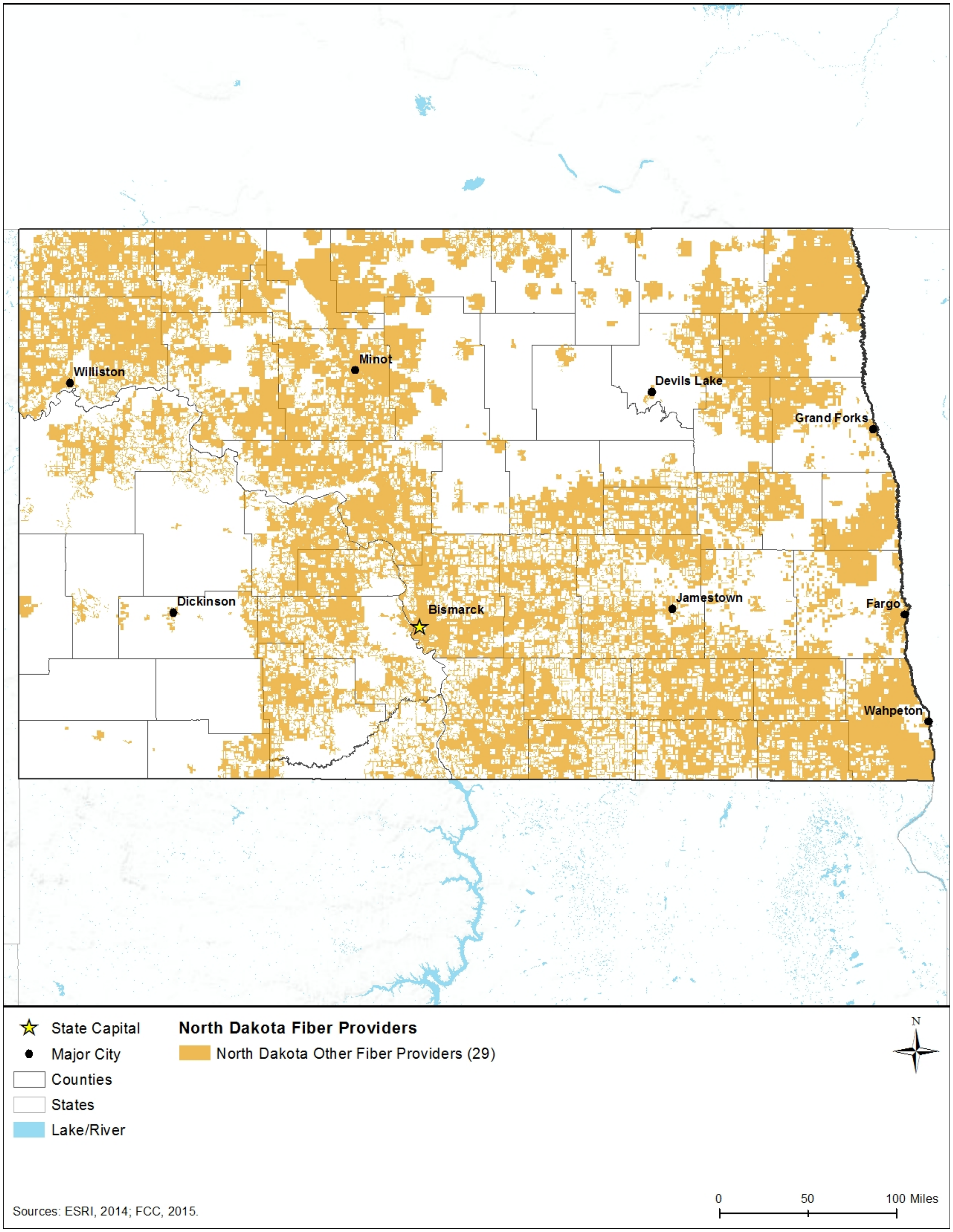


Figure 13.1.1-13: Other Providers Fiber Availability in North Dakota

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among and between telecommunications carriers and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013). Ownership of data centers may be public or private; comprehensive information regarding data centers may not be publicly available as some are related to secure facilities.

13.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 13.1.4, Water Resources, describes the potable water sources in the state.

Electricity

North Dakota is home to three types of electric utilities: investor owned utilities (IOUs), municipal electric companies, and rural electric cooperatives (RECs). Investor-owned utilities have their rates and service conditions regulated by the North Dakota Public Service Commission (PSC). The PSC does not have jurisdiction over these areas of service for municipal providers or rural cooperatives. RECs are owned by their respective customers, and are largely accountable to them (NDAREC, 2015). However, PSC does have authority over all providers with regard to enforcement of safety regulations. The PSC also arbitrates territory conflicts between OIUs and RECs (PSC, 2015a). The PSC currently oversees four IOUs that operate in North Dakota: Montana-Dakota Utilities Co., MDU Resources Group, Inc. Co., Northern States Power Company, and Otter Tail Corporation. In addition, there are 16 rural electric distribution cooperatives and 6 rural electric generation and transmission cooperatives that fall under the partial jurisdiction of the PSC (PSC, 2015b).

The vast majority of North Dakota's electricity is produced by plants using coal as a fuel source (EIA, 2015f). In 2014, the state produced 36,462,508 megawatthours[9] of electricity from several sources; of this, coal accounted for 27,394,068 megawatt hours (75 percent); ; the remaining 25 percent was accounted for by wind and hydroelectric power sources, with a minimal amount produced by natural and other gasses, petroleum liquids, or biomass (EIA, 2015f). These general trends have held true for several years: "In 2013, 79 percent of North Dakota's net electricity generation came from coal, almost 16 percent came from wind energy, and about 5 percent came from conventional hydroelectric power sources" (EIA, 2015b). As far back as 2001, coal-fueled

[9] One megawatthour can be defined as "One thousand kilowatt-hours or 1million 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, 2016a).

generation plants have accounted for up to 95 percent of the North Dakota's electricity (EIA, 2015a).

The state's location and population create an interesting situation regarding the usage of electricity; because of the lower population levels, North Dakota has consumes very little electricity in regard to the rest of the country. However, due to its weather and large industrial sector, it has a high per capita usage in relation to other states. Nearly half (49.3 percent) of North Dakota's power is used by the industrial sector, while 23.7 percent is used by the transportation sector, 14.5 percent by the commercial sector, and 12.5 percent by the residential sector (EIA, 2015b).

Water

Drinking water in North Dakota is overseen by the Division of Municipal Facilities. The Division certifies water system operators, inspects facilities, and helps finance the building of new water systems (NDDH, 2015a). Funding of new water systems, and changes to existing systems, are aided by the Drinking Water State Revolving Loan Fund (DWSRF). The state contributes a 20 percent match, with the remaining costs covered by the water system (NDDH, 2015b). The Drinking Water Program must review and approve these plans before funding them, with a turnaround of approximately 150 projects each year. The DWSRF offers funds to both public and privately owned community water systems (NDDH, 2015b).

Much of the regulatory work done by the Division of Municipal Facilities is performed by its Drinking Water Program, which regulates public water systems (NDDH, 2015c). The Program defines a public drinking water system as one with a minimum of "15 service connections or serves at least 25 people on a regular basis" (NDDH, 2015c). Public water systems are further broken down into three categories: community, transient non-community, and non-transient non-community. Community systems are involved in providing water to a given community, such as a town or mobile home community (NDDH, 2015c). Transient non-community systems serve ever changing groups of people, such as the water systems at a rest stop or restaurant. Non-transient non-community systems serve the same people on a regular basis, but in an area not categorized as a community. Examples of non-transient non-community water systems include power plants or office buildings. In total, there are approximately 515 public water systems in the state, serving 86 percent of the population (NDDH, 2015c). The standards to which public water systems are held are mandated by the U.S. Safe Drinking Water Act. These standards are upheld by the Drinking Water Program through the monitoring of contaminants and possible contaminants and inspection of water system facilities. In addition, the Drinking Water Program gives assistance regarding technical issues to citizens with private water wells (NDDH, 2015c).

Wastewater

Wastewater management in North Dakota is managed by the state Department of Health and it's Division of Water Quality. The Division operates a number of programs to handle different types of wastewater; among these are the Ground Water Protection Program, the Surface Water Protection Program, and the North Dakota Pollution Discharge Elimination System (NDPDES)

Permits Program (NDDH, 2015d). The Ground Water Protection Program protects the source of much of rural North Dakota's drinking water and seeks to restore polluted areas of the state's groundwater (NDDH, 2015e). The Source Water Protection Program is specifically used to "prevent contamination of public water supplies" and "raise public awareness of water resources used for public water supplies" (NDDH, 2015f).

The NDPDES Permits Program is one of the most important, as it issues permits to pollutant sources as a means of monitoring the state's bodies of water. Examples of these permitted pollutant sources include municipal waste treatment plants, animal feed operations, and oil refineries. Different permit types allow the program to track the types and concentration levels of discharged pollutants in the water supply (NDDH, 2015g). While the NDPDES Permits Program certifies facilities that produce wastewater, the Drinking Water Program offers required training and certification for wastewater treatment operators. It also performs inspections of wastewater facilities to ensure agreement with state and federal environmental regulations (NDDH, 2015b).

Solid Waste Management

The management of North Dakota's solid waste is overseen by the Solid Waste Program of the state Department of Health. They work with land based solid waste disposal facilities to ensure environmental compliance at the state and federal level (NDDH, 2015h). Much of the state's solid waste eventually ends up in one of its 13 municipal landfills, 4 industrial landfills, or 87 inert landfills. This information regarding the number of landfills is accurate as of 2012, 2009, and 2013, respectively. Inert landfills are those that contain materials that are not hazardous but also will not decompose; this includes materials such as concrete or drywall. In addition to these landfills, there are 46 composting facilities and 9 electronic waste recycling facilities (NDDH, 2015i). The most recent North Dakota Recycling Survey Results indicate that in 2009, 590,038 tons of municipal solid waste was generated in the state, a rate of 1,824 lbs. per person (NDDH, 2010). A study of recycling successes in the state showed a recycling rate of 18 percent. Of this, 11 percent was post-consumer recycling (NDDH, 2015j).

13.1.2. Soils

13.1.2.1. 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.

13.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Section 1.8, Overview of Relevant Federal Laws and Executive Orders. A list of applicable state laws and regulations is included in Table 13.1.2-1 below.

Table 13.1.2-1: Relevant North Dakota Soil Laws and Regulations

State Law / Regulation	Agency	Applicability
General Construction Permit (Chapter 33-16-01 of the North Dakota Department of Health [NDDH] Health Rules)	NDDH	Requires erosion and sediment control measures for construction activities disturbing one acre or more, as part of the Storm Water Pollution Prevention Plan under the General Construction Permit.

13.1.2.3. Environmental Setting

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

- Central Feed Grains and Livestock Region
- Northern Great Plains Spring Wheat Region
- Western Great Plains Range and Irrigated Region

Within and among North Dakota's three LRRs are 11 Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of North Dakota's MLRAs are presented in Figure 13.1.2-1 and Table 13.1.2-2, respectively.

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

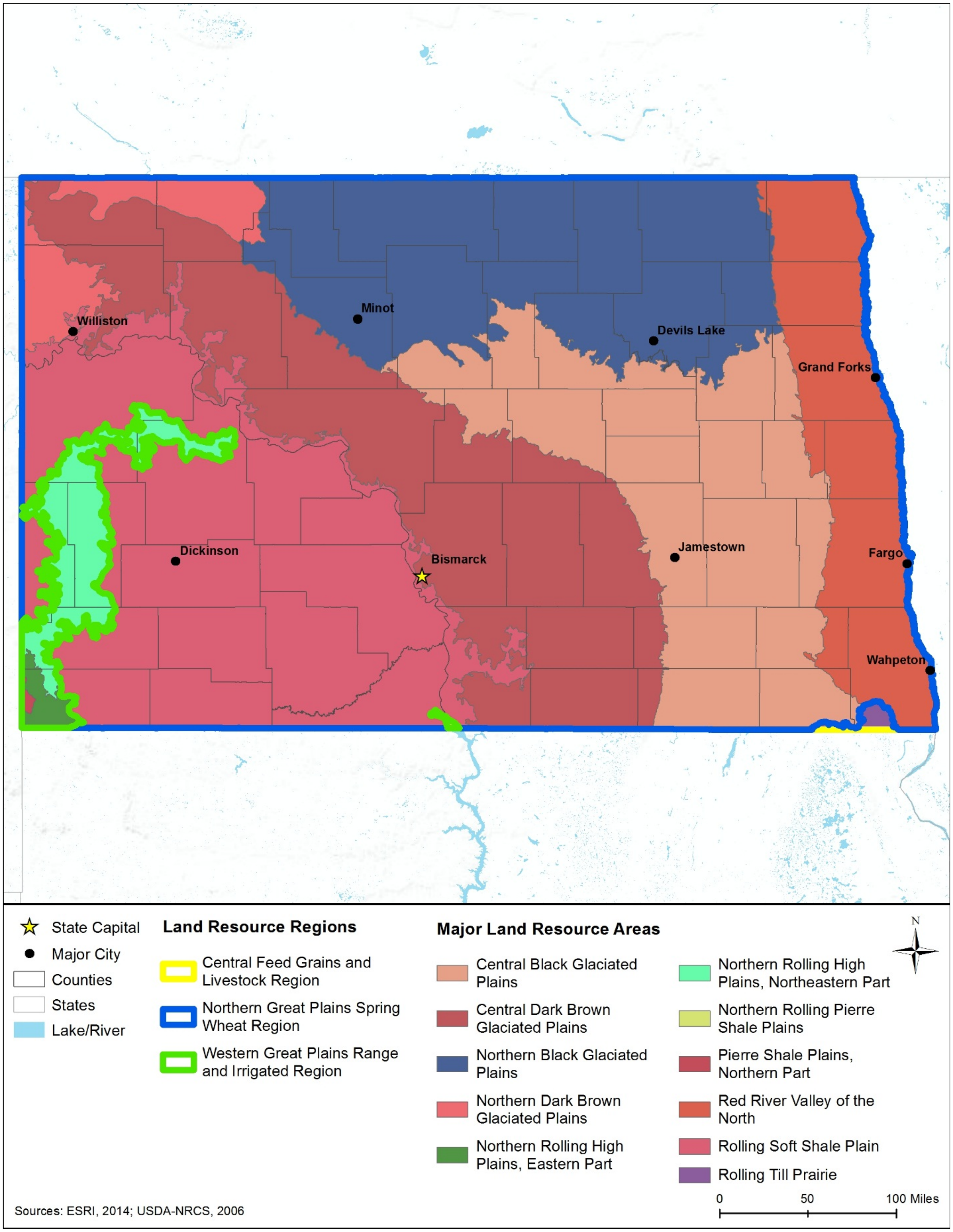


Figure 13.1.2-1: Locations of Major Land Resource Areas in North Dakota

Table 13.1.2-2 Characteristics of Major Land Resource Areas in North Dakota

MLRA Name	Region of State	Soil Characteristics
Central Black Glaciated Plains	Eastern North Dakota	Mollisols[a] is the dominant soil order. These clayey or loamy[b] soils typically range from poorly drained to well drained, and are very deep.
Central Dark Brown Glaciated Plains	Central and Northwestern North Dakota	Mollisols is the dominant soil order. These loamy or clayey soils typically range from poorly drained to well drained, and are very deep.
Northern Black Glaciated Plains	Northern North Dakota	Mollisols is the dominant soil order. These clayey or loamy soils range from poorly drained to well drained, and are typically very deep.
Northern Dark Brown Glaciated Plains	Northwestern North Dakota	Inceptisols[c] and Mollisols are the dominant soil orders. These loamy or clayey and very deep soils are typically moderately well drained or well drained.
Northern Rolling High Plains, Eastern Part	Southwestern North Dakota	Alfisols,[d] Entisols,[e] Inceptisols, and Mollisols are the dominant soil orders. These clayey or loamy soils are typically well drained and range from shallow to very deep.
Northern Rolling High Plains, Northeastern Part	Western North Dakota	Entisols, Inceptisols, and Mollisols are the dominant soil orders. These loamy and typically well drained soils range from shallow to very deep.
Northern Rolling Pierre Shale Plains	Southern North Dakota	Entisols, Inceptisols, Mollisols, and Vertisols[f] are the dominant soil orders. These clayey soils range from shallow to very deep, and are typically well drained.
Pierre Shale Plains, Northern Part	Southwestern North Dakota	Alfisols, Entisols, and Vertisols are the dominant soil orders. These clayey soils range from shallow to very deep, and are typically well drained.
Red River Valley of the North	Eastern North Dakota	Mollisols and Vertisols are the dominant soil orders. These soils are clayey or loamy, and are very deep. They are somewhat poorly drained to very poorly drained.
Rolling Soft Shale Plain	Western North Dakota	Entisols and Mollisols are the dominant soil orders. These soils are clayey or loamy and range from shallow to very deep. They are typically moderately well drained to somewhat excessively drained.
Rolling Till Prairie	Southeastern North Dakota	Mollisols is the dominant soil order. These loamy soils range from very poorly drained to well drained, and are very deep.

Source: (NRCS, 2006)

[a] Mollisols: "Soils that have a dark colored surface horizon relatively high in content of organic matter. They are base rich throughout and quite fertile. Mollisols form under grass in climates that have a moderate to pronounced seasonal moisture deficit." (NRCS, 2015b)

[b] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)

[c] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface." (NRCS, 2015b)

[d] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10% of the world's ice-free land surface." (NRCS, 2015b)

[e] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface." (NRCS, 2015b)
[f] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2% of the world's ice-free land surface." (NRCS, 2015b)

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

13.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy;[15] there are 12 soil orders in the world and they are characterized by both observed and inferred[16] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015c). The STATSGO2[17] soil database identifies 14 different soil suborders in North Dakota (NRCS, 2015d). Figure 13.1.2-2 depicts the distribution of the soil suborders, and Table 13.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[12] The flora and fauna of a region.
[13] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, D.; Olshansky, R.; Rogers, B. R., 2004).
[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).
[15] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013b).
[16] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015c).
[17] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

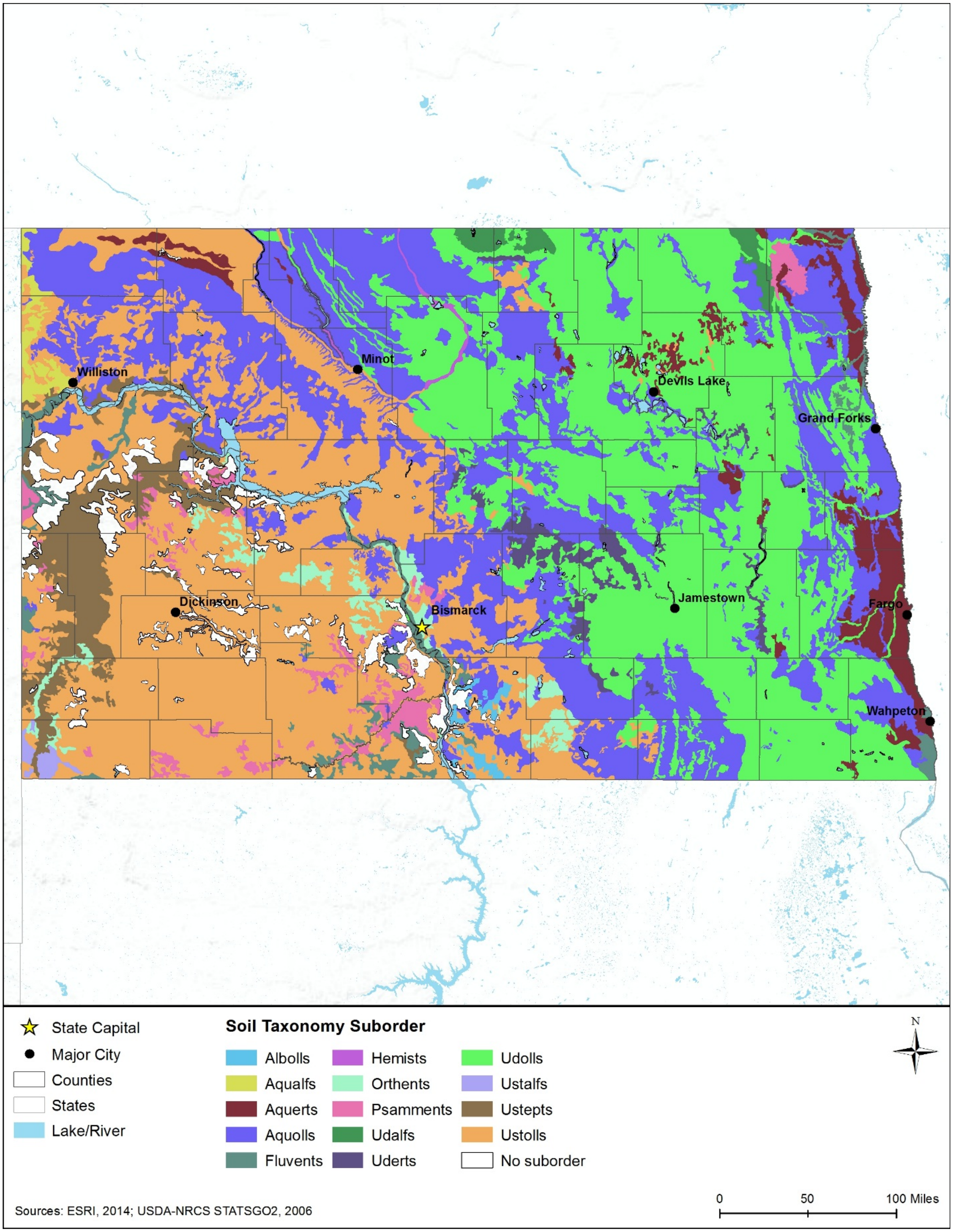


Figure 13.1.2-2: North Dakota Soil Taxonomy Suborders

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Table 13.1.2-3 Major Characteristics of Soil Suborders[18] Found in North Dakota, as depicted in Figure 13.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Albolls	Albolls have a fluctuating groundwater table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Silt Loam	0-1	Poorly drained	Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Clay	0-2	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Vertisols	Aquerts	Aquerts are wet soils, with prolonged moisture at or near the soil surface. Their natural vegetation includes savanna, grass, and forest. They are used as forest, rangeland, and cropland, although drainage for cropland can be difficult due to poor drainage.	Silty clay	0-1	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, coarse sand, fine sandy loam, loam, sandy loam, silt loam, silty clay, silty clay loam, satisfied sandy loam to silty clay loam, very fine sandy loam	0-3	Somewhat poorly drained to very poorly drained	No, Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on floodplains, 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.	Loam, silt loam, silty clay, silty clay loam, stratified very fine sandy loam to silty clay loam	0-25	Somewhat poorly drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Histosols	Hemists	Hemists are usually found in broad, flat areas, such as coastal plains and outwash plains as well as closed depressions. They are typically under natural vegetation and uses for rangeland, woodlands, and/or wildlife habitat, although some large areas have been cleared and drained, and utilized for cropland.	Mucky peat	0-1	Very poorly drained	Yes	A, D	Low, High	High, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Loam, silt loam, silty clay loam, weathered bedrock	3-50	Well drained	No	D	High	Very Low	High	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, sand, weathered bedrock	6-45	Somewhat excessively drained to excessively drained	No	A, C	Low, Medium	High, Low	Low to Medium, depending on slope	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.	Clay loam, loam	3-9	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Vertisols	Uderts	Uderts are found in humid areas, and primarily used as cropland, forest, or pasture. They have low permeability, and water usually must be drained from the surface of cropland.	Silty clay	6-15	Well drained	No	C	Medium	Low	Medium	Low

[18] Soil suborders constitute a broad range of soil types. Within each suborder, the range of soil types may have a range of properties across the state, which result in multiple values being displayed in the table for that suborder.

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
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.	Clay loam, extremely gravelly sand, fine sand, fine sandy loam, gravelly coarse sand, gravelly loam, gravelly sand, loam, loamy fine sand, loamy sand, sandy clay loam, sandy loam, silt loam, silty clay loam, stratified silt loam to clay loam	0-40	Moderately well drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Alfisols	Ustalfs	Ustalfs are primarily used for grazing or cropland, and they support savanna and grassland vegetation. They are found in areas with a marked dry season.	Loam	0-9	Moderately well drained	No	D	High	Very Low	High	Low
Inceptisols	Ustepts	Ustepts are freely drained soils, typically used as pasture or cropland, although some support forest, rangeland, and wildlife habitat.	Loam, sandy loam, silt loam	0-75	Well drained	No	B	Medium	Moderate	Medium	Low
Mollisols	Ustolls	Ustolls typically supported grass and forest vegetation, and are now primarily used as cropland or rangeland. They are generally freely drained, and found in subhumid to semiarid climates. Areas with drought are common, and blowing soil can be an issue.	Clay, clay loam, fine sandy loam, loam, loamy fine sand, sand and gravel, silt loam, silty clay, silty clay loam, stratified very fine sand to silt loam	0-25	Somewhat poorly drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

[a] 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). Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[b] Based on Runoff Potential, described in Section 13.1.2.5.

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

13.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential. [19] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 13.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in North Dakota.

- **Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[20] 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). Hemists, Psamments, Udolls, and Ustolls fall into this category in North Dakota.
- **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. Aquolls, Fluvents, Udalfs, Udolls, Ustepts, and Ustolls fall into this category in North Dakota.
- **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. Albolls, Aquolls, Fluvents, Psamments, Udalfs, Uderts, Udolls, and Ustolls fall into this category fall into this category in North Dakota.
- **Clay loam, silty clay loam, sandy clay, silty clay, or clay soils.** This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University, 2015). Albolls, Aqualfs, Aquerts, Aquolls, Hemists, Orthents, Udolls, Ustalfs, and Ustolls fall into this category in North Dakota.

13.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 13.1.2-3 provides a summary of the erosion potential for each soil suborder in North Dakota. Soils with the highest erosion potential in North Dakota include those in the Albolls, Aqualfs, Aquerts, Aquolls, Fluvents, Hemists, Orthents, Psamments,

[19] 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.
[20] 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).

Udalfs, Uderts, Udolls, Ustalfs, Ustepts, and Ustolls suborders, which are found throughout most of the state (Figure 13.1.2-2).

13.1.2.7. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates. (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFS, 2009b). Other characteristics that factor into compaction and rutting risk include soil composition (i.e., low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than 10 tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 13.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in North Dakota. Soils with the highest potential for compaction and rutting in North Dakota include those in the Albolls, Aqualfs, Aquerts, Aquolls, and Hemists suborders, which are found throughout most of the state, except the southwestern portion (Figure 13.1.2-2).

13.1.3. Geology

13.1.3.1. 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 Water Resources (Section 13.1.4), Human Health and Safety (Section 13.1.15), and Climate Change (Section 13.1.14).

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

- Section 13.1.3.3, Environmental Setting: Physiographic Regions and Provinces[21, 22]
- Section 13.1.3.4, Surface Geology
- Section 13.1.3.5, Bedrock Geology[23]

[21] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[22] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[23] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015c).

- Section 13.1.3.6, Paleontological Resources[24]
- Section 13.1.3.7, Fossil Fuel and Mineral Resources
- Section 13.1.3.8, Geologic Hazards[25]

13.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 13.1.3-1 below.

Table 13.1.3-1: Relevant North Dakota Geology Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
Chapters 54-17.3 and 43-04 of the North Dakota Century and Administrative Codes	North Dakota Geological Survey	Any activity that involves investigation, excavation, collection, or otherwise recording paleontological resources on state lands, requires a permit.
North Dakota State Building Code	North Dakota Department of Commerce	Seismic requirements for construction of building foundations.

13.1.3.3. Environmental Setting: Physiographic Regions and Provinces

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

North Dakota is entirely within the Interior Plains Physiographic Region (USGS, 2003b) (Figure 13.1.3-1). The Interior Plains are composed of two physiographic provinces: the Central Lowland and Great Plains.

[24] Paleontology: “Study of life in past geologic time based on fossil plants and animals” (USGS, 2015d).
[25] 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, 2013b).

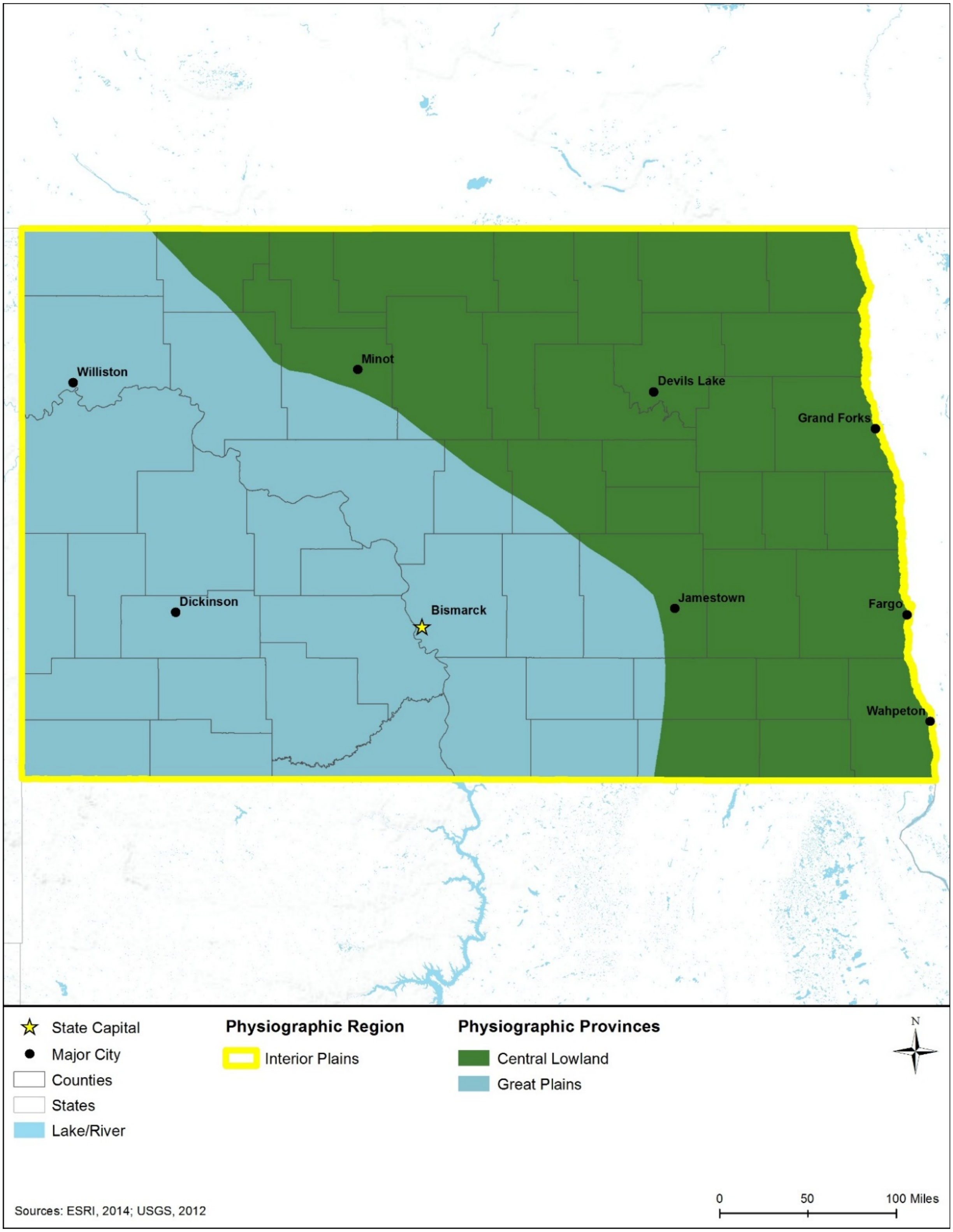

Figure 13.1.3-1: Physiographic Regions, Provinces, and Sections of North Dakota

Interior Plains Region

The Interior Plains Region extends across much of the interior of the United States, roughly between the western edge of the Appalachian Highlands (near states including Ohio, Tennessee, and Alabama), and the eastern edge of the Rocky Mountain System (including states such as Montana, Wyoming, and Colorado) (Fenneman, 1916). Metamorphic[26] and igneous[27] rocks dating to the Precambrian Era (older than 542 million years ago (MYA)) underlie the entire region.[28] There is minimal topographic relief throughout the region, except for the Black Hills of South Dakota. During the Mesozoic Era, much of the Interior Plains were covered by the oceans, resulting in the formation of sedimentary rocks,[29] which lie on top of the Precambrian basement rocks. Erosion from the Rocky Mountains to the west and the Ozark/Ouachita Mountains to the east, also contributed to the formation of sandstone,[30] mudstone,[31] and clay (USGS, 2014a).

As reported above, the Interior Plains Region within North Dakota is composed of two physiographic provinces: the Central Lowland and Great Plains (USGS, 2003b).

Central Lowland Province **–** As the largest physiographic province in the United States, the Central Lowland Province includes more than 580,000 square miles and encompasses the eastern portion of the Interior Plains Region. Much of the region is flat lying and is at about 2,000 feet above sea level (ASL) (NPS, 2014a).

Within North Dakota, the Central Lowland includes much of the eastern portion of the state. The North Dakota Geological Survey identifies seven distinct areas within the Central Lowland, all of which were formed as a result of historical glacial activity (Bluemle, J.; Biek, B., 2015). Two distinct topographical features in North Dakota's Central Lowland Province are the Missouri Escarpment[32] and Pembina Escarpment. The Missouri Escarpment is a steep slope that cuts diagonally across North Dakota from northwest to southeast, and forms the border between the Central Lowland (in the eastern half of the state) from the Great Plains to the west. This topographical feature formed as a result of a continental ice sheet. In the eastern portion of the province, the Pembina Escarpment forms the western edge of the Red River Valley. Between the two escarpments lies the Drift Prairie, which is characterized by "glacial deposits, or drift, composed of rocks of different sizes cover the area. Glacial melt caused small ponds or 'potholes' to form. Gently rolling hills surround the potholes" (State Historical Society of North Dakota, 2015a).

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[26] Metamorphic Rock: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids" (USGS, 2015e).
[27] Igneous Rock: "Rocks that solidified from molten or partly molten material, such as magma" (USGS, 2005).
[28] For consistency, this PEIS uses the University of California Berkeley Geologic Time Scale for all of the FirstNet PEIS state documents. Time scales differ among universities and researchers; FirstNet utilized a consistent time scale throughout, which may differ slightly from other sources. (University of California Museum of Paleontology, 2011)
[29] 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, 2014g)
[30] Sandstone: "Sedimentary rock made mostly of sand-sized grains" (USGS, 2015e).
[31] Mudstone: "A very fine-grained sedimentary rock formed from mud" (USGS, 2015e).
[32] Escarpment: "A cliff formed by faulting, erosion, or landslides" (USGS, 2015e).

Great Plains Province – The Great Plains Province includes more than 450,000 square miles and encompasses the western portion of the Interior Plains Region. The Great Plains, which are the second largest physiographic province in the United States, are noted for their flat topography that is interrupted by the occasional hill or lowland. (USGS, 2003b) (NPS, 2014a)

Within North Dakota, the Great Plains includes much of the western portion of the state. The North Dakota Geological Survey identifies four distinct areas within the Great Plains (Bluemle, J.; Biek, B., 2015). Elevation rises to the west throughout the province and ranges from 1,600 to 3,500 feet above sea level (ASL) (State Historical Society of North Dakota, 2015a). The area between the Missouri Escarpment and the Missouri River to the west is locally referred to as the Missouri Coteau, which is characterized by "a broken line of little hills… and small ponds" (State Historical Society of North Dakota, 2015a). West of the Missouri Coteau, in the far western portion of the state, are the Missouri Badlands, which were never impacted by glacial activity; rocky formations and rugged topography are characteristic of this area (State Historical Society of North Dakota, 2015a).

Figure 13.1.3-2 displays the location of each of these sub-areas within North Dakota's Central Lowland and Great Plains.

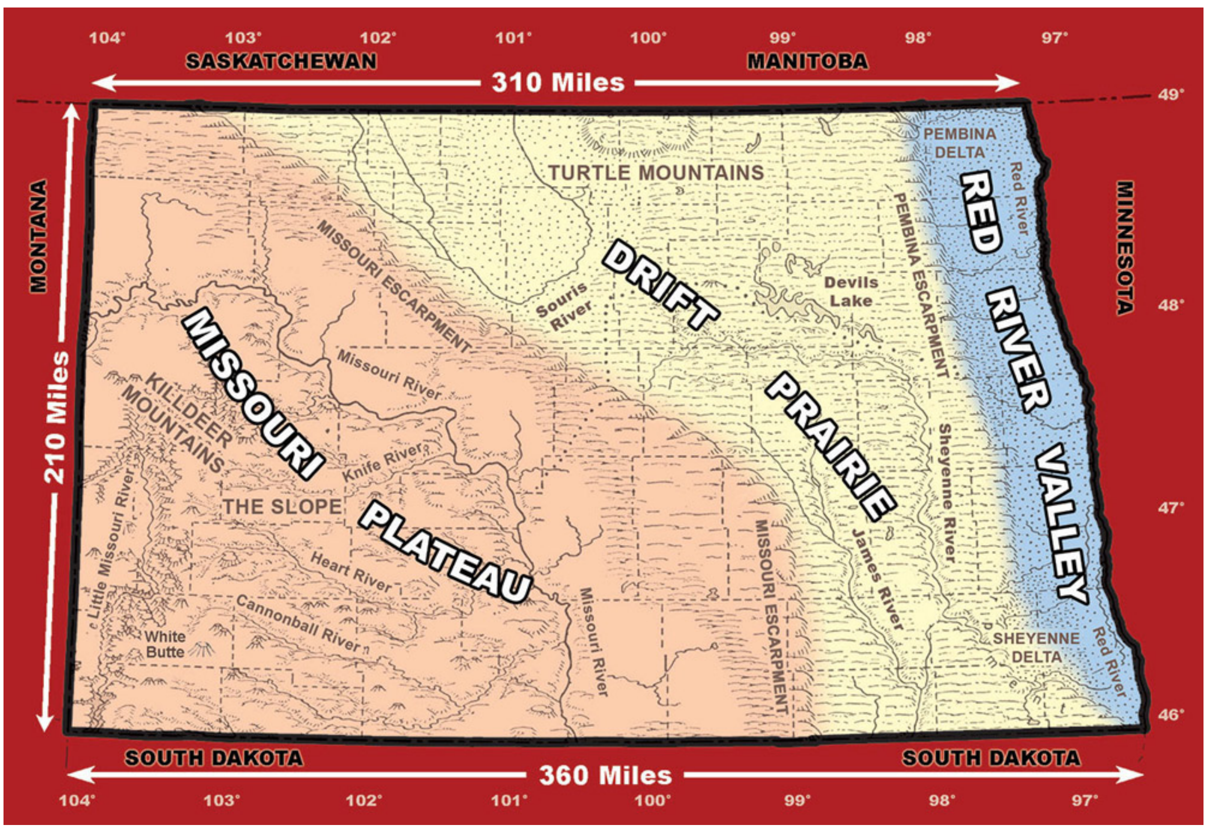


Figure 13.1.3-2: Representation of sub-areas within North Dakota's Central Lowland and Great Plains

Source: (State Historical Society of North Dakota, 2016b)

13.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[33] 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,[34] subsidence,[35] and erosion. (Thompson, 2015)

North Dakota's landscape in the northern and eastern areas of the state is reflective of a landscape smoothed by glaciers. Ice Age glaciers stopped just north of the present-day Missouri River (Trimble D. , 1980), and were diverted to the south and east due to the presence of the Missouri Escarpment. Areas to the south and west of the Missouri Escarpment and Missouri River (which were not affected by the Ice Age glaciers) are characterized by buttes, hills, and large valleys, formed from the erosion of sandstone,[36] siltstone,[37] lignite,[38] and claystone that are mostly from the Paleocene-aged Fort Union group. Areas to the north and east of the Missouri River and Missouri Escarpment are characterized by gently rolling topography and is known as “drift prairie.” Moraines[39] are present where glacial debris has accumulated; these landforms have been attributed to the Wisconsinan glaciation between 70,000 and 10,000 years ago. In eastern North Dakota, the flat Red River Valley plain denotes where the floor of the glacial Lake Agassiz once existed; this area is approximately 35 miles wide, with flat-bed silt and clay deposits in the center (Bluemle, J.; Biek, B., 2015).

Surface deposits throughout the state have been attributed to Cretaceous (146 to 66 MYA) formations (e.g., Hell Creek, Fox Hills, and Pierre Formations) and Tertiary (66 to 2.6 MYA) formations (e.g., White River Group, Golden Valley Formation, Sentinel Butte Formation, Bullion Creek Formation, and Cannonball/Ludlow/Slope Formations). Quaternary (2.6 MYA to present) glacial drift (e.g., Coleharbor Group) is also prevalent in the northeastern part of the state (North Dakota Geological Survey, 1977).

Figure 13.1.3-3 depicts the main surficial composition of North Dakota.

[33] 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, 2013d).
[34] Slope failure: “Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses” (Idaho State University 2000).
[35] Subsidence: “Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials” (USGS, 2000).
[36] Sandstone: “Sedimentary rock made mostly of sand-sized grains” (USGS, 2015e).
[37] Siltstone: “A sedimentary rock made mostly of silt-sized grains” (USGS, 2015e).
[38] Lignite Coal: “Lignite is a coal in the early stages of coalification, with properties intermediate to those of bituminous coal and peat. The two geographical areas of the U. S. with extensive lignite deposits are centered in the States of North Dakota and Texas” (USEPA, 1998).
[39] Moraine: “A general term for unstratified and unsorted deposits of sediment that form through the direct action of, or contact with, glacier ice” (USGS, 2013d).

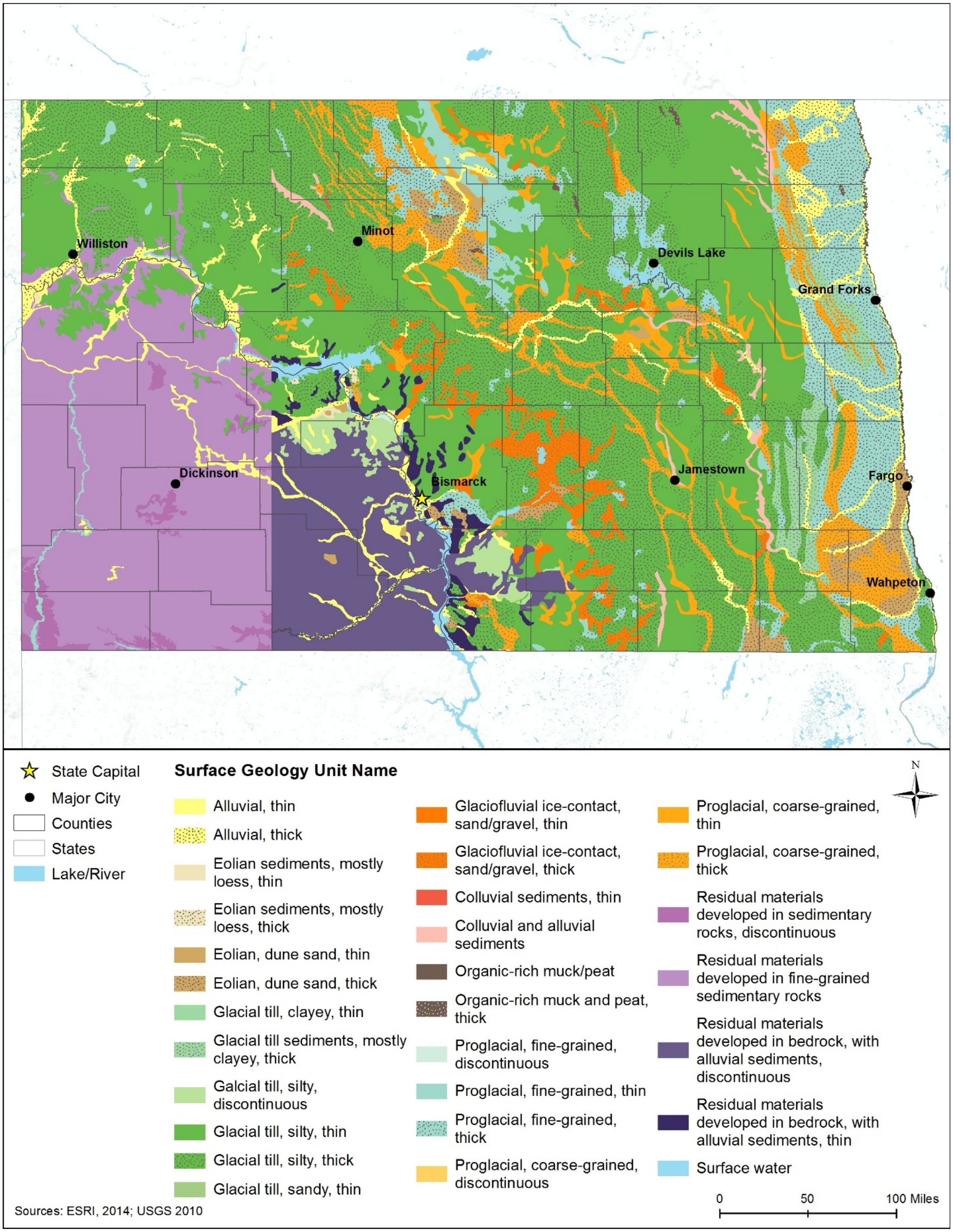


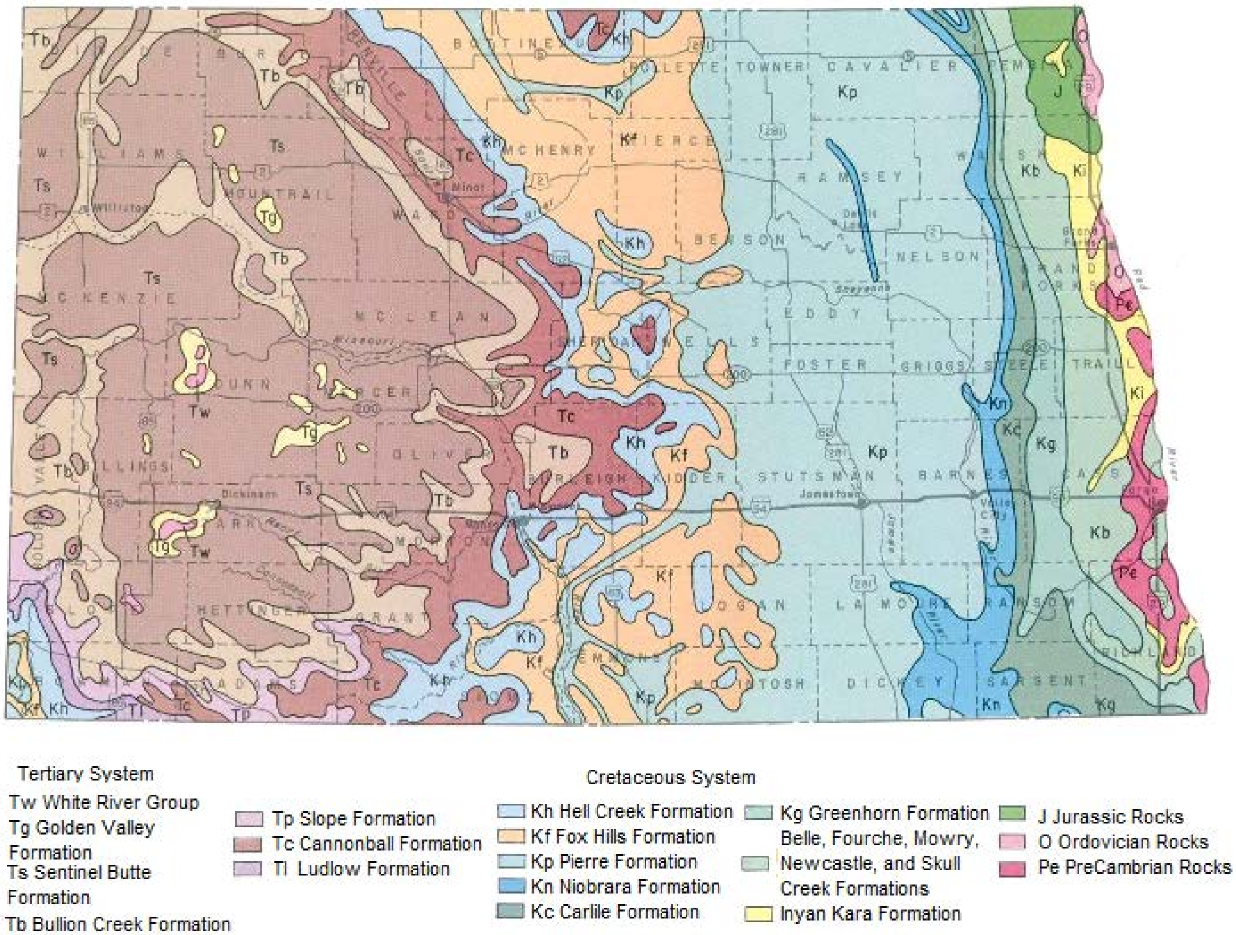
Figure 13.1.3-3: Generalized Surface Geology for North Dakota

13.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015a) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[40] rock composition, and regional tectonism.[41] 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 (New Hampshire Department of Environmental Services, 2014).

North Dakota's bedrock is evident on ground surfaces southwest of the Missouri River, especially along valley walls. North and east of the Missouri River, most bedrock is covered by glacial sediment. The oldest exposed bedrock in southwestern North Dakota is gray to black shale of the Carlile, Niobrara, Pierre, and Cannonball Formations, which date to the Cretaceous Period (146 to 66 MYA). The Fox Hills Formation, also dating from the Cretaceous Period, is composed of marine sand. Other bedrock materials in southwestern North Dakota were deposited by water and wind, and are known as continental sediment; these materials comprise the Hell Creek, Ludlow, Slope, Bullion Creek, and Sentinel Butte formations (all of which date from the Cretaceous or Tertiary [66 MYA to present] Periods), and include sand, silt, clay, sandstone, lignite, petrified wood, flint, scoria,[42] and freshwater limestone.[43] The material can vary from soft, easily crushable material to extremely hard rock. The remaining bedrock materials exposed at the surface was also deposited by wind and water, and includes the Golden Valley Formation and White River Group sediment; these materials include clay, sand, siltstone, and limestone (Bluemle, 1977). Bedrock dating from the Jurassic Period (200 to 146 MYA), Ordovician Period (488 to 444 MYA), and Precambrian Era (older than 542 MYA), is found in far eastern North Dakota, along the Red River (North Dakota Geological Survey, 1988). Figure 13.1.3-4 displays the general bedrock geology for North Dakota.

[40] 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, 2000b).
[41] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2016b).
[42] Scoria: "Very bubbly (vesicular) basalt or andesite. Both scoria and pumice develop their bubbly textures when escaping gas is trapped as lava solidifies. Scoria is more dense and darker than pumice." (USGS, 2015e)
[43] 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, 2015e)



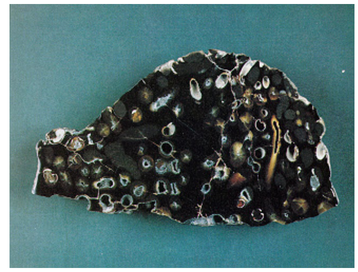
Source: (North Dakota Geological Survey, 1988)

Figure 13.1.3-4: Generalized Bedrock Geology for North Dakota

13.1.3.6. Paleontological Resources

Marine fossils are encountered in rocks of various ages throughout North Dakota; in particular, marine fossils are common in Paleozoic (542 to 251 MYA) Era and Jurassic (200 to 146) Period rocks, as North Dakota flooded by an inland sea during these periods. By the Cretaceous Period (146 to 66 MYA), the Rocky Mountains had risen to the west, creating rivers that flowed east and deposited sediments in western North Dakota; these sediments contain also many marine fossils. Throughout the Cenozoic Era (66 MYA to present) the majority of the state was above sea level. Fossils have been found volcanic ash and fluvial deposits. During the Quaternary Period (2.6 MYA to present), the northeastern two thirds of the state was covered by glaciers; fossils of terrestrial animals have been found in glacial deposits in North Dakota. (Paleontology Portal, 2015)

North Dakota State Fossil
Teredo Petrified Wood



Source: (North Dakota State Government, 2011)

Paleozoic marine fossils include invertebrates such as corals, trilobites[44], brachiopods[45], bryozoans[46], and graptolites,[47] cephalopods,[48] gastropods,[49] bivalves,[50] sponges, and fish. Carboniferous Period (359 to 299 MYA) fossils include shark remains. Fossils from the Permian Period (299 to 251 MYA) include fusulinids[51]. Jurassic Period fossils include foraminifera,[52] bivalves, echinoderms,[53] and gastropods. Marine fossils from the Cretaceous Period include the sea turtle, mosasaur, marine invertebrates, and sharks. Early Cenozoic Era fossils recorded in North Dakota include freshwater mollusks, titanotheres, and champosaurs. Sequoia, magnolia, ginkgo, and bald cypress have also been found, along with Teredo Petrified Wood, which is the state fossil of North Dakota. The Teredo was a mollusk that lived 60 MYA in the trees that were found near swamps; this organism would burrow through the tree, and as the tree petrified, the wood was replaced by silica and quartz that preserved the evidence of the Teredo (North Dakota State Government, 2011). Late Cenozoic fossils include the mastodon, mammoth, bison, camel, horse, and giant ground sloth fossils (Paleontology Portal, 2015).

13.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

As of 2013, North Dakota ranked second nationwide for crude oil production; for 2014, North Dakota produced more than 396,866 thousand barrels with 173 rotary rigs in operation (EIA, 2016b) (EIA, 2014a). The Bakken Shale Formation is one of the largest oil fields in the country.

[44] Trilobite: "Any member of Trilobita, an extinct class of marine arthropods. Trilobites are known from the Cambrian to the Permian. They had segmented, oval-shaped bodies and were the first animals to have complex eyes (similar to the compound eyes in modern insects)." (Smithsonian Institution, 2016)

[45] Brachiopod: "Any member of a phylum of marine invertebrate animals called Brachiopoda. Brachiopods are sessile, bivalved organisms, but are more closely related to the colonial Bryozoa than the bivalved mollusks. Brachiopod diversity peaked in the Paleozoic, but some species survive." (Smithsonian Institution, 2016)

[46] Bryozoan: "Common name for any member of the phylum Bryozoa. Bryozoans are invertebrate aquatic organisms most commonly found in large colonies" (Smithsonian Institution, 2016).

[47] Graptolite: "Any member of the Graptolithina, a class of extinct marine invertebrate animals. Graptolites are believed to have been planktonic and are especially prevalent in Ordovician and Silurian rocks." (Smithsonian Institution, 2016)

[48] Cephalopod: "Any mollusk of the class Cephalopoda, which includes squids, octopus, and ammonites. They are characterized by the tentacles attached to their heads." (Smithsonian Institution, 2016)

[49] Gastropods: "Any member of a large class of mollusks (Gastropoda), commonly called snails. Gastropods live in marine, freshwater, and terrestrial habitats. They have a univalve, often spiral shell (or none at all), a muscular foot for locomotion, and distinctive sensory organs." (Smithsonian Institution, 2016)

[50] Bivalves: "A mollusk with a soft body enclosed by two distinct shells that are hinged and capable of opening and closing" (Smithsonian Institution, 2016).

[51] Fusulinids: "Any member of a group of extinct foraminifera that first appeared in the Carboniferous and went extinct at the end of the Permian. Many fusulinids were large for single-celled organisms" (Smithsonian Institution, 2016).

[52] Foraminifera: "Any member of the order Foraminifera. Foraminifera, or forams, are single-celled organisms with calcareous shells that can be found in every marine habitat" (Smithsonian Institution, 2016).

[53] Echinoderm: "Common name for members of the phylum Echinodermata. These organisms are characterized by bodies showing radial symmetry (usually in fives) and the presence of tube feet in most forms." (Smithsonian Institution, 2016)

"In 2008, the U.S. Geological Survey estimated that the Bakken formation contained more than 3.6 billion barrels of oil." Additionally, there may be more than 3B additional barrels of recoverable oil in the nearby Three Forks formations in the Williston Basin (EIA, 2014a). Figure 13.1.3-5 displays the location of the Bakken Formation in North Dakota.

In 2014, North Dakota produced 326,537 million cubic feet of natural gas, a 1.2 percent share of nationwide production, from 200 natural gas producing wells. The Bakken Shale Formation is a large source of natural gas as well. Most reservoirs in North Dakota are sources of both oil and natural gas, as reservoirs that strictly have natural gas are very rare (EIA, 2014a).

Minerals

As of 2015, North Dakota's total nonfuel mineral production was valued at $243M, ranking 42nd nationwide (in terms of total dollar value). North Dakota's leading nonfuel mineral commodities were construction sand and gravel, crushed stone, lime, common clays, and industrial sand and gravel (USGS, 2016a).

North Dakota is one of the top 10 coal-producing states nationwide; in 2013, North Dakota mined more than 27.6M short tons of coal, accounting for 2.8 percent of total nationwide production. Western North Dakota has the largest deposit of lignite coal in the world (EIA, 2014a).

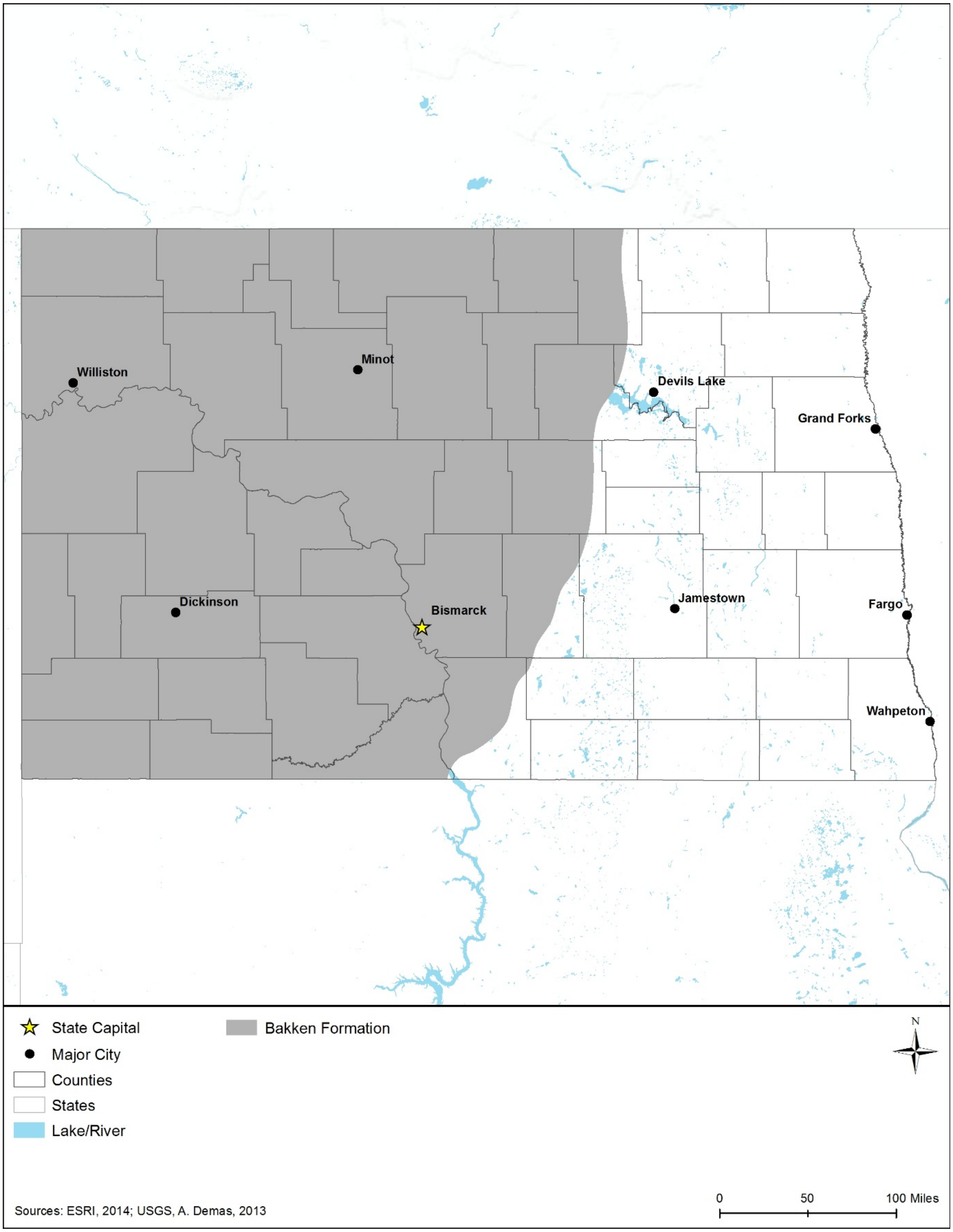


Figure 13.1.3-5: Location of the Bakken Shale Formation throughout North Dakota

13.1.3.8. Geologic Hazards

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

Earthquakes

Between 1973 and March 2012, there were three earthquakes of a magnitude 2.5 (on the Richter scale[54]) or greater in North Dakota (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, 2012a).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common in North Dakota, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes happen where tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth" (Oregon Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014c). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale. North Dakota is located far from any convergence boundary (Oregon Department of Geology, 2015).

Figure 13.1.3-6 depicts the seismic risk throughout North Dakota; the box surrounding the range of colors shows the seismic hazards in the state. 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 (percent g). Most pre-1965 buildings are likely to experience damage with exceedances of 10 percent g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 percent g. (USGS, 2010)

Areas of greatest seismicity in North Dakota are concentrated in the northwest portions of the state, though North Dakota is at minimal risk of experiencing a significant earthquake event (USGS, 2014d). The largest earthquake to ever impact North Dakota occurred in 1909 and measured 5.5 on the Richter scale (USGS, 2012b).

[54] 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, 2014h)

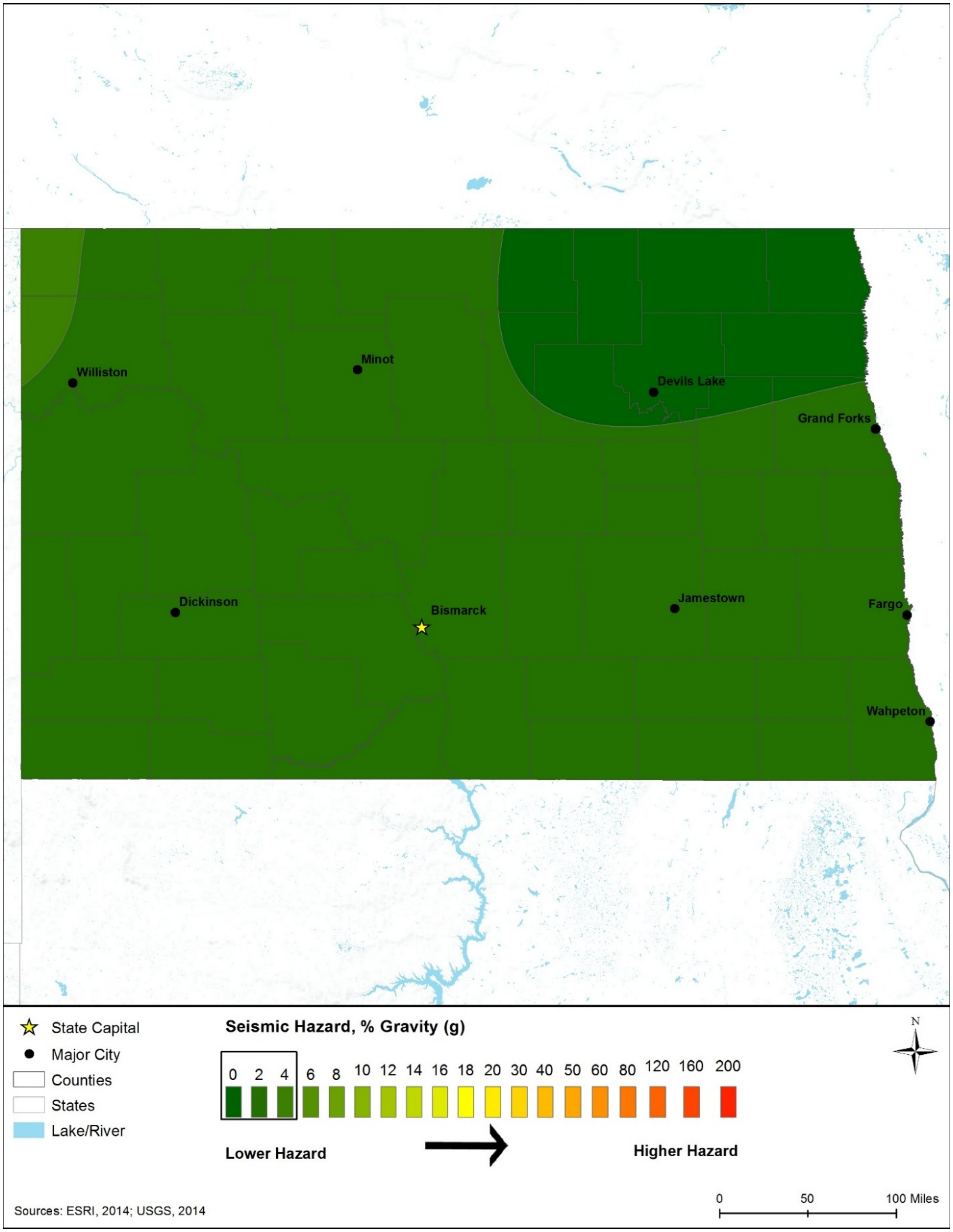


Figure 13.1.3-6: North Dakota 2014 Seismic Hazard Map

Landslides

Within North Dakota, the potential for landslides is greatest in southwestern areas of the state, as well as north of Minot (Figure 13.1.3-7). "The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures" (USGS, 2003a). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. (USGS, 2003a)

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

Within North Dakota, landslides typically occur in the form of slumps.[55] As noted above, most landslides in North Dakota occur in the southwestern portions of the state, including "along the flanks of the high buttes in southwestern North Dakota, including HT (Black) Butte, Chalky Buttes, Sentinel Butte, and East and West Rainy Buttes, and along parts of the valleys of the Des Lacs, Missouri, Little Missouri, and Heart Rivers." Soil slides are common within sandstone[56] and mudstone[57] layers within the Fort Union Formation in western North Dakota), which dates to between 66 and 64 MYA. These landslides frequently occur on slopes of 15 degrees or more. (Trimble, D., 1979)

Figure 13.1.3-7 shows landslide incidence and susceptibility throughout North Dakota.

[55] Slumps: "Slumps are landslides characterized by shearing and rotational movement of an independent mass of rock or earth along a curved slip surface" (Trimble, D., 1979).
[56] Sandstone: "Sedimentary rock made mostly of sand-sized grains" (USGS, 2015e).
[57] Mudstone: "A very fine-grained sedimentary rock formed from mud" (USGS, 2015e).

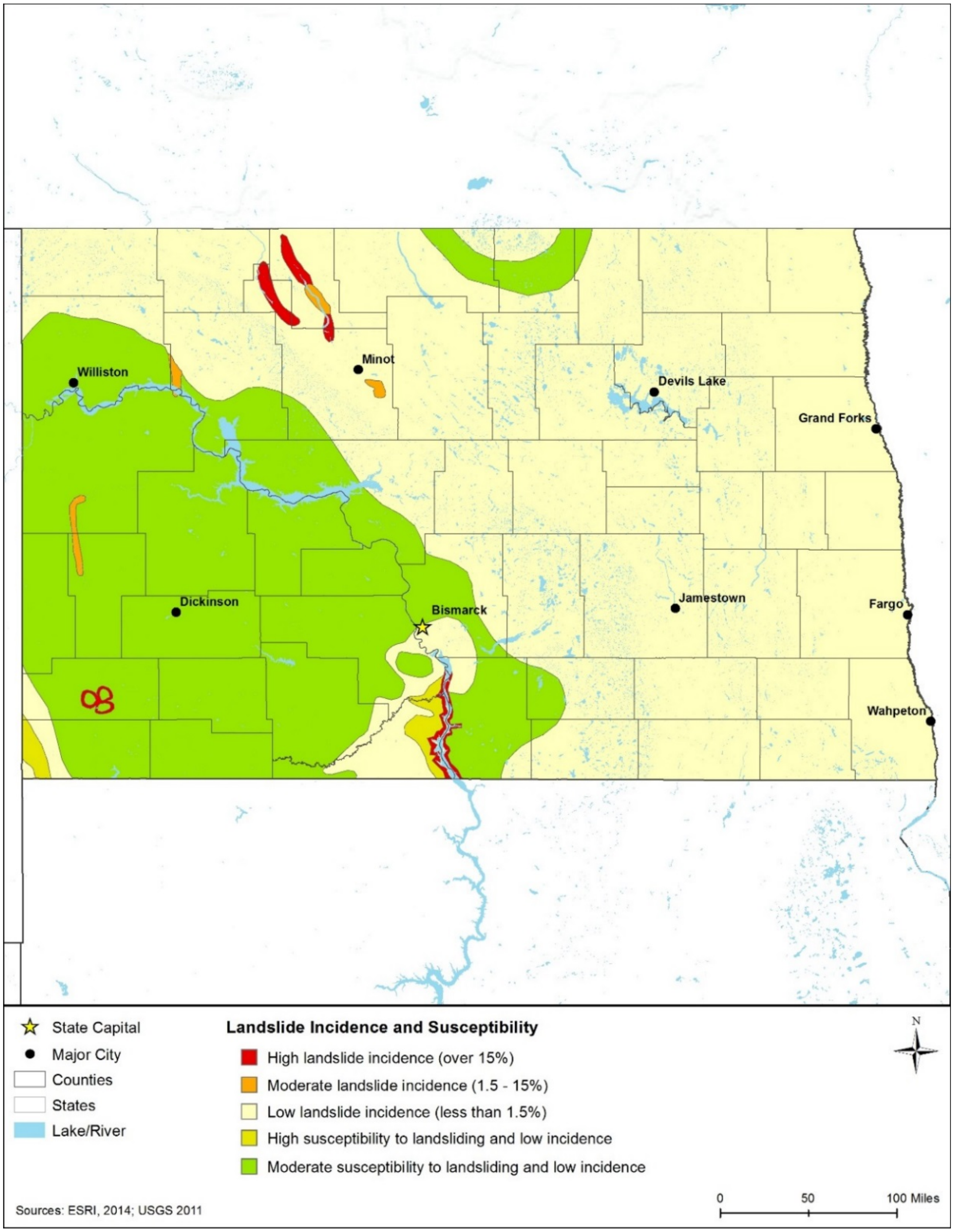


Figure 13.1.3-7: North Dakota Landslide Incidence and Susceptibility Hazard Map[58]

[58] Susceptibility hazards not indicated in Figure 13.1.3-7 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014i)

Land Subsidence

Land subsidence is a “gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials.” Nationwide, the main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. Subsidence has been observed in western North Dakota. Land subsidence in North Dakota is generally attributed to one of two issues: 1) subsidence over formerly mined areas and 2) “subsidence over naturally ignited and burned underground coal beds” (Trimble, D., 1979). More than 80 percent of subsidence in the U.S. is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (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. Additionally, land subsidence can affect vegetation and land use (USGS, 2013a).

One cause of subsidence in North Dakota is the gradual collapse of abandoned coal mine areas, many of which date to the early 1900s. Subsidence is particularly a problem in areas that were mined less than 100 feet below the ground surface; on the other hand, subsidence has not occurred in areas where mining took place more than 200 feet below the ground surface. Mine subsidence due has been observed near Beulah, Wilton, Lehigh, Haynes, and Belfield.

A second cause of land subsidence in North Dakota is subsidence that occurs over naturally burning layers of lignite coal. When naturally lignite coal burns underground, eventually the coal burns out and turns to ash, resulting in the collapse of overlying rock layers into the space previously occupied by the coal. “Spectacular subsidence has occurred over a burning underground coal bed at Burning Coal Vein Park near the Little Missouri River, northwest of Amidon.” (Trimble, D., 1979)

13.1.4. Water Resources

13.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 13.1.5). These resources can be grouped into watersheds which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health (USGS, 2014e).

13.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C, Environmental Laws and Regulations. Table 13.1.4-1 summarizes the major North Dakota laws and permitting requirements relevant to the state's water resources.

Table 13.1.4-1: Relevant North Dakota Water Laws and Regulations

State Law / Regulation	Regulatory Agency	Permit Requirements
Title 61 Waters, Chapter 61-01 General Provisions	NDDH, Division of Water Quality	Defines North Dakota water permit requirements.
North Dakota Pollutant Discharge Elimination System (NDPDES)	NDDH	Construction activities that disturb one or more acre of soil and have a potential to contribute pollutants to waters of the state. (NDDH, 2015l)
Clean Water Act (CWA) Section 404 permit, Nationwide Permit, North Dakota regional conditions	U.S. Army Corps of Engineers (USACE), Omaha District	Pre-construction notification is required for any activities in the Missouri River including Lake Sakakawea and Lake Oahe. (USACE, 2015a)
CWA Section 401 permit	NDDH	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 NDDH indicating that the proposed activity will not violate water quality standards. (NDDH, 2001)

13.1.4.3. Environmental Setting: Surface Water

Surface water resources are natural and engineered lakes, ponds, rivers, and streams. According to the North Dakota State Water Commission (NDSWC), North Dakota has approximately 1.3 million acres of waterbodies with 3,297 manmade reservoirs and 988 waterbodies greater than 10 acres. These surface waters supply drinking water, provide flood control, transportation corridors, and aquatic habitat, and support power generation, recreation, tourism, agriculture, and fishing across the state These surface waters supply drinking, agricultural, and industrial water; support power generation; and provide water for fish, wildlife, and recreational use across the state. (NDSWC, 2015a)

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). North Dakota's waters (lakes, rivers, and streams) are divided into five major watersheds, or drainage basins (Figure 13.1.4-1). Appendix A-1, Table A-1: Characteristics of North Dakota's Watersheds, provides detailed information on the state's major watersheds, as defined by the NDDH. Visit www.swc.nd.gov/4dlink9/4dcgi/GetSubCategoryPDF/293/Water%20Plan.pdf for information and additional maps about each watershed's location, size, and water quality. (NDSWC, 2015a)

The largest watershed in North Dakota is the Missouri River Basin, encompassing the western half of the state and draining nearly 48 percent of the state's total area. The watershed is naturally well-drained due to the many hilly plains located south and west of the Missouri River. East of the Missouri River lies many small lakes and wetlands. (State of North Dakota, 2014) On the northeastern border of the Missouri River Basin lies the Mouse (Souris) River Basin, encompassing an approximate 8,734 square miles of hilly terrain, flat glacial lake plains, and forested hills (NDSWC, 2014a) (NDSWC, 2015a). East of the Mouse River Basin is the Devils Lake Basin, the smallest watershed in North Dakota. The Devils Lake Basin drainage system is formed by "chains of waterways and connecting lakes" that terminate in Devils Lake. The James River Basin is south of this watershed, beginning in central North Dakota and extending to the border with South Dakota (NDSWC, 2015a). In eastern North Dakota, the Red River Basin stretches from the state's northern border to the southern border, encompassing approximately 17,300 square miles (NDSWC, 2015a) (NDDH, 1999).

Freshwater

As shown in Figure 13.1.4-1, major rivers in North Dakota include the Missouri, James, Sheyenne, Little Missouri, Mouse (Souris), Red, Heart, Pembina, Cannonball, Knife, and Maple Rivers. The Missouri River crosses into North Dakota and meanders east into Lake Sakakawea. The Heart and Knife Rivers join the Missouri River from the west as it flows south from Lake Sakakawea. In eastern North Dakota, the Red River of the North flows north toward Canada for approximately 394 miles, forming the North Dakota-Minnesota border. The Sheyenne River, a major tributary to the Red River of the North, originates in central North Dakota and flows in a southeasterly direction before turning northeast to join the Red River of the North. (USFWS, 2002)

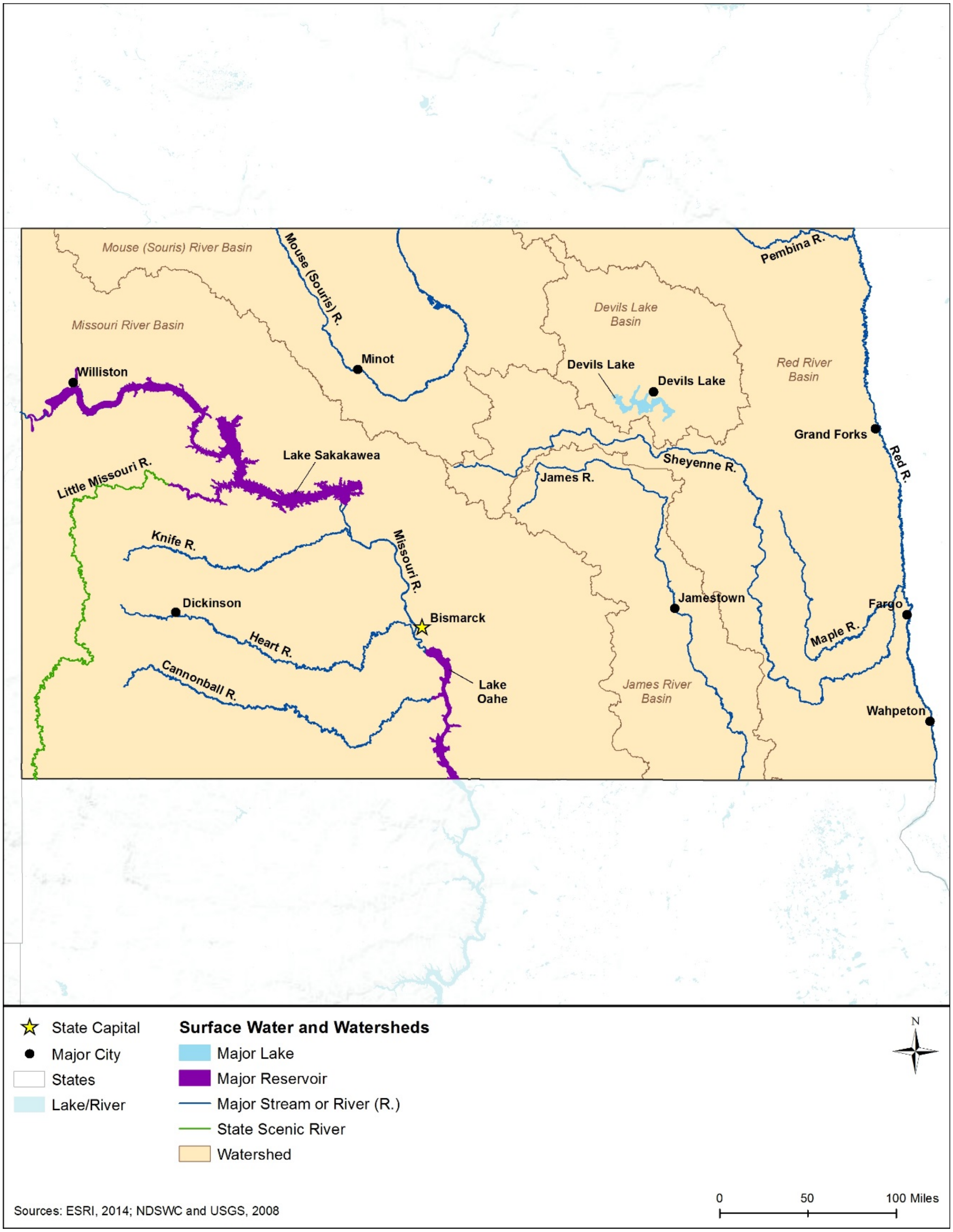


Figure 13.1.4-1 Major North Dakota Watersheds, defined by NDDH, and Surface Waterbodies

The major lakes within North Dakota include Lake Sakakawea, Lake Oahe, and Devils Lake. Lake Sakakawea is one of the three largest manmade reservoirs in the nation and is located in west-central North Dakota. It is approximately 575 square miles in surface area and 178 miles long. Lake Sakakawea was constructed with the completion of the Garrison Dam for hydroelectric power, navigation, flood control, and irrigation (NDPRD, 2015b). Lake Oahe is located in south North Dakota and is 231 miles long with 2,250 miles of shoreline. The lake provides many recreational opportunities including fishing, swimming, and bird watching (USACE, 2015b). Devils Lake is located in the northeastern North Dakota, and at approximately 2,327,000 acres "is the second largest closed basin[59] lake in the United States, behind the Great Salt Lake." (NRCS, 2007a). Devils Lake has no natural outlet until water levels reach approximately 1,446 feet. In June 2011, Devils Lake reached this spill elevation and grew to approximately 330 square miles in size (NDSWC, 2014b). Devils Lake is often used for recreational activities, such as sailing and fishing. (USGS, 2013b)

13.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

North Dakota does not have any federally designated National Wild and Scenic Rivers (National Wild and Scenic Rivers System, 2015).

State Designated Scenic River

Under the Little Missouri State Scenic River Act, North Dakota has designated the Little Missouri River (Figure 13.1.4-1) as a state scenic river to maintain its "free-flowing natural condition." Further, the Act establishes the Little Missouri River commission, which is in charge of protecting and maintaining "the scenic, historic, and recreational qualities of the Little Missouri River and its tributary streams." (State of North Dakota, 2015)

13.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[60] the causes of impairment, and probable sources. Table 13.1.4-2 summarizes the water quality of North Dakota's assessed major waterbodies by category, percent impaired, designated use,[61] cause, and probable sources. Figure 13.1.4-2 shows the Section 303(d) waters in North Dakota as of 2014.

As shown in Table 13.1.4-2, various sources affect North Dakota's waterbodies, causing impairments. Only 7 percent of North Dakota's rivers and streams are impaired, whereas about

[59] Closed basins: allow inflow of water but do not allow outflow; rather, water evaporates out of the lake (NOAA, 2015c).

[60] 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, 2015o)

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

73 percent of the assessed lakes, reservoirs, and ponds are impaired. Major causes of impairment include mercury and nutrients (USEPA, 2015v). North Dakota lakes, such as Lake Sakakawea and Devils Lake, had elevated mercury levels and were assessed as not supporting fish consumption use. Additionally, nutrient loading to North Dakota's lakes and reservoirs are often caused by cropland runoff and erosion; runoff from animal feeding operations such as livestock feeding; and hydrologic modifications[62]. Hydrologic modifications increase the runoff and delivery rates to lakes and reservoirs, thus increasing the lake's watershed size. (NDDH, 2015m)

Table 13.1.4-2 Section 303(d) Impaired Waters of North Dakota, 2014

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	100%	6.9%	Agriculture, aquatic life, fish consumption, industrial, municipal and domestic, recreation	Pathogens [c], habitat alterations, sediment, unknown sources	Agriculture, habitat alterations, unknown sources, urban-Related Runoff/Stormwater
Lakes, Reservoirs, and Ponds	87%	73.2%	Agriculture, aquatic life, fish consumption, industrial, municipal and domestic, recreation	Mercury, nutrients	Atmospheric deposition [d], unknown sources, agriculture, natural/wildlife

[a] Some waters may be considered for more than one water type.
[b] North Dakota has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015a).
[d] Atmospheric deposition: phenomena that occurs when pollutants are transferred from the air to the earth's surface and pollutants travel from the air into the water through rain and snow, falling particles, and absorption of the gas form of the pollutants into the water.

Source: (USEPA, 2015v)

Agricultural activities, such as grazing, animal feeding and handling, and crop production are major impairments for North Dakota's rivers and streams. These activities are the primary source of elevated levels of pathogens (e.g., *E. coli*) in North Dakota's rivers and streams, and result in recreational use impairment (NDDH, 2015m). Additionally, rivers and streams within the state are assessed for fish consumption. The Red River of the North is the only river in the state with mercury levels exceeding the United States Environmental Protection Agency (USEPA) limit for fish consumption (NDSWC, 2015a).

[62] Hydrologic modifications are "activities that disturb natural flow patterns of surface water and groundwater," (e.g., construction, dams and impoundments, channelization, dredging, and land reclamation activities) (USEPA, 1975).

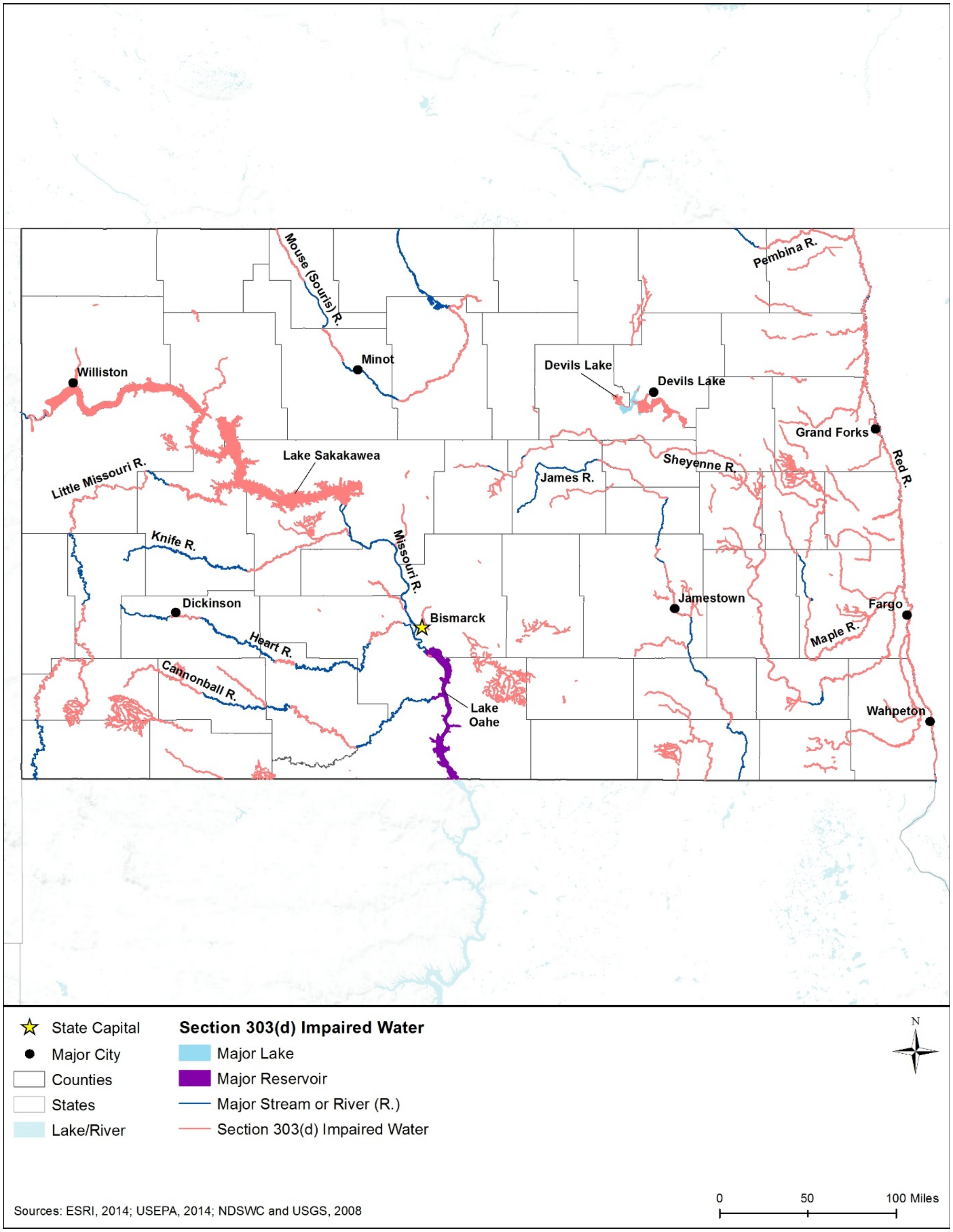


Figure 13.1.4-2: Section 303(d) Impaired Waters of North Dakota, 2014

13.1.4.6. Floodplains

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)

There is one primary type of floodplain in North Dakota. Riverine and lake floodplains occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. Lake water levels, particularly Devil’s Lake in North Dakota, can fluctuate dramatically as it is a closed basin lake and has no outlet for maintaining balance between inflow and outflow. In mountainous areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (FEMA, 2014b)

Summer 2011 Flooding - Missouri/Souris Rivers

Record snowfall over the northern Rocky Mountains and High Plains followed by heavy precipitation caused massive flooding along the Missouri and Souris Rivers in North Dakota. 4,000 homes were flooded due to record high water levels along the Souris River, forcing 11,000 residents to evacuate. Breached levees along the Missouri River caused the flooding of thousands of acres of farmland and damage to transportation infrastructure. Flood damages totaled over $2 billion dollars. (NOAA, 2012)

Source: (PHE, 2011)

Flooding is the leading cause for disaster declaration by the president in the U.S. and results in significant damage throughout the state annually (NOAA, 2015a). There are several causes of flooding in North Dakota, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. Snow runoff and precipitation events, combined with levee failures and ice jams, results in an increased likelihood for flash floods. Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. (State of North Dakota, 2014) Major flood events include the 1997 Red River Valley flood, caused by heavy snowfall, a severe ice storm, ice jams, and rapid spring melting. Fifty thousand residents of the Red River Valley were evacuated, resulting in disaster housing assistance totaling over $35.6 million (NDSWC, 1997). More recently, North Dakota experienced widespread flooding in the spring of 2009. Records were "broken in every major drainage basins in the state" with significant damage to 430 homes and 17 dams, in addition to devastating agricultural losses. The 2009 floods are estimated at $623 million in total losses. (State of North Dakota, 2014)

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 327 communities in North Dakota 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, North Dakota had two communities participating in the CRS (FEMA, 2014d).[63]

13.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, rivers, lakes, ponds, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

North Dakota’s principal aquifers consist of unconsolidated glacial deposits and sedimentary bedrock. Unconsolidated rock aquifers contain the least mineralized groundwater. Groundwater is generally very hard but can be successfully treated for commercial, home, and irrigation use. Bedrock aquifers contain more mineralized groundwater with increased salinity in deeper aquifers. In most areas, groundwater is soft with high levels of sodium and dissolved solids. As such, groundwater is suitable for most domestic uses but not for irrigation. (USGS, 1983)

Groundwater is a valuable resource for North Dakota supplying approximately 60 percent of the state’s population for domestic uses (NDDH, 1999). Of this, approximately 55 percent of groundwater is utilized for irrigation, 18 percent for municipal use, 9 percent for rural domestic and livestock use, 5 percent for rural water systems use, and 4 percent for industrial use (NDDH, 1999). Statewide the most serious threats to groundwater include agricultural operations, aboveground and underground storage tanks, surface impoundments, spills and releases, and large industrial facilities (NDDH, 2015m).

Table 13.1.4-3 provides details on aquifer characteristics in the state; Figure 13.1.4-3 shows North Dakota's principal aquifers. There are no sole source aquifers (SSAs) within North Dakota (USEPA, 2015w).

[63] A list of the 2 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA’s NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

Table 13.1.4-3 Description of North Dakota's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Lower Tertiary Aquifers Semi-consolidated and consolidated sandstone	Western half of North Dakota	Water is generally hard and contains excessive dissolved solids concentrations and increased salinity. Suitable for domestic water supply and livestock watering, but limited use in irrigation.
Upper Cretaceous Aquifers Consolidated sandstone interbedded with shale, siltstone, and occasional thin beds of coal	Central and far southwest corner of North Dakota	Water is generally hard and contains excessive dissolved solids concentrations and increased salinity. Suitable for domestic water supply and livestock watering, but limited use in irrigation.
Lower Cretaceous Aquifers Consolidated sandstone	Along eastern North Dakota border	Water is generally hard and contains excessive dissolved solids concentrations and increased salinity. Suitable for domestic water supply and livestock watering, but limited use in irrigation.
Aquifers of Alluvial and Glacial Origin These aquifers consist mainly of the sand, gravel, and bedrock eroded by the glaciers	Found beneath major river and stream valleys or lake plains and terraces, all over the state.	Suitable for most uses. Water is generally soft and contains large concentrations of dissolved solids.
Paleozoic Aquifers Limestone and dolomite	Along eastern North Dakota border	At depth, the water can have high concentrations of dissolved minerals and contain oil, gas, and brine. As such, high salinity levels prohibit use of the water for purposes other than those in which water quality is not a factor.

Source: (Moody, Carr, Chase, & Paulson, 1986) (USGS, 1996)

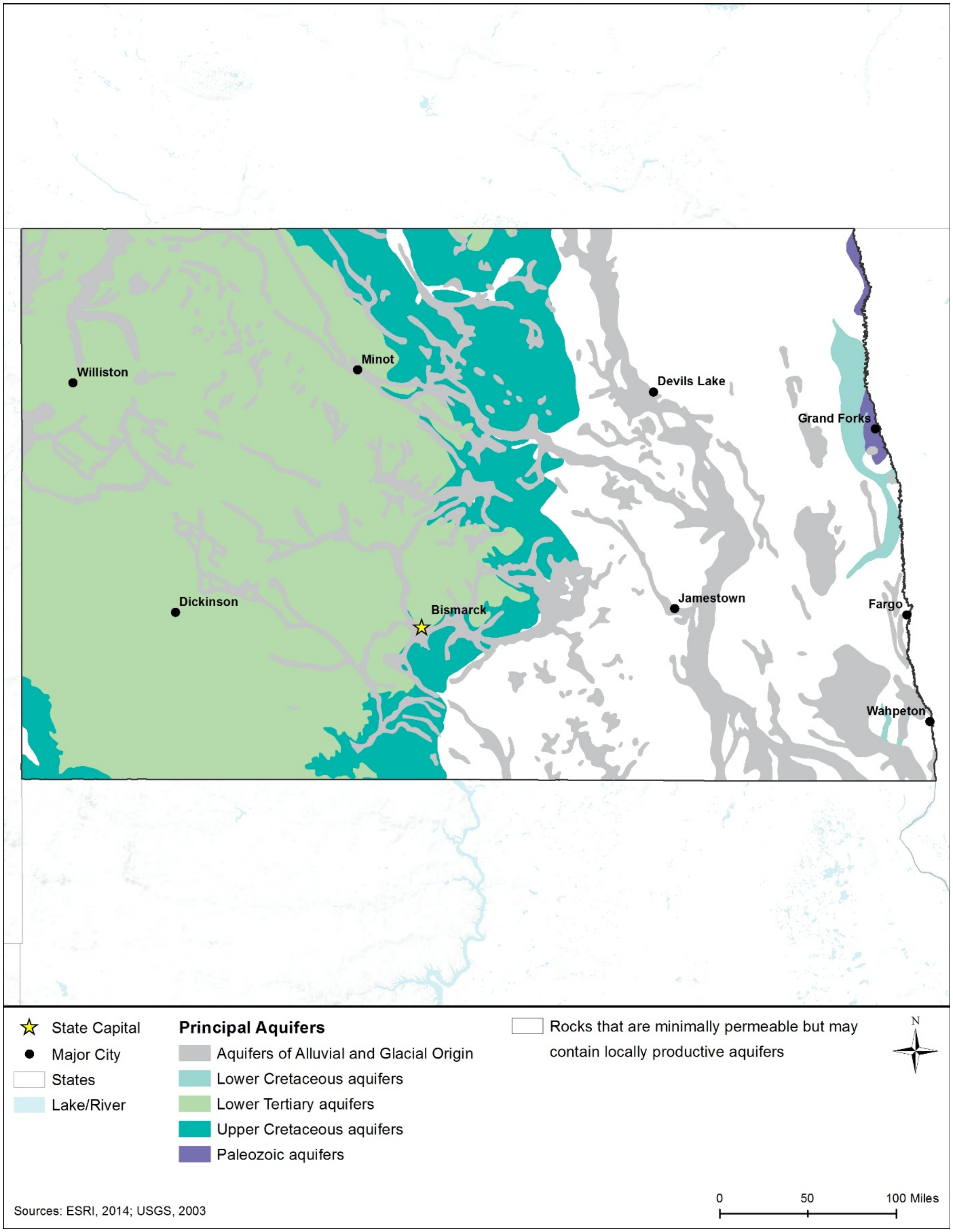


Figure 13.1.4-3 Principal Aquifers of North Dakota

13.1.5. Wetlands

13.1.5.1. 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).

13.1.5.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 13.1.5-1 summarizes the major North Dakota state laws and permitting requirements relevant to the state's wetlands. Wetlands in North Dakota are regulated by the USACE, the NDDH, the North Dakota State Water Commission, the local County Water Resource Boards, and the local Soil and Water Conservation Districts (USDA-NRCS). North Dakota includes wetlands in the state’s definition of waters.

Table 13.1.5-1: Relevant North Dakota Wetlands Laws and Regulations

State Law / Regulation	Regulatory Authority	Applicability
Clean Water Act (CWA) Section 404 permit, Regional Conditions, North Dakota	USACE, Omaha District	NWPs, 12.Utility Line Activities, 33.Temporary Construction, Access, and Dewatering, and 39.Commercial and Institutional Developments, cannot be used in peatlands[64] in North Dakota.[a]
ND Century Code 61-32-01 et. seq.	ND State Water Commission	For draining of a wetland with a watershed area of 80 acres or more.[b]
CWA Section 401 certification	NDDH	Activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from NDDH indicating that the proposed activity will not violate state water quality standards.[c]

[a] (USACE, 2015a)
[b] (NDSWC, 2015b)
[c] (NDDH, 2001)

13.1.5.3. Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted Addressed. Confirmed all 5 wetland types are described (bulleted items). 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 (as detailed in Table 13.1.5-2). The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats (USFWS, 2015a). Three of these Systems are present in North Dakota, as detailed in Table 13.1.5-2.

- 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 30 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 are 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 in excess of 0.5 ppt."

[64] Peatlands are saturated freshwater wetlands where plants grow on partially decomposed plant remains. The two types of peatlands are bogs and fens; categorized by their water source. Bogs receive water only from precipitation, while ground or surface water recharge fens (USACE, 2015a).

- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy greater than 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 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 North Dakota, palustrine (freshwater) wetlands, in particular prairie pothole wetlands found on river floodplains across the state, are the main type of wetlands, as shown in Figure 13.1.5-1 and Figure 13.1.5-2, western and eastern North Dakota respectively. Riverine wetlands comprise approximately one percent of the wetlands in the state and are not discussed in detail in this PEIS. Lacustrine wetlands are found along shallow lakes, in the central parts of the state. Statewide, there are approximately 2.8 million acres of wetlands (USFWS, 2014a).

Table 13.1.5-2 uses 2014 NWI data to characterize and map North Dakota wetlands on a broad-scale.[65] These data are not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 13.1.5-2 correspond to the wetland types in the figures.

Table 13.1.5-2: North Dakota 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 ash and elm trees are common in state PFO wetlands.	Throughout the state, often found along rivers and streams. Also, found in isolated depressions	34,579
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.		

[65] The wetland acreages were obtained from the USFWS (2014) National Wetlands Inventory. Data from this inventory was downloaded by state at https://www.fws.gov/wetlands/. The wetlands data contains a wetlands classification code, which are a series of letter and number codes, adapted to the national wetland classification system in order to map from (e.g., PFO). Each of these codes corresponds to a larger wetland type; those wetland areas are rolled up under that wetlands type. The codes and associated acres that correspond to the deepwater habitats (e.g., those beginning with M1, E1, L1) were removed. The wetlands acres were derived from the geospatial datafile, by creating a pivot table to capture the sum of all acres under a particular wetland type. The maps reflect/show the wetland types/classifications and overarching codes; the symbolization used in the map is standard to these wetland types/codes, per the USFWS and Federal Geographic Data Committee.

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[66] prairie potholes, and sloughs.[67]	Throughout the state, in low-lying areas in floodplains. Concentrated in the Prairie Pothole Region	2,179,229
Palustrine unconsolidated bottom	PUB	PUB and PAB wetlands 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	115,363
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[68], and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	2,205
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	18,335
Lacustrine wetland	L2	L2 wetland 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, but including any areas with abundant submerged or floating-leaved aquatic vegetation. L2 wetlands are less than 8.2 feet deep.	Central parts of the state	483,531
			Total	**2,833,242**

Source (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015b) (FGDC, 2013)
[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data have been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (FGDC, 2013)
[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. (USFWS, 2015c)

[66] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water (Edinger, et al., 2014).
[67] Slough: "swamp or shallow lake system, usually a backwater to a larger body of water" (NOAA, 2014).
[68] 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).

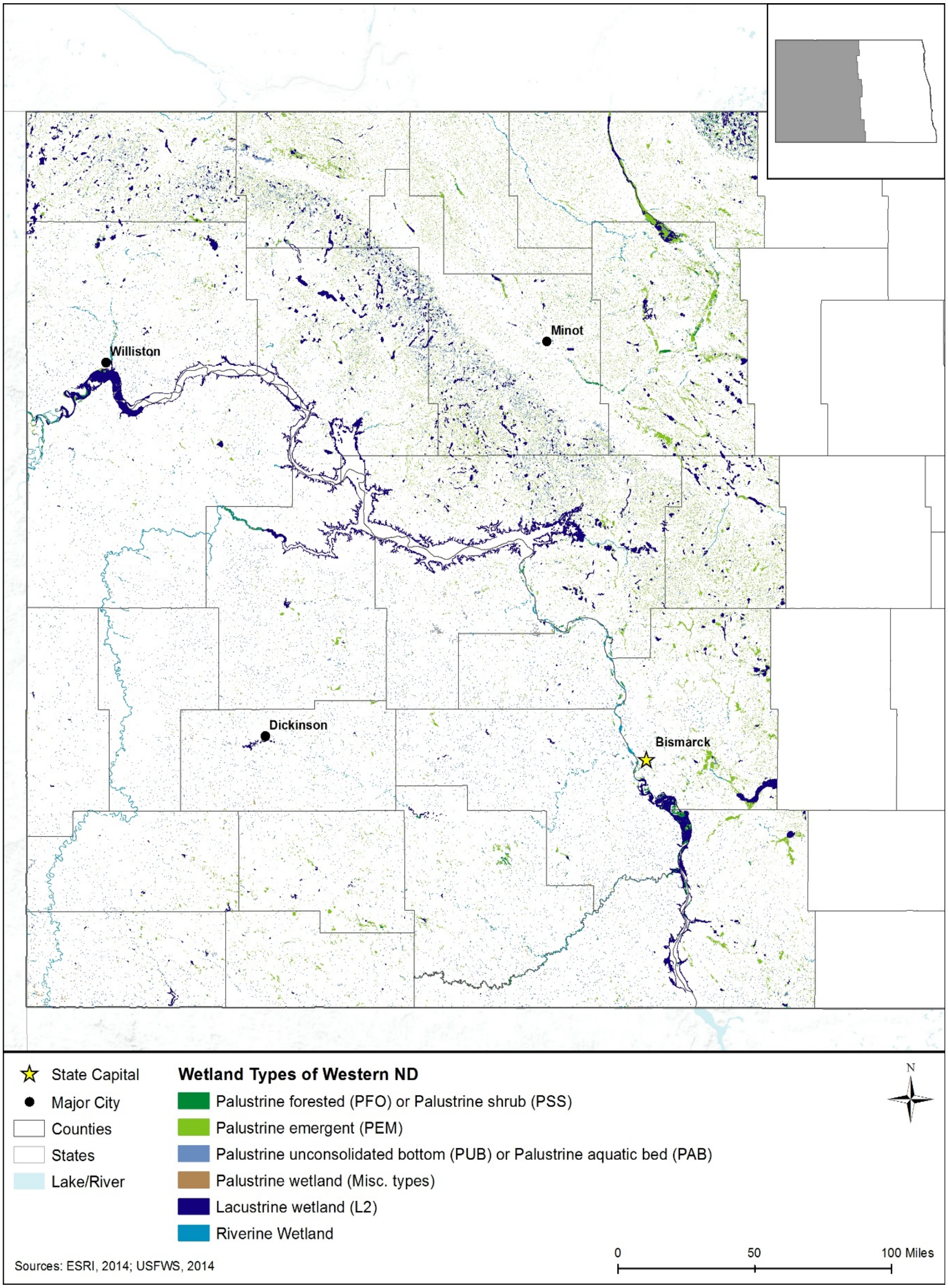


Figure 13.1.5-1: Wetlands by Type, in Western North Dakota, 2014

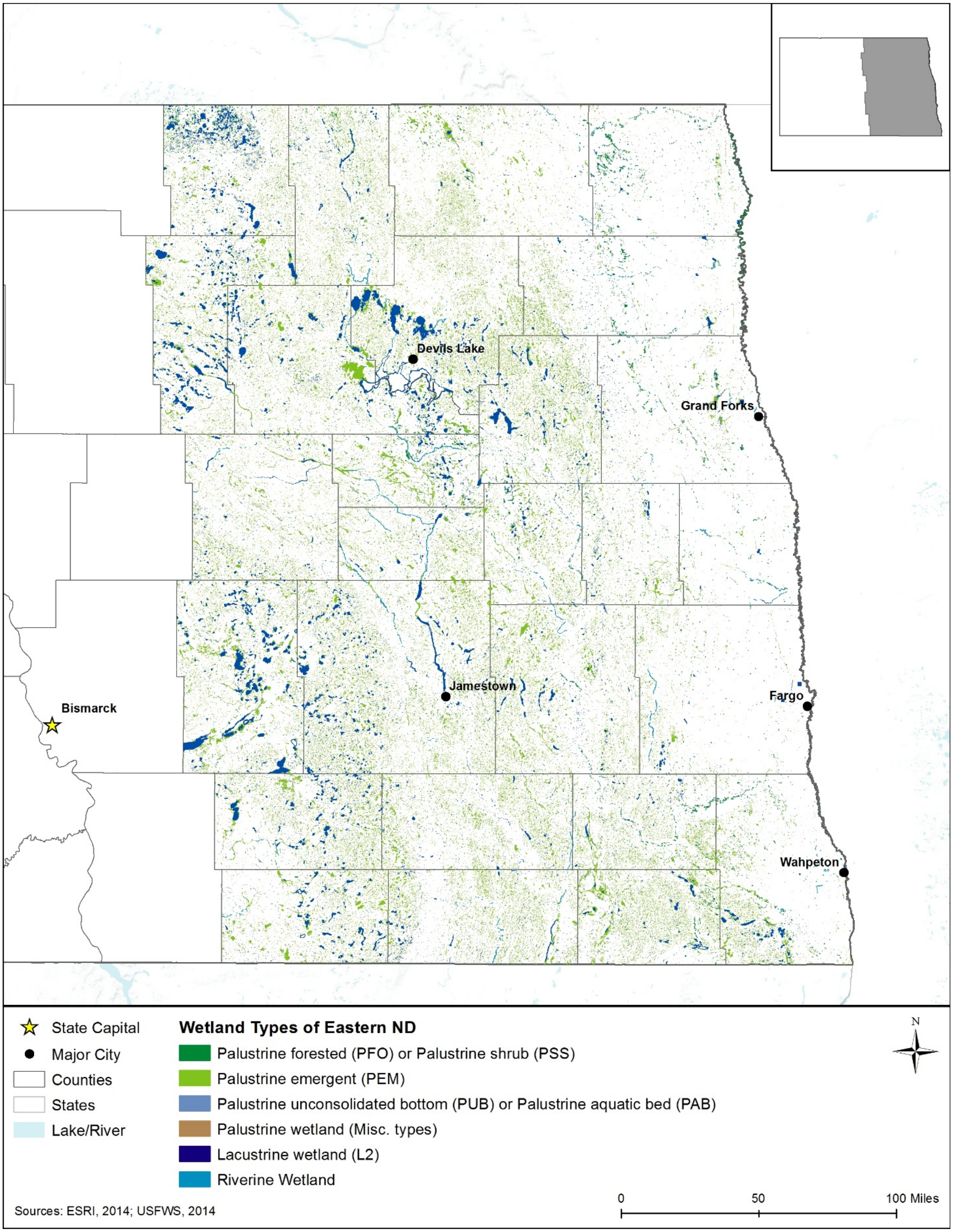


Figure 13.1.5-2: Wetlands by Type, Eastern North Dakota, 2014

Palustrine Wetlands

In North Dakota, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). More than 90 percent of the wetlands in the state are prairie potholes, formed by glaciers (Herman & Johnson, 2008). Prairie potholes, sometimes called sloughs, are palustrine emergent wetlands (PEM). Common PEM plants in North Dakota include fine-textured grasses, sedges, and rushes (NDGFD, 2012a).

Prairie potholes occur primarily in the Prairie Pothole Region of Alberta, Saskatchewan, Manitoba, North Dakota, South Dakota, Minnesota, and Iowa (Figure 13.1.5-1). North Dakota is in the center of the Prairie Pothole Region an area about 300 thousand square miles, as it is about 1,000 miles long and about 300 miles wide (Herman & Johnson, 2008). About one-half the nation's duck population originates in the Prairie Pothole Region of North Dakota and other prairie states (USGS, 2013c) (Herman & Johnson, 2008).

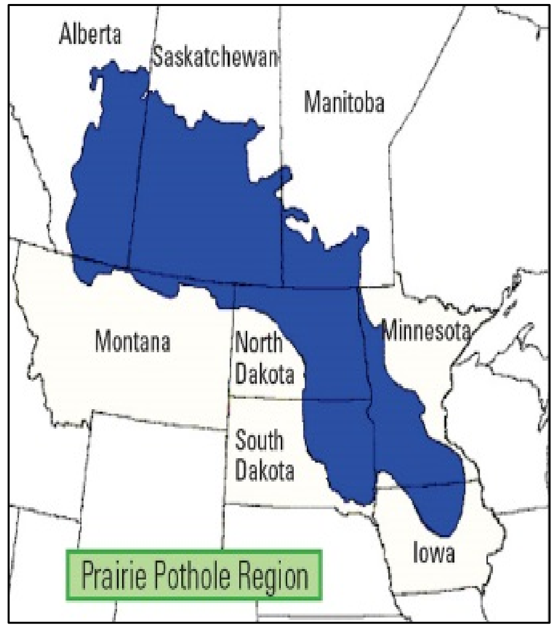


Figure 13.1.5-3 Prairie Pothole Region

Source: (USFWS, 2015q)

Other palustrine wetlands that occur in North Dakota, but are not common are scrub-shrub (PSS) wetlands and forested (PFO) wetlands (as described in Table 13.1.5-2). In North Dakota, PSS and PFO wetlands are usually found along river or deepwater areas. Common PFO plants include cottonwood (*Populus sp.*), green ash (*Fraxinus pennsylvanica*), and elm (*Ulmus sp.*) trees and PSS plants are Missouri gooseberry (*Ribes missouriense*), black currant (*Ribes nigrum*), and nannyberry (*Viburnum lentago*). (Hagen, Isakson, & Dyke, 2005)

Figure 13.1.5-4 Prairie Potholes in North Dakota

Source: (USFWS, 1999)

Palustrine wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds (PAB/PUB) formed by water lilies (*Nymphaea sp.*) and other floating-leaved or free-floating plants. Cattails (*Typha sp.)* are often found growing in or around PAB/PUB wetlands in North Dakota, and they offer important breeding grounds for waterfowl and other wildlife (Herman & Johnson, 2008). These are the easiest wetlands to recognize and occur throughout the state.

Lacustrine Wetlands

In North Dakota, lacustrine wetlands hold water year-round, and are important sources of habitats for fish in North Dakota, and also serve as recreational areas for fishing. There are more than 483,000 acres of lacustrine wetlands in the state, or approximately 17 percent of all the wetlands, and are found along the central parts of the state. (Herman & Johnson, 2008)

State Wetland Trends

North Dakota once had approximately 4.9 million acres of wetlands, or about 11 percent of the state's land area. "By the 1980s, the acreage had decreased to about 2.7 million acres, for a loss of about 45 percent" (USGS, 2013c). In 2014, there were approximately 2.8 million acres of wetlands in the state (USFWS, 2014a). Almost 50 percent of the state's wetlands have been lost, primarily from draining and filling for farming. Many have been converted to agricultural uses (NDGFD, 2012b). Based on the USFWS NWI 2014 analysis, PEM (includes prairie potholes) is the dominant wetland type (93 percent), followed by PUB/PAB (ponds) (5 percent), PFO/PSS (1 percent, and other palustrine wetlands (less than 1 percent) (USFWS, 2014a). There are currently more than 2.3 million acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a). The greatest concentration of wetlands in the state occur in the Prairie Potholes region in the northern and eastern areas of the state.

13.1.5.4. Wetlands of Special Concern or Value

In addition to protections under the state's wetland regulations and national CWA, North Dakota considers certain wetland communities as areas of special value due to their global or regional scarcity, "unusual local importance," or habitats they support. These include prairie potholes (discussed in 13.1.5.3) and peatlands.

Peatlands

In North Dakota, areas classified as peatlands are protected under the USACE Nationwide permit regional conditions. Peatlands are "waterlogged areas with a surface accumulation of peat (organic matter) 30 centimeters (12 inches) or more thick" (USACE, 2015a). Peatlands control water runoff during storms, reduce soil erosion, absorb, filter, and hold contaminants. They control water flow by soaking up flood and meltwater, then releasing the water more slowly. Peatlands also convert accumulated plant materials to peat, which stores carbon. There are two main types of peatlands, differentiated by how they receive water; bogs receive water only from precipitation; fens are fed by surface and groundwater. Both are rare in North Dakota and provide habitat for rare plant species (NDGFD, 2012b).

Other Important Wetland Sites in North Dakota

There are two National Natural Landmarks in North Dakota, Rush Lake and Sibley Lake, which are prairie potholes, and therefore considered wetlands (NPS, 2012a). Section 13.1.8, Visual Resources, describes all of North Dakota's National Natural Landmarks.

Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including Natural

Resources Conservation Service (NRCS) Agricultural Conservation Easement Program, and easements managed by natural resource conservation groups such as state land trusts, Ducks Unlimited, North Dakota Parks and Recreation Department (NDPRD), and USFWS (NCED, 2015). According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements, NRCS holds more than 131,700 acres in conservation easements in North Dakota (NCED, 2015).

13.1.6. Biological Resources

13.1.6.1. Definition of the Resource

This section describes the biological resources of North Dakota. Biological resources include terrestrial[69] vegetation, wildlife, fisheries and aquatic[70] habitats,[71] and threatened[72] and endangered[73] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of the significant topographic variation within the state, North Dakota supports a wide diversity[74] of biological resources ranging from prairie settings across much of the state, pothole wetlands scattered around the state, and small mountains in the north central portion of the state. Each of these topics is discussed in more detail below.

13.1.6.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Pertinent federal laws relevant to the protection and management of biological resources in North Dakota are summarized in Appendix C, Environmental Laws and Regulations. Table 13.1.6-1 summarizes major state laws relevant to the state's biological resources.

Table 13.1.6-1: Relevant North Dakota Biological Resources Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
North Dakota Noxious Weed Control Act (North Dakota Century Code [NDCC] 63-01.1-01 through 01-17)	North Dakota Department of Agriculture (NDDA)	Requires every person to do all that is necessary in order to control and prevent noxious weeds from spreading; prohibits distribution or sale of noxious weeds; gives the NDDA responsibility for enforcement and coordinates with city and county weed boards and other related state and federal agencies.

69 Terrestrial: "Pertaining to land" (USEPA, 2015p).
70 Aquatic: "Pertaining to water" (USEPA, 2015p).
71 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, 2015c).
72 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)).
73 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)).
74 Diversity: "An ecological measure of the variety of organisms present in a habitat." (USEPA, 2015p)

State Law / Regulation	Regulatory Agency	Applicability
Aquatic Nuisance Species (NDCC 20.1-17-01 through 17-09)	NDGFD	Establishes a program for decontamination of vessels, limiting the transport of aquatic invasive species[75] and for establishing fines if the law is broken.
The Plant Pests Act (NDCC 4-33-01 through 12)	NDDA	Allows the NDDA to suppress, control or eradicate the spread of plant pests in the state; provides authority to quarantine areas for up to 90 days that may be cause for plant pest spread; gives authority to inspect any conveyance that may contain a plant pest or host.
Propagation of Protected Birds and Mammals (NDCC 20.1-09-01 through 09-05)	NDGFD	Governs the ability of residents to propagate, domesticate, or possess live protected birds or mammals through a permitting process.

13.1.6.3. Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology[76], soils, climate, and water of a given geographic area and correlates with distinct areas identified as ecoregions. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems of regional extent. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (NWF, 2015) (WWF Global, 2015) (USDA, 2015). Ecoregion boundaries often coincide with physiographic regions of a 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 divides North America into 15 broad Level I ecoregions. These Level I ecoregions are further divided into 50 Level II ecoregions. These Level II ecoregions are further divided into 182 smaller Level III ecoregions. This Section provides an overview of the terrestrial vegetation resources for North Dakota at USEPA Level III. (USEPA, 2016f)

As shown in Figure 13.1.6-1, the USEPA divides North Dakota into four Level III ecoregions. The four ecoregions support four types of plains communities with varying types of prairies and grasslands, agriculture, wetlands, and forests. Glaciers previously existed on many of the plains making the soils extremely fertile and allowing for pothole and seasonally flooded wetlands. Much of the land has been converted to agricultural land, including wheat, alfalfa, potatoes, beans, soybeans, and corn. Additionally, some forested communities exist within North Dakota and are primarily concentrated around watercourses and wetlands, in the Turtle Mountains, and in the northeast and southwest portions of the state (Hagen, Isakson, & Dyke, 2005). Table 13.1.6-2 provides a summary of the general abiotic characteristics, vegetative communities, and the typical vegetation found within each of the four North Dakota ecoregions.

[75] 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, 2015p)
[76] 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.

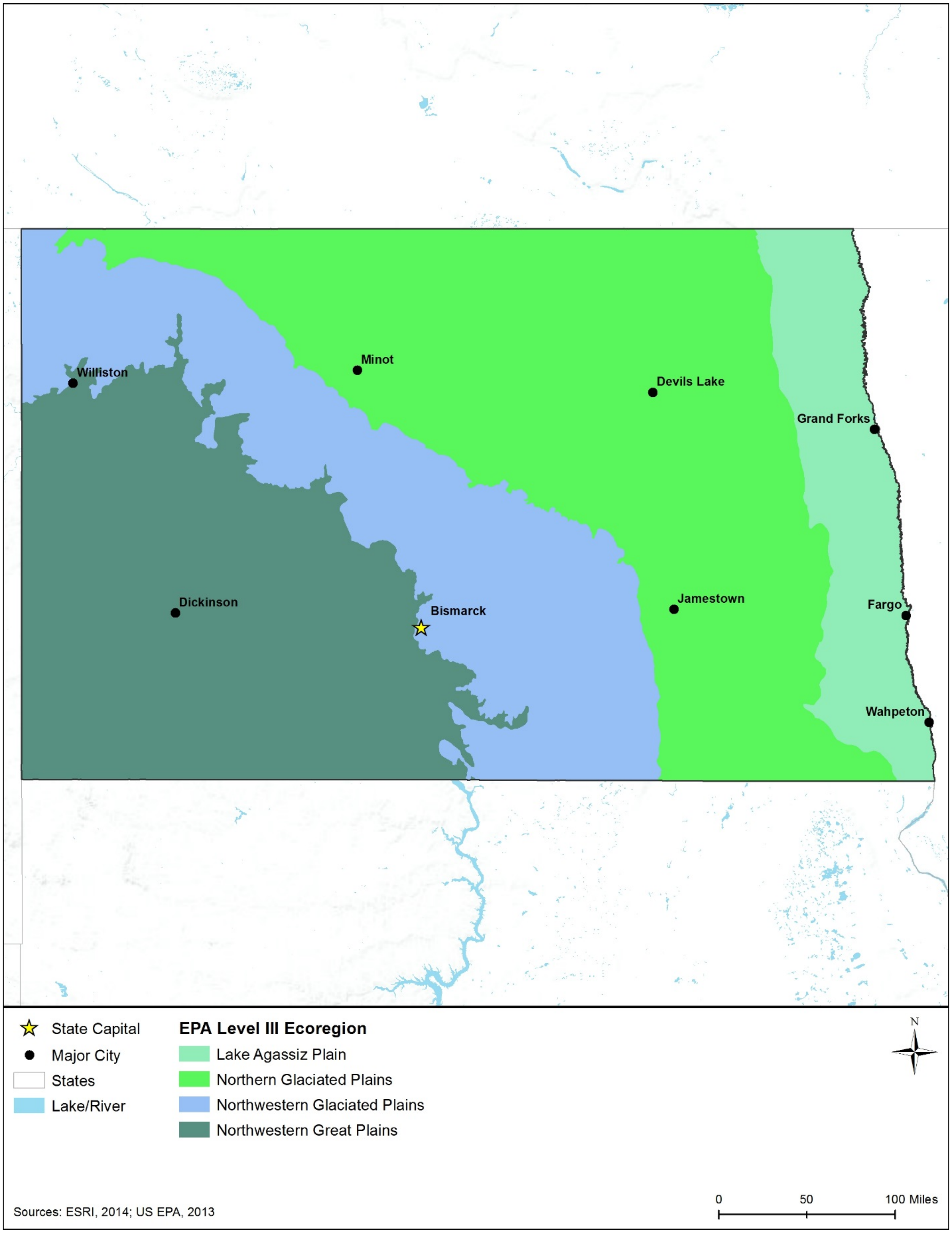


Figure 13.1.6-1: USEPA Level III Ecoregions in North Dakota

Table 13.1.6-2: USEPA Level III Ecoregions of North Dakota

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
43	Northwestern Great Plains	A semiarid rolling plain with some native grasslands in steeper topography. Agricultural development has replaced many native grasslands.	Level to rolling plains, badlands, deciduous riparian woodlands, salt pans	• **Coniferous Trees –** Rocky Mountain juniper (*Juniperus scopulorum)* • **Deciduous Trees –** cottonwood (*Populus* spp.) and green ash (*Fraxinus pennsylvanica*) • **Shrubs –** dwarf sagebrush (*Artemisia arbuscular*), big sagebrush (*Artemisia tridentata*), and snowberry (*Symphoricarpos* spp.) • **Forbs/Grasses –** western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), buffalograss (*Bouteloua dactyloides*), and Sandberg bluegrass (*Poa secunda*)
42	Northwestern Glaciated Plains	The westernmost extent of glaciation, this area has a high concentration of wetlands. The easternmost boundary marks the start of the Great Plains. Farming and ranching are abundant.	Pothole wetlands, glaciated plains, deciduous riparian woodlands	• **Deciduous Trees –** cottonwood (*Populus* spp.), green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and aspen (*Populus* spp.) • **Shrubs –** peachleaf willow (*Salix amygdaloides*), buffaloberry (*Shepherdia argentea*), and sumac (*Rhus* spp.) • **Forbs/Grasses –** western wheatgrass (*Pascopyrum smithii*), needle and thread grass (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), prairie cordgrass (*Spartina pectinata*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*) and saltgrass (*Distichlis spicata*)

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
46	Northern Glaciated Plains	A flat and gently rolling landscape with tall and short grass prairies and seasonal wetlands. Some agriculture is present, but very dependent on climatic conditions.	Seasonal emergent wetlands, rolling plains, flat plains	• **Deciduous Trees –** bur oak (*Quercus macrocarpa*), paper birch (*Betula papyifera*), aspen (*Populus* spp.), and boxelder (*Acer negundo*) • **Shrubs –** red osier dogwood (*Cornus sericea*), serviceberry (*Amelanchier* spp.), and snowberry (*Symphoricarpos* spp.) • **Herbaceous –** green needlegrass (*Nassella viridula*), needle and thread grass (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Pascopyrum smithii*)
48	Lake Agassiz Plain	Lake Agassiz was a proglacial lake that previously filled the area and left behind thick lacustrine sediments. An extremely flat area that once was tallgrass prairie is now primarily used as agriculture.	Glacial lake plains, deciduous riparian woodlands	• **Deciduous Trees –** cottonwood (*Populus* spp.), green ash (*Fraxinus pennsylvanica*), and willow (*Salix* spp.). • **Herbaceous –** wheatgrass spp. (*Pascopyrum* spp.), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and saltgrass (*Distichlis spicata*)

Source: (Bryce, et al., 1996)

Communities of Concern

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

The NDPRD manages a list of all types of natural communities known to occur, or that have historically occurred, in the state. North Dakota has its own ranking system and also follows the U.S. National Vegetation Classification system (USNVC). Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Each natural community is assigned a rank based on its rarity and vulnerability. The USNVC ranking system assesses rarity using a state rank (S1, S2, S3, S4, S5) that indicates its rarity within North Dakota. Communities ranked as an S1 by the USNVC are of the greatest concern. This rank is typically based on the range of the community, the number of occurrences, the viability of the occurrences, recent trends, and the vulnerability of the community (Faber-Langendoen, D., 2001). A list of North Dakota's rare S1 communities was compiled from a list provided by the Association for Biodiversity Information of all North Dakota plant community descriptions, which provides some state rank information for plant communities (Faber-Langendoen, D., 2001) and a list provided and compiled by NDPRD staff (Dirk, 2015).

Twelve vegetative communities are ranked as Level 1 communities[77] in North Dakota. A description of the communities of conservation concern in North Dakota along with their state rank, distribution, abundance, and the associated USEPA Level III ecoregions, can be found in North Dakota Appendix B1, Table B-1. These communities represent the rarest terrestrial habitat in the state. The communities can be found scattered throughout the state, with some being concentrated in unique areas.

Nuisance and Invasive Plants

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

Noxious weeds are defined as "any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or

[77] Level 1: "Species having a high level of conservation priority because of declining status either here or across their range or high rate of occurrence in North Dakota constituting the core of the species breeding range (i.e. "responsibility" species) but are at-risk range wide" (NDGFD, 2016b).

not widely prevalent in the U.S., and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the U.S. or the public health (Federal Noxious Weed Act of 1974)." 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 (Government Printing Office, 2011). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S. (88 terrestrial, 19 aquatic, and 5 parasitic), of which 11 are known to occur in North Dakota (USDA, 2014).

Noxious weeds are a threat to North Dakota's rangeland[78], cropland, pastureland[79], forests, and wildlands. Noxious weeds can have adverse ecological and economic impacts to these resources by displacing native species, degrading wildlife habitat, and increasing soil erosion[80]. The North Dakota Noxious Weed Control Act (NDCC 63-01.1-01 through 01-17) requires that every person do all things necessary and proper to control the spread of noxious weeds. In addition, the Act further stipulates that no one may "distribute, sell or offer for sale" any noxious weeds. A total of 11 state-listed noxious weeds/complexes are regulated in North Dakota as set forth in the Administrative Rules of North Dakota (Title 7, Article 6). None of these species occur on the Federal Noxious Weed List (USDA, 2014). Of these species/complexes, 10 of them are terrestrial and one is an aquatic species (NDDA, 2015). The following species by vegetation type are regulated in North Dakota.

- **Aquatic –** Purple loosestrife (*Lythrum salicaria*);
- **Shrubs –**Saltcedar (*Tamarix chinensis, T. parviflora, T. ramosissima*); and
- **Terrestrial Forbs and Grasses –** Absinthe wormwood (*Artemisia absinthium*), Canada thistle (*Cirsium arvense*), dalmatian toadflax (*Linaria dalmatica*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea stoebe*), and yellow toadflax (*Linaria vulgaris*).

In addition to the Noxious Weed Control Act, North Dakota regulates other plants considered pests through the Plant Pests Act (NDCC 4-33-01 through 12). This act allows the NDDA to "suppress, control, or eradicate the spread of plant pests in the state." The commissioner has the right to quarantine areas for up to 90 days that may be cause for plant pest spread. This Act also gives the commissioner the right to inspect any conveyance that may contain a plant pest or host.

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[78] Rangeland: "A Land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland" (USEPA, 2015p).

[79] Pastureland: "Land used primarily for the production of domesticated forage plants for livestock" (USEPA, 2015p).

[80] 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, 2015p).

13.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in North Dakota, divided among mammals,[81] birds,[82] reptiles and amphibians,[83] and invertebrates.[84] 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,[85] nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within North Dakota. 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 NDGFD, the state is home to 80 mammal species (Dyke, Johnson, & Isakson, 2015), 16 reptile species, 12 amphibian species (Johnson, 2015), and 400 bird species (Dyke, Johnson, & Isakson, 2015).

Mammals

Common and widespread mammalian species in North Dakota include beaver (*Castor canadensis*), black-tailed prairie dog (*Cynomys ludovicianus*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*). Most mammals are widely distributed in the state; however, there are some species, such as the bison (*Bison bison*) which are found on a few protected lands throughout the state and pronghorn antelope (*Antilocapra americana*) which are primarily found on the extreme southwestern part of the state (NDGFD, 2012c). Two threatened and endangered mammals are located in North Dakota. Section 3.1.6.5, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

In North Dakota white-tailed deer (*Odocoileus virginianus*), mule deer, elk (*Cervus canadensis*), moose (*Alces alces*), pronghorn, bighorn sheep (*Ovis canadensis*), and some furbearers are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), some furbearers, and upland and migratory game birds. The following 12 species of furbearers may be legally hunted or trapped in the North Dakota: badger (*Taxidea taxus*), beaver, bobcat (*Lynx rufus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), mink (*Neovison vison*), mountain lion (*Puma concolor*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and weasel (*Mustela sp.*) (NDGFD, 2012d).

North Dakota has identified 21 mammals as Species of Greatest Conservation Need (SGCN). The SGCN list consists of at-risk species that are rare or declining, and can provide funding to

[81] Mammals: "Warm-blooded vertebrates that give birth to and nurse live young; have highly evolved skeletal structures; are covered with hair, either at maturity or at some stage of their embryonic development; and generally have two pairs of limbs, although some aquatic mammals have evolved without hind limbs" (USEPA, 2015p).
[82] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves" (USEPA, 2015p).
[83] 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, 2015p).
[84] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015p).
[85] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.

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. The SGCN list is updated periodically and was recently updated in 2015 from the 2005 Comprehensive Wildlife Strategy (Dyke, Johnson, & Isakson, 2015).

Birds

The number of native bird species documented in North Dakota varies according to the timing of the data collection effort, changes in bird taxonomy,[86] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., wetlands, large rivers and lakes, plains, badlands, mountains, etc.) found in North Dakota support a large variety of bird species. As of 2015, over roughly 400 species of resident and migratory birds have been documented in North Dakota. Among the 400 extant[87] species in North Dakota, 47 SGCN have been identified (Dyke, Johnson, & Isakson, 2015).

North Dakota is located within the Central Flyway. The eastern edge of the Central Flyway is in line with the North Dakota eastern border. Covering the entire state, the Central Flyway spans from the Gulf Coast of Texas to the Canadian boreal forest. Large numbers of migratory birds utilize this flyway and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a).

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 entire state all year, but may also be migratory (NDGFD, 2012e). Golden eagles are found in a variety of habitats within their range, but they generally nest on mountains and cliffs. Golden eagles are uncommon in North Dakota, and are found during migration and sometimes year-round in areas with abundant prey sources such as prairie dogs (NDGFD, 2012e).

A number of Important Bird Areas (IBAs) have also been identified in North Dakota, as can be seen in Figure 13.1.6-2. The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation

[86] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013c).
[87] Extant: "A species that is currently in existence (the opposite of extinct)" (USEPA, 2015p).

priorities to local sites that provide critical habitat for native bird populations. IBA priority areas are based on a number of specific criteria. Generally, global IBAs are sites determined important for globally rare species or support bird populations[88] at a global scale. Continental IBAs are sites determined important for continentally rare species or support bird populations at a continental scale, but do not meet the criteria for a global IBA. State IBAs are sites determined important for state rare species or support local populations of birds.

According to the Audubon Society, a total of 39 IBAs, providing over 2 million acres of land, have been identified in North Dakota, including breeding ranges,[89] migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/riparian[90] areas. These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the eastern half of the state, within Northern Glaciated Plains and the Lake Agassiz Plains. IBAs in North Dakota are mostly prairie and/or wetland communities that are key habitats for many migrating birds. The Turtle Mountains IBA is a unique area to the state and provides woodlands, lakes, and wetlands which provide habitat for the greatest number of species in the state of North Dakota. Other IBAs such as the Lostwood National Wildlife Refuge provides pothole wetlands critical for many breeding migratory birds including piping plover (*Charadrius melodus*) (The Audubon Society, 2015).

A number of threatened and endangered birds are located in North Dakota, including the piping plover discussed above. Section 3.1.6.6, *Threatened and Endangered Species and Species of Conservation Concern*, identifies these protected species.

Reptiles and Amphibians

A total of 28 native reptile and amphibian species, such as turtles, snakes, and salamanders occur in the state of North Dakota, including 2 salamanders, 10 frogs and toads, 5 turtles, 3 lizards, and 8 snakes. North Dakota is limited in its herptile diversity due to the cold climate (Johnson, 2015). Species present typically occur in the arid plains, seasonal wetlands, or forested riparian areas in the state. Of the 28 native reptile and amphibian species, 11 SGCN have been identified (Dyke, Johnson, & Isakson, 2015).

[88] 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, 2015d).
[89] Breeding range: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015p).
[90] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands." (USEPA, 2015p)

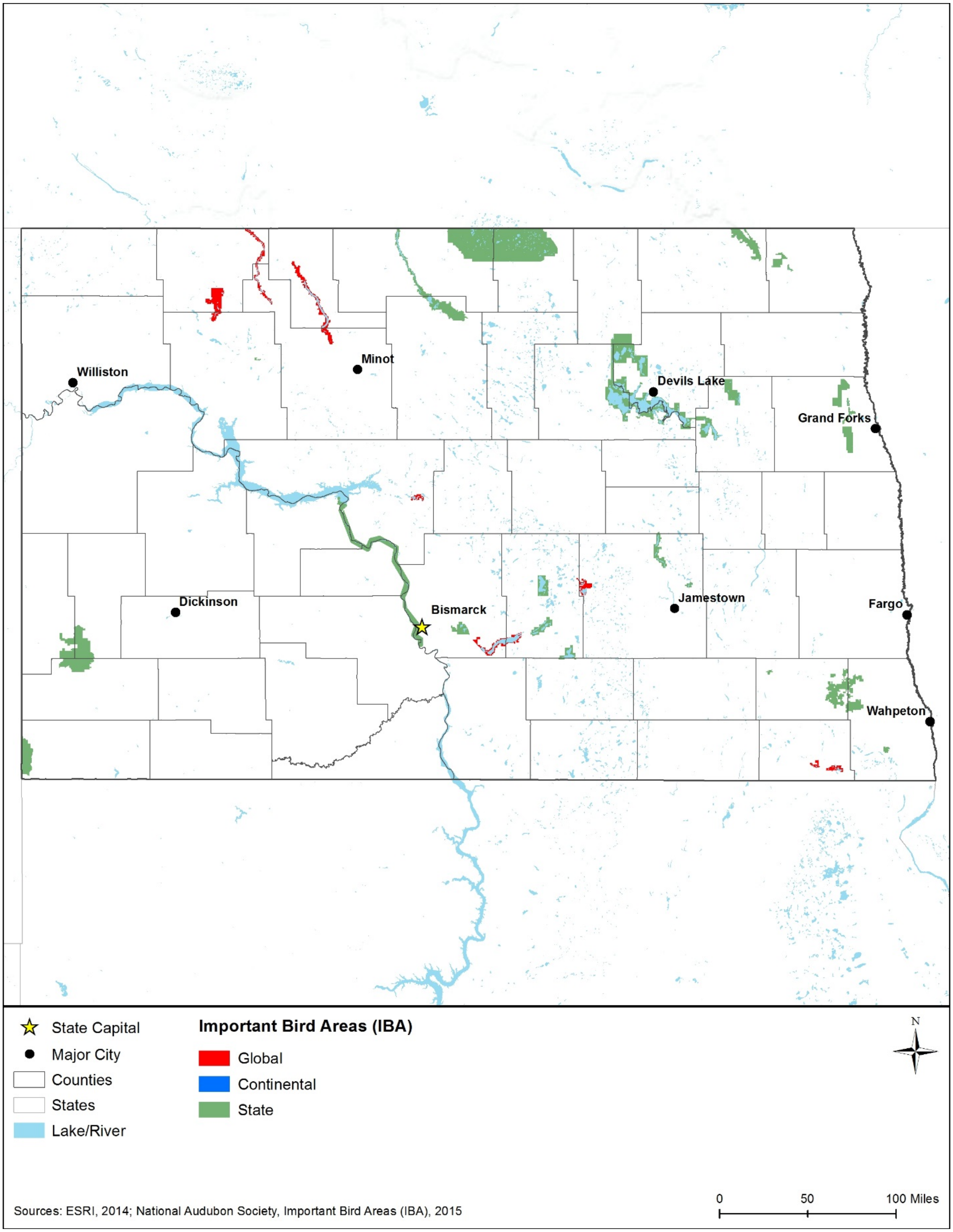

Figure 13.1.6-2: Important Bird Areas in North Dakota

North Dakota's turtle and frog species are classified as nongame species. The Fish, Frog, and Turtle Regulation Act (NDCC 20.1-06-16 and 20.1-06-17) prohibits turtle and frog species from being taken for sale, human consumption, or scientific purposes without first obtaining a license or permit. A permit must be obtained for taking turtles and a license must be obtained from the director at his or her discretion for taking frogs.

Invertebrates

North Dakota is home to numerous species of invertebrates, including a wide variety of flies, moths, wasps, bees, ants, and beetles (Goodwin, 2013). A total of three insect species are considered SGCN (Dyke, Johnson, & Isakson, 2015). The 2015 State Wildlife Action Plan was the first state plan to include information about invertebrate species. This was partially possible due to a large project in 2010 aimed to develop background information on North Dakota invertebrates. The result was mapping and distribution information for 12 Orders[91] of insects in the state and a total of 761 morphospecies[92] identified (Dyke, Johnson, & Isakson, 2015) (Goodwin, 2013).

Invasive Wildlife Species

North Dakota maintains a list of prohibited animals (NDCC 48-12-01.1-02), which includes raccoons, skunks, and any animal deemed to be "a significant threat to human or animal health in North Dakota." This regulation also categorizes other domesticated animals and pets into Category 1 through 3 lists, with Category 1 being least harmful and not requiring a permit, to Category 3 determined to "pose species concerns, including species which are inherently dangerous or environmentally hazardous" and require permits and housing and care requirements. Species in Category 3 include wild species in suidae family (pigs, hogs, and boars); big cats; bears (*Ursus sp.*); wolves (*Canis lupus*) and wolf-hybrids; venomous reptiles; primates; nondomestic sheep and hybrids; and nondomestic goats and hybrids (NDCC 48-12-01.1-02). In North Dakota, feral swine could adversely impact several native large and small mammals, including bear, turkey, waterfowl, and deer (West, Cooper, & Armstrong, 2009). They feed on reptiles and amphibians, destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans. Importation of nontraditional livestock is regulated (NDCC 48-12-01.1-04) and requires an importation permit, approval from the state veterinarian that individuals are disease-free, approval from the board, veterinarian certificate of approval, and disease tests and health statements. This regulation also disallows the importation of red deer and red deer hybrids into Zones 1 and 2 of the state.

In North Dakota, Dutch elm disease is the only pest found in the state. Caused by the fungus (*Ophiostoma novo-ulmi*), Dutch elm disease only impacts trees in the elm family (*Ulmaceae*). This disease can rapidly kill a tree within one year of exposure but typically takes up to three years. Dutch elm disease is widespread throughout North Dakota and is carried by the several

[91] Order: "An order is a scientific way to categorize related organisms. An order is a smaller grouping than a class, but bigger than a family or genus." (BBC, 2015)

[92] Morphospecies: A way to identify a species based on "recognizable morphological differences between species." (Barratt, Derraik, Rufaut, Goodman, & Dickinson, 2003)

beetle species (e.g., native elm bark, European elm bark, and banded elm bark beetles). Presently, there is no remedy for this disease. Also, species such as the gypsy moth (Lymantria dispar dispar), Asian longhorn beetle (Anoplophora glabripennis), and emerald ash borer (Agrilus planipennis) represent emerging concerns in the region. (NDSU, 2015a) (NDSU, 2014)

13.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in North Dakota, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. No essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) exists in North Dakota. Critical habitat for threatened and endangered fish species, as defined by the Endangered Species Act (ESA), does exist within North Dakota and is discussed in Section 3.1.6.5, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

North Dakota is home to populations of more than 96 species of freshwater fish, ranging in size from small darters and minnows to larger species such as salmon and sturgeon (NDGFD, 2016a). Of the 96 species, 22 species are listed as SGCN (Dyke, Johnson, & Isakson, 2015). These species are grouped into 19 families; a brief description of those families that contain common species, notable sport fish species, or species of concern is listed below (NDGFD, 2016a).

The bullheads/catfishes family includes seven species, which include the channel catfish (*Ictalurus punctatus*), stone cat (*Noturus flavus),* yellow bullhead (*Ameiurus natalis*), black bullhead (*Ameiurus melas*), brown bullhead (*Ameiurus nebulosus*), flathead catfish (*Pylodictis olivaris*), and tadpole madtom (*Noturus gyrinus*). All seven species are native to North Dakota (NDGFD, 2016a). The yellow bullhead is a North Dakota SGCN (Dyke, Johnson, & Isakson, 2015). The channel catfish prefers large rivers and lowland lakes and can be found in the Red River, Missouri River, and Lake Oahe. Black bullhead are the most common bullhead in North Dakota (NDGFD, 2016a). The stone cat, yellow bullhead, and black bullhead are smaller members of the catfish family that rarely reach an adequate size to be targeted by fisherman.

The codfish family includes one species, burbot (*Lota lota*), which is native to North Dakota and is considered a SGCN (Dyke, Johnson, & Isakson, 2015) (NDGFD, 2016a). Burbot may be caught and eaten by anglers. They are voracious predators and therefore are able to be caught with many lures. Burbot are most commonly found in colder waters in North Dakota (NDGFD, 2016a).

The drum family includes one species, freshwater drum (*Aplodinotus grunniens*), which is native to North Dakota. Freshwater drum are the only drum species that live in entirely in freshwater. This species can be found in deep rivers and lakes, in calm, still water. Drum can be eaten and are caught by anglers in North Dakota (NDGFD, 2016a).

The shortnose gar (*Lepisosteus platostomus*) is the only species of gar in North Dakota. It can be found in backwaters of the Missouri River, where it is often found resting near the surface of water. This species is less abundant than previously, and is likely due to the construction of dams along the Missouri River (NDGFD, 2016a).

The banded killifish (*Fundulus diaphanous*) is the only killifish species in North Dakota (NDGFD, 2016a). Limited information about this species' distribution in North Dakota is available. Banded killifish prefer slow, quiet lakes, ponds, and streams with sandy, gravelly, or detritus substrates (Hammerson, G., 2012a).

Two lamprey species, chestnut lamprey (*Ichthyomyzon castaneus*) and silver lamprey (*Ichthyomyzon unicuspis*), exist in North Dakota and both are considered SGCN (Dyke, Johnson, & Isakson, 2015) (NDGFD, 2016a). Little information is available regarding the distribution of the two species within the state. Both lamprey species can be found in medium to large rivers or large reservoirs (Hammerson, G., 2012b) (Hammerson, G., 2012c).

Approximately 34 species of minnows occur in North Dakota, with two of them being introduced (i.e., nonnative) species. This family has the largest number of fish species in the state. Common minnow species in North Dakota include the carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), golden shiner (*Notemigonus crysoleucas*) and creek chub (*Semotilus atromaculatus*). Carp are introduced and may cause severe aquatic ecosystem impacts. Fathead minnow are a small species that average from 1.5 to 3.5 inches, and are an important bait fish in North Dakota (NDGFD, 2016a). This family contains 12 SGCN (Dyke, Johnson, & Isakson, 2015).

One species in the mooneye family, goldeye (*Hiodon alosoides*), is present in North Dakota. Goldeye are an important forage fish for species such as catfish and pike. They are primarily found in North Dakota in the Red River of the North and Missouri River (NDGFD, 2016a).

The paddlefish family in North Dakota is comprised of just one species, which is listed as a SGCN (Dyke, Johnson, & Isakson, 2015) (NDGFD, 2016a). Paddlefish (*Polyodon spathula*) inhabit slow or quiet areas of large rivers or reservoirs, and is only found in the Missouri and Yellowstone Rivers in North Dakota. They have also established a spawning run upstream from Lake Sakakawea into the Yellowstone and Missouri rivers. In North Dakota, the species commonly grows up to 100 pounds (NDGFD, 2016a).

A total of nine species of perches occur in North Dakota, including large members such as yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), and sauger (*Sander canadensis*). Darters are also included and are much smaller than the other species, and rarely exceed 4 inches (10.16 cm) in length. Only one species, zander (*Sander lucioperca*), are considered non-native to the state. Walleye occur in large lakes and reservoirs with sandy or gravelly substrates. Sauger prefer fast-moving waters of rivers and streams (NDGFD, 2016a).

Three species of pikes/pickerals occur in North Dakota's waters, the northern pike (*Esox lucius*), the tiger muskellunge (*Esox masquinongy* X *Esox lucius*), and pure muskellunge (*Esox masquinongy)*. Northern pike is the only one of the three that is native to the state. The northern pike is the state fish, and are often caught by anglers. Tiger muskellunge are a hybrid between northern pike and pure muskellunge. Pure muskellunge are found in select waters in North Dakota (NDGFD, 2016a).

One species in the shad family, gizzard shad (*Dorosoma cepedianum*), is present in North Dakota (NDGFD, 2016a). Limited information about the distribution of this species in North Dakota is available. Gizzard shad may be found in medium to large rivers, reservoirs, lakes, swamps, sloughs, and other quiet, open waters. The species can occur in clear to silty waters (Hammerson, 2011).

The rainbow smelt (*Osmerus mordax*) is the only species in the smelt family that occurs in North Dakota. Rainbow smelt are a small fish species averaging 7 to 9 inches (17.78 to 22.86 cm) long. They are an important food source for salmon, walleye, and various other predatory fish (NDGFD, 2016a).

Brook stickleback (*Culaea inconstans*) are the only species in the stickleback family in North Dakota. Brook stickleback are native to North Dakota. They are a very small fish that often do not exceed 3 inches (7.62 cm) in length. They are often used as bait fish by anglers (NDGFD, 2016a).

The sturgeon family is comprised of three species in North Dakota including pallid sturgeon (*Scaphirhynchus albus*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), and lake sturgeon (*Acipenser fulvescens*). The pallid sturgeon is listed as SGCN and listed as endangered under the federal ESA (see Section 3.1.6.5) (Dyke, Johnson, & Isakson, 2015) (NDGFD, 2016a) . The shovelnose sturgeon is the most common sturgeon species in North Dakota. State law now requires that all sturgeon caught must be released to assist in the conservation of the rare pallid sturgeon, which looks similar to the other species. Sturgeon are primarily found in the Missouri River system within North Dakota (NDGFD, 2016a).

The sucker family includes 11 species in North Dakota (NDGFD, 2016a). One species, blue sucker (*Cycleptus elongates*), is listed as a SGCN (Dyke, Johnson, & Isakson, 2015). It can be found in main channel areas of large- or medium-sized rivers, including the Missouri and Yellowstone rivers. Common and widespread species include the shorthead redhorse (*Moxostoma macrolepidotum*), bigmouth buffalo (*Ictiobus cyprinellus*), and white sucker (*Catostomus commersonii*) (NDGFD, 2016a).

The sunfish family includes nine species, many of which are highly popular with sport fishermen (Dyke, Johnson, & Isakson, 2015). Two species, largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), are non-native to the state. One of the most commonly encountered species is bluegill (*Lepomis macrochirus*). Often, this species is stunted due to overpopulation within waterbodies. White crappie (*Pomoxis annularis*) are tolerant of turbid water and can be found in reservoirs such as Lake Tschida and Patterson Lake. Black crappie (*Pomoxis nigromaculatus*) are common and can be found in clear waters within the state (NDGFD, 2016a).

White bass (*Morone chrysops*) are the only species in the temperate bass family present in North Dakota (NDGFD, 2016a). Limited information is available about this species' distribution within North Dakota. White bass can be found in large lakes, reservoirs, pools, and waterways with slow-moving waters. This species typically form schools and are present near the surface of waterbodies (Hammerson, G., 2007).

North Dakota has seven species in the trout family, all of which are non-native. Water conditions in the state are not suitable for trout spawning and reproduction, and therefore all species must be stocked annually. Some of the most common are brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*). Brown trout are stocked in the Missouri River system and also in a few lakes within the state. Rainbow trout are the most successfully stocked trout species, and have been introduced into the Missouri River System and some smaller lakes. Chinook salmon (*Oncorhynchus tshawytscha*) are the largest trout found in the state and are stocked in the Missouri River system (NDGFD, 2016a).

Shellfish and Other Invertebrates

Limited information is available regarding freshwater invertebrate species in the state. A recent study was conducted on freshwater mussels in the state. This research indicates that North Dakota is home to 15 mussel species and the western part of the state is mostly devoid of mussels, while the eastern half of the state has much diversity. In the eastern half of the state, the Sheyenne, Maple, and Goose rivers all showed high numbers of mussels and species diversity. The three most widely distributed mussels in the state include giant floater (*Pyganodon grandis*), white heelsplitter (*Lasmigona complanata*), and fatmucket (*Lampsilis siliquiodea*) (NDGFD, 2011). Out of the 15 identified mussel species in the state, 10 are considered SGCN (Dyke, Johnson, & Isakson, 2015).

Invasive Aquatic Species

North Dakota strictly regulates the spread of Aquatic Nuisance Species (ANS) through the ANS code (NDCC 20.1-17). This regulation governs the creation of a statewide ANS management plan, an ANS committee, rules to prevent the transport of ANS, and penalties. The NDGFD and state Aquatic Invasive Species Committee (ND ANS) identified an official list of plants, fish, bivalves, and invertebrates that “have caused irreversible ecologic and/or economic consequences elsewhere” (NDGFD, 2013). Identified ANS in North Dakota include Eurasian watermilfoil (*Myriophyllum spicatum*), several snakehead species (*Channa spp.*), and the Zebra mussel (*Dreissena polymorpha*) (NDGFD, 2013).

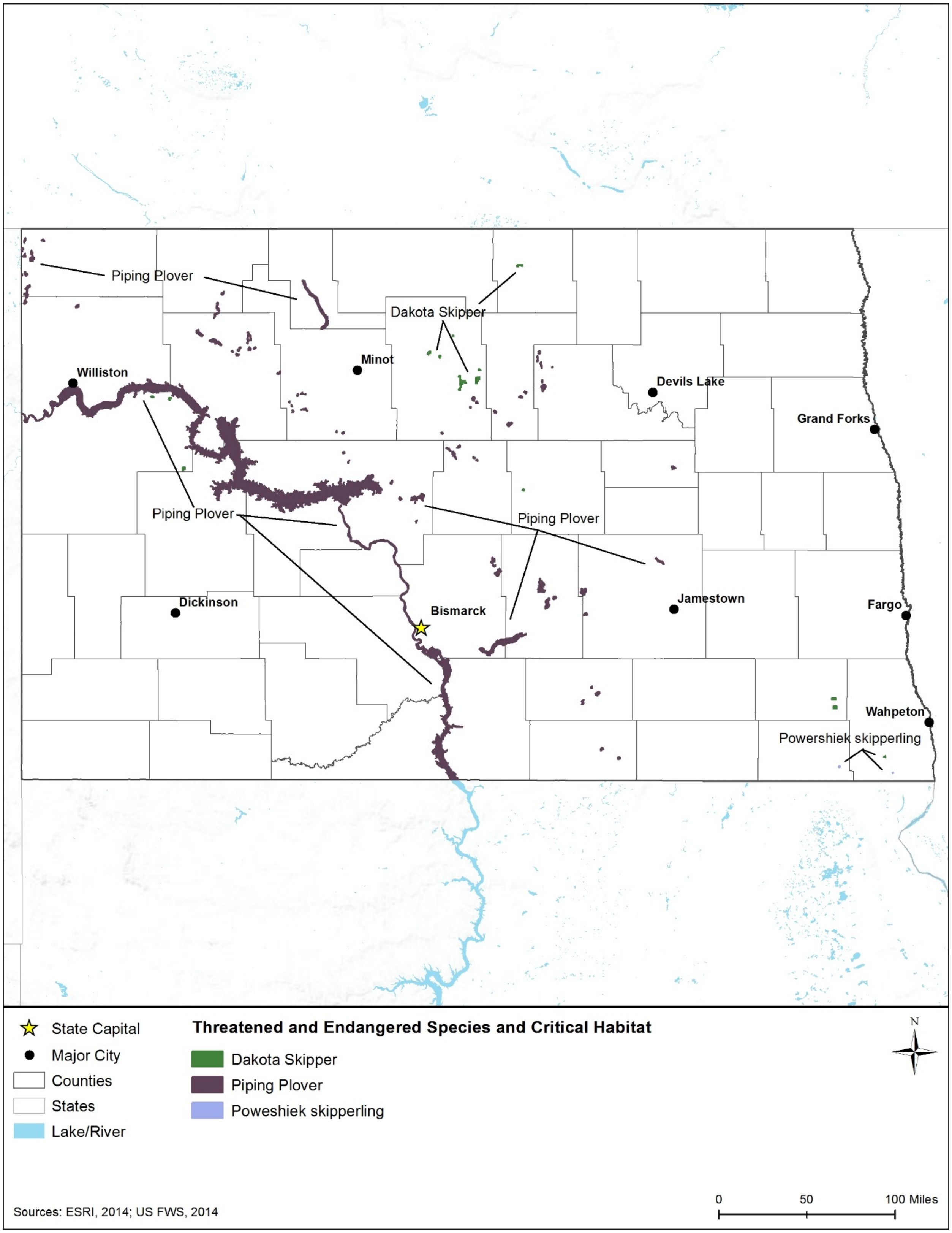

Figure 13.1.6-3: ESA Designated Critical Habitat for the State of North Dakota

13.1.6.6. 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 North Dakota. The USFWS Office has identified four federally endangered and five federally threatened species known to occur in North Dakota (USFWS, 2015d). Of these, two have designated critical habitat[93] (USFWS, 2015e). The nine federally listed species include one mammal, four birds, one fish, two invertebrates, and one plant (USFWS, 2015d), and are discussed in detail under the following sections.

Federal land management agencies maintain lists of species of concern for their landholdings; these lists are not discussed below as they are maintained independently from the ESA. For future site-specific analysis on those lands, consultation with the appropriate land management agency would be required.

Mammals

One threatened mammal species is federally listed for North Dakota as summarized in Table 13.1.6-3. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in North Dakota is provided below.

Table 13.1.6-3: Federally Listed Mammal Species of North Dakota

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in North Dakota	Habitat Description
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Late-successional forests.

[a] T = Threatened

Source: (USFWS, 2015d)

Northern Long-eared Bat. The northern long eared bat is distinguished from other Myotis species by it large ears, which on average measure 0.67 inch. This species is an insectivorous medium sized bat, with the average adult weighing from 0.18 ounce to 0.28 ounce and an average body length of 3.03 inches to 3.74 inches. The northern long eared bat has dark brown ears and wing membranes, medium to dark brown fur on its back, and tawny- to pale-brown fur on its underside. The northern long eared bat was listed threatened in 2015 (80 FR 17973 18033, April 2, 2015) (USFWS, 2015f).

Historically, the northern long eared bat has been most commonly observed in the northeastern United States and further north in Quebec and Ontario (USFWS, 2015f). In North Dakota, it is known or believed to occur in 53 counties throughout the state (USFWS, 2015g). This species is reliant on late-successional forests, with low edge to interior ratios. The specie uses the large dead trees found in the late-successional forests at nesting sites and day roosts. Threats to the

[93] 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)).

northern long eared bat include destruction, modification, or curtailment of the species habitat including agricultural and residential development, logging, oil, gas, mineral and wind energy development, and mine closures (USFWS, 2015f).

Birds

Two endangered and two threatened species are federally listed for North Dakota as summarized in Table 13.1.6-4. These listed bird species occur along riverine habitats, lakes, and wetlands. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in North Dakota is provided below.

Table 13.1.6-4: Federally Listed Bird Species of North Dakota

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in North Dakota	Habitat Description
Least Tern	*Sterna antillarum*	E	No	River banks of the Missouri, Ohio, Red, and Rio Grande River.
Piping Plover	*Charadrius melodus*	T	No	Vegetated wetlands, beaches, lakes, or rivers of the Great Plains.
Red Knot	*Calidris canutus rufa*	T	No	Coastlines of the South Platte and Arkansas Rivers.
Whooping Crane	*Grus Americana*	E	No	Marshes, wet meadows and prairies, and riverine habitats.

[a] E = Endangered, T = Threatened

Source: (USFWS, 2015d)

Least Tern. The least tern is a nine-inch-long, grey, and white gull, with black markings on its head. The species was federally listed as endangered in 1985 (50 FR 21784 21792, May 28, 1985). The tern utilizes sandbars and islands as breeding areas along the Missouri and Yellow Stone rivers in North Dakota and breeds along several other major river systems in the U.S., which include the Ohio, Red, and Rio Grande River (USFWS, 1990).

Least Tern Photo credit: USFWS

Suitable habitat for least terns consists of relatively unvegetated sandbars near rivers, reservoirs and other open water habitat. The primary threat to this species is the destruction and degradation of habitat. Nest disturbance and predation can also be factors. The primary causes of habitat loss historically have been dam construction, recreational activities, and the alteration of flow regimes along major river systems (USFWS, 2013b).

Piping Plover. The piping plover is a small, migratory shorebird of approximately seven inches in length, a wingspan of 19 inches, and weighing approximately two ounces. The species has a grey back, white underbelly, black head markings, and neck ring. In the northern plains region, the species was listed as threatened in 1985 (50 FR 50726 50734, December 11, 1985). The piping plover occurs in Northern Great Plains, along the Atlantic Coast, and in the Great Lakes Area within the U.S. for approximately 3 to 4 months during the summer breeding season (USFWS, 2003) (USFWS, 2012a). In North Dakota, it is known or believed to occur in 25 counties throughout the state (USFWS, 2015h).

Suitable habitat consists of open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers. Nesting often occurs in palustrine wetlands[94] in the Northern Great Plains. Threats to piping plovers include destruction and degradation of preferred habitat resulting from construction and development activities and water control structures, nest predation, and nest abandonment caused by human presence or disturbance (USFWS, 2003).

Red Knot. The red knot is a ruddy brown bird with grey and white speckled wings of approximately nine inches in length. The species was listed as threatened in 2014 (79 FR 73705 73748, December 11, 2014). The 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" (USFWS, 2005).

Though Delaware Bay on the Atlantic coast is a favorite staging area, Red knots have been sighted stopping over in North Dakota during spring migration. Threats to this species include impacts to the reduced availability for foraging at staging areas and reduction of arctic breeding habitat as a result of climate change (USFWS, 2014b).

Whooping Crane. The whooping crane is a large snowy white plumed bird with a black beak and feet. It is the tallest bird of North America, growing to a height of up to 5 feet. The species was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C §1531 *et seq*.) (USFWS, 2015i). The whooping crane nests in Canada and in Florida and Wisconsin in the U.S. Historically, the whooping crane utilized northeastern North Dakota as part of its major nesting area. The whooping crane currently uses the Missouri River in North Dakota as a stopover during its spring and fall migrations (USFWS, 2007). In North Dakota, it is known or believed to occur in 53 counties throughout the state (USFWS, 2015i).

Whooping Crane. Photo Credit: USFWS

Suitable habitat for the whooping crane consists of marshes, wet meadows and prairies, riverine habitats, and agricultural fields. Historically, threats to the whooping crane included hunting, displacement by humans, and loss of habitat. Contributing factors to this species' decline

[94] Palustrine wetlands: "Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens" (USEPA, 2015p).

include their isolated populations, loss, and degradation of migration stopover habitat, construction of additional power lines, degradation of coastal ecosystems, and threat of chemical spills (USFWS, 2007).

Fish

One endangered fish species is federally listed for North Dakota as summarized in Table 13.1.6-5. The Pallid Sturgeon occurs in the Missouri River throughout North Dakota. Information on the habitat, distribution, and threats to the survival and recovery of this species in North Dakota is provided below.

Table 13.1.6-5: Federally Listed Fish Species of North Dakota

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in North Dakota	Habitat Description
Pallid Sturgeon	*Scaphirhynchus albus*	E	No	Large-river obligate dwelling in bottom of dynamic channels. Found in the Missouri River in 11 counties of North Dakota.

[a] E = Endangered

Source: (USFWS, 2015d)

Pallid sturgeon. The endangered pallid sturgeon (*Scaphirhynchus albus*) is one of two species of sturgeon found east of the Continental Divide; it is the larger of the two species, and weighs up to 60 pounds. The pallid sturgeon was federally listed as endangered in 1990 (55 FR 36641 36647, September 6, 1990). The species' range extends the length of the Missouri and Mississippi Rivers (USFWS, 2015j). In North Dakota, the pallid sturgeon is found downstream from Garrison Dam to the headwaters of Lake Oahe (USFWS, 2014c). It is known or believed to occur in the Missouri River in 11 counties of North Dakota (USFWS, 2015j).

The Pallid sturgeon prefers large rivers with strong currents; they can withstand a wide range of turbidity conditions. The key reason for this species' decline has been habitat fragmentation and alteration from the damming of major rivers and other large tributaries (USFWS, 2014c).

Invertebrates

One endangered and one threatened invertebrate species are federally listed for North Dakota as summarized in Table 13.1.6-6. The Dakota Skipper occurs in prairies throughout North Dakota. The Poweshiek Skipperling occurs in prairies and meadows in the southeastern corner of North Dakota. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in North Dakota is provided below.

Table 13.1.6-6: Federally Listed Invertebrate Species of North Dakota

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in North Dakota	Habitat Description
Dakota Skipper	*Hesperia dacotae*	T	Yes; Brookings, Day, Deuel, Grant, Marshall, and Roberts Counties, North Dakota	Wet bluestem prairies, and dry upland prairies. Found in 19 counties throughout North Dakota.
Poweshiek Skipperling	*Oarisma poweshiek*	E	Yes; Richland County, North Dakota.	Tallgrass dry to wet prairies, moist meadows, grassy lake and stream beds, and sedge meadows. Found in Richland and Sargent counties in southeastern corner of state.

[a] E = Endangered, T = Threatened

Source:(USFWS, 2015d)

Dakota Skipper. The Dakota skipper (*Hesperia dacotae*) is a small to medium sized butterfly with differences in male and female appearances, and a wingspan of 0.9 inches to 1.3 inches. The males of the species have a prominent mark on the forewing and ranges in color from orange to brown. The females of the species feature orange and white spots on the forewing and are a darker brown color. The Dakota skipper was listed as threatened in 2014 (79 FR 63671 63748, October 24, 2014) (USFWS, 2014d) and was granted designated critical habitat in 2015 (80 FR 59247 59384, October 1, 2015) within Brookings, Day, Deuel, Grant, Marshall, and Roberts Counties, North Dakota (USFWS, 2015e). In North Dakota, it is known or believed to occur in 19 counties throughout the state (USFWS, 2015k).

The best documentation of the Dakota skipper's historical range is from the North Central Glaciated Plains, Red River Valley, and the North East Glaciated Plains in the north-central United States and south-central Canada. However, knowledge of its full historical range is limited due to habitat destruction of native prairies predating biological surveys. The Dakota skipper occupies two types of high quality undisturbed prairies. One type is wet bluestem prairie containing three blossoming wildflowers during the Dakota skipper flight period: harebell (*Campanula rotundifolia*), wood lily (*Lilium philadelphicum*) and, smooth camas (*Zygadenus elegans*). The second type is dry upland prairies dominated by bluestem and needle grasses and is better suited for the Dakota skipper when abundant with purple coneflower (*Echinacea angustifolia*). Threats to the species included habitat destruction and degradation, including prairie conversion to agricultural lands, encroachment of invasive and woody species, indiscriminate pesticides and herbicide use, and climate conditions such as drought (USFWS, 2014d).

Poweshiek Skipperling. The Poweshiek skipperling (*Oarisma poweshiek*) is a small, slender-bodied butterfly. The wingspan varies across its range, generally ranging from 0.9 inches to 1.2 inches. The upper side of the wings are dark brown with light orange margins and the head is also light orange. The lower surface of the wings are dark to light brown with prominent white veins. The Poweshiek skipperling was listed as endangered in 2014 (79 FR 63671 63748, October 24, 2014) (USFWS, 2014d) and was granted designated critical habitat in 2015 (80 FR 59247 59384, October 1, 2015). Critical habitat in North Dakota includes Richland County

(USFWS, 2015e). In North Dakota, it is known or believed to occur in Richland and Sargent counties, in the southeastern corner of the state (USFWS, 2015l).

Historically, the Powershiek skipperling occupied wet to dry tall grass prairies from Iowa to Manitoba, with most of its documented sites in the North Central Glaciated Plains and Red River Valley. The Powershiek Skipper occupies high quality, dry to wet prairies, moist meadows, grassy lake and stream beds, and sedge meadows. Threats to the species include habitat destruction and fragmentation, which can prevent populations from migrating or recolonizing potential suitable habitat (USFWS, 2014d).

Plants

One threatened plant species is federally listed for North Dakota as summarized in Table 13.1.6-7. The western prairie fringed orchid occurs within prairies and bogs in the southeastern corner of North Dakota. Information on the habitat, distribution, and threats to the survival and recovery of this species in North Dakota is provided below.

Table 13.1.6-7: Federally Listed Plant Species of North Dakota

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in North Dakota	Habitat Description
Western Prairie Fringed Orchid	*Platanthera praeclara*	T	No	Prairies, bogs, lakeside prairies and sand prairies. Found in Ransom and Richland counties, in the southeastern corner of North Dakota.

[a] T = Threatened

Source: (USFWS, 2015d)

Western Prairie Fringed Orchid. The western prairie fringed orchid is a perennial herb that is dormant during the winter and adapted to dormant seasonal prairie fires. The orchid grows stalks up to 4 feet tall and inflorescences of large white flowers emerge in May (USFWS, 2010b). The species was federally listed as threatened in 1989 (54 FR 39857 39863, September 28, 1989) and can be found along the edge of the plains from Minnesota south to Oklahoma. In North Dakota, it is known or believed to occur in Ransom and Richland counties, in the southeastern corner of the state (USFWS, 2015m).

The orchid is found in prairies and meadows and utilizes support from mycorrhizal fungi during seed germination. The western prairie fringed orchid requires measured periodic disturbance (i.e., fire, mowing, or grazing) and consistent soil moisture. A large scattered population occurs in North Dakota on federally owned sand prairie managed by USFS (USFWS, 2010b). Threats to the species include land conversion, impacts to the few species of sphinx moths which pollinate the orchid, and lowering of groundwater levels (USFWS, 2015m).

13.1.7. Land Use, Recreation, and Airspace

13.1.7.1. Definition of the Resources

The following summarizes major land uses, recreational venues, and the airspace considerations in North Dakota, 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 man-made development (BLS, 2013a).

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, lakes, forests, recreational facilities, museums, historic sites, and other areas/facilities. Recreational resources are typically managed by federal, state, county, or local governments.

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

Airspace

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

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

Mexico" (FAA, 2014). The ATO is comprised of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2016a). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

13.1.7.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, summarizes numerous federal laws and regulations that, to one degree or another, affect land use in North Dakota. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities.

Several sections of the North Dakota Century Code (NDCC) provide state-level guidance for land use planning in North Dakota. These sections include NDCC 40-47-03, NDCC 58-03-12, and NDCC 11-33-03 and are located at: http://www.legis.nd.gov/general-information/north-dakota-century-code.

Because the Nation's airspace is governed by federal laws, there are no specific North Dakota state laws that would alter the existing conditions relating to airspace for this PEIS. However, there are state statutes that address the safety of the airspace and flight safety at public airports and obstructions to airspace considerations as addressed in the North Dakota Century Code Update, Title 2, Aeronautics (North Dakota Legislative Branch, 2016).

13.1.7.3. Land Use and Ownership

For the purposes of this analysis, North Dakota is classified into primary land use groups based on coverage type such as forest and woodlands, agricultural, shrub/grassland, developed land, surface water, and public land/surface water/other land covers. Land ownership within North Dakota has been classified into four main categories: private, federal, state, and tribal land.

Land Use

Table 13.1.7-1 identifies the major land uses by coverage type in North Dakota. Agricultural land comprises the largest portion of land use with 58.1 percent of North Dakota's total land occupied by this category. Shrub and grassland is the second largest area of land use with 23.3 percent of the total land area. Developed land accounts for approximately 9.6 percent and forest and woodland accounts for approximately 3.9 percent of the total land area. The remaining percentage of land includes public land, surface water, and other land covers, shown in Figure 13.1.7-1, that are not associated with specific land uses (USGS, 2012c).

Table 13.1.7-1: Major Land Use in North Dakota by Coverage Type

Land Use	Square Miles[a]	Percent of Land
Forest and Woodland	2,757	3.9%
Shrub and Grassland	16,464.8	23.3%
Agricultural Land	41,089.6	58.1%
Developed Land	6,748.8	9.6%
Surface Water	3,052.3	4.3%
Public Land, Surface Water, and other Land Covers	565.4	0.8%

[a] Square miles are rounded to the nearest whole number. The maps and tables are prepared from the analysis of GIS data and imagery; a margin of error may result 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. Other federal or state data sources may have slightly different totals.

Source (USGS, 2012d)

Forest and Woodland

Forest and woodland areas are located in the northcentral and northeastern regions of the state. Forest and woodland vegetation also occurs along rivers and streams in the western part of North Dakota. The Dakota Prairie Grassland is the only unit managed by the USFS in North Dakota. Approximately 68 percent of forest and woodland areas in North Dakota are held by private owners (USFS, 2013). Section 13.1.6, Biological Resources, presents additional information about terrestrial vegetation.

State Forests

The North Dakota Forest Service manages five state forests and one memorial tree grove. The state forests provide a variety of uses including recreation opportunities, wildlife habitat, and forest and woodland products. The mission of the North Dakota Forest Service is to, “care for, protect and improve forest and natural resources to enhance the quality of life for present and future generations” (North Dakota Forest Service, 2010).

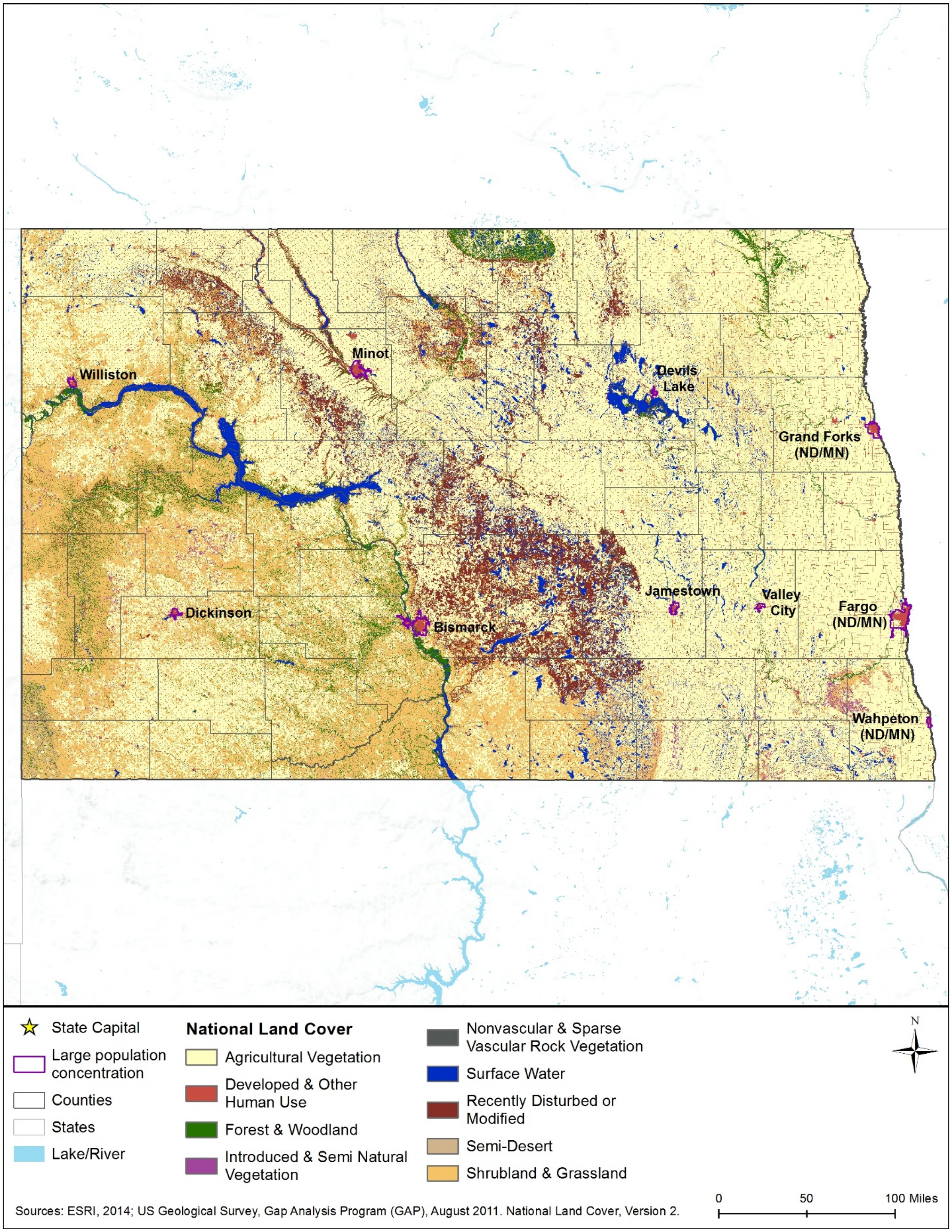

Figure 13.1.7-1: Major Land Use Distribution by Coverage Type

Private Forest and Woodland

Private forest owners collectively own approximately 68 percent of North Dakota's total forest and woodland areas (USFS, 2013). Most of the forest and woodland parcels owned by families are 10 acres or less. The majority of private forest owners have minimal activity on their land. Most of the owners plan to transfer the property to another family member (North Dakota Forest Service, 2010). For additional information regarding forest and woodland areas, see Section 13.1.6.3, Vegetation and Section 13.1.8, Visual Resources.

Shrub and Grassland

Approximately 23 percent of North Dakota's surface area is classified as shrub and grassland. The largest concentrations of grasslands are in western and southcentral North Dakota. Portions of these grasslands are within the Dakota Prairie Grasslands managed by the USFS. These areas provide a variety of land uses such as wildlife habitat, recreation, hunting, and livestock grazing (USFS, 2016). For additional information on shrub and grassland, see Section 13.1.6, Vegetation.

Agricultural Land

Agricultural land occurs throughout North Dakota with the largest concentration in the eastern portion of the state (Figure 13.1.7-1). Approximately 58.1 percent of North Dakota's total land area is classified as agricultural land (approximately 41,090 square miles). In 2012, there were 30,961 farms in North Dakota and 89 percent were owned and operated by families or individuals, with the average farm size of 1,268 acres (USDA, 2012). Some of the state's largest agricultural uses include spring wheat, durum, soybeans, corn, hay, dry beans, sunflower, barley, dairy, and beef (USDA, 2016). The USDA Census of Agriculture website provides additional information by county: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/North_Dakota/.

Developed Land

Developed land in North Dakota tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 13.1.7-1). Approximately 9.6 percent of North Dakota land is developed (approximately 6,749 square miles). These areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 13.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 13.1.7-1 shows where these areas are located within the Developed land use category.

Table 13.1.7-2: Top Five Developed Metropolitan Areas in North Dakota (2014 Estimate)

Metropolitan Area	Population Estimate
Fargo (ND/MN)	115,863
Bismarck	68,896
Grand Forks (ND/MN)	56,057
Minot	47,997
Dickinson	22,322
Total Estimated Population of Top Five Metropolitan Areas	**311,135**
Total State Estimated Population	**739,482**

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

Land Ownership

Land ownership within North Dakota has been classified into four main categories: private, federal, state, and tribal (Figure 13.1.7-2).[95]

Private Land

Privately owned land in North Dakota and primarily falls within the agricultural land, shrub and grassland, developed land, and forest and woodland land uses. Private land exists in all regions of the state.[96]

Federal Land

The federal government manages 6,407 square miles (nine percent) of North Dakota land with a variety of land types and uses, including military bases and facilities, national wildlife refuges (NWRs), national grassland, national park, and national historical sites. Four federal agencies manage the majority of federal lands throughout the state (Table 13.1.7-3 and Figure 13.1.7-2) (USGS, 2012e) (USGS, 2014f). There may by other federal lands, but they are not shown on the map due to their small size relative to the entire state.

[95] Land ownership data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive data set that contains large quantities of information relevant to the Proposed Action. The data was queried to show Owner and used USGS' PAD-US ownership symbolization for consistency. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

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

Table 13.1.7-3: Federal Land in North Dakota

Agency	Square Miles	Type
Department of Defense (DoD)	765	Military Bases and Facilities
U.S. Fish and Wildlife Service (USFWS)	3,800	NWR
U.S. Forest Service (USFS)	1,727	National Grassland
National Park Service (NPS)	115	National Park and National Historic Sites
Total	**6,407**	NA

Sources: (USGS, 2012e) (USGS, 2014f)

- DoD owns and manages 765 square miles used for military bases and facilities (DoD, 2014);
- USFWS owns and manages 3,800 square miles consisting of 24 NWRs in North Dakota (USFWS, 2014e);
- USFS owns and manages 1,727 square miles set aside as the Dakota Prairie National Grassland (USFS, 2016); and
- The NPS manages 115 square miles consisting of one National Park and two National Historic Sites, as well as other affiliated areas (NPS, 2014b) (USGS, 2012e) (USGS, 2014f).

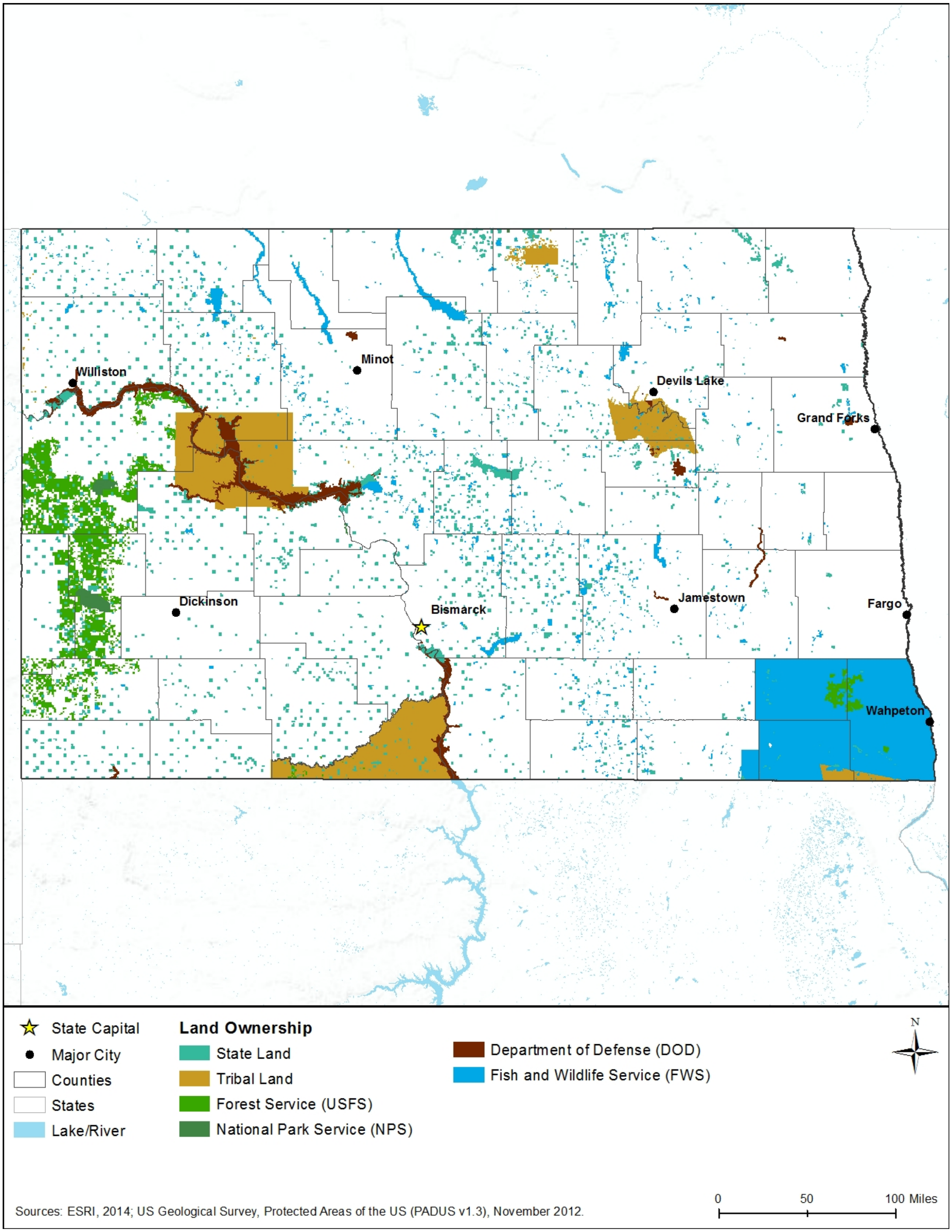

Figure 13.1.7-2: Federal and State Land Ownership Distribution

State Land[97]

The North Dakota state government owns approximately 1,467 square miles of land (USGS, 2012e) (USGS, 2014f). This land is comprised of State Parks, Wildlife Management Areas, State Forests, and State Trust Land.

Table 13.1.7-4: State Land in North Dakota [a]

Agency	Square Miles	Representative Type
North Dakota Parks and Recreation Department	22	State Parks
North Dakota Game and Fish Department	323	Wildlife Management Areas
North Dakota Forest Service	72	State Forests
North Dakota Department of Trust Lands	1,094	State Trust Land

[a] Acres are not additive due to overlapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management Areas.
Source: (USGS, 2012e) (USGS, 2014f)

The acres are not additive due to overlapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management Areas.

- The NDPRD manages 22 square miles consisting of 13 State Parks;
- The NDGFD manages 323 square miles consisting of 220 Wildlife Management Areas;
- The North Dakota Forest Service manages 72 square miles consisting of five State Forests and a memorial tree grove; and
- The North Dakota Department of Trust Lands manages 1,094 acres of State Trust Lands (USGS, 2012e) (USGS, 2014f).

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages 3,392 square miles, or 4.8 percent of the total land within North Dakota (USGS, 2012e) (USGS, 2014f).[98] These lands are composed of 4 Indian Reservations currently located in the north central, central, and southern regions of North Dakota and a portion of a fifth reservation that lies mostly in South Dakota (Lake Traverse Reservation). For additional information regarding tribal land currently located in the state, see Section 13.1.11, Cultural Resources.

Table 13.1.7-5: Indian Reservations and Other Tribal Land Holdings in North Dakota

Reservation Name	Square Miles
Fort Berthold Reservation	1,579
Lake Traverse Reservation	108
Spirit Lake Sioux Reservation	472
Standing Rock Reservation and Trust Land	1,120
Turtle Mountain Reservation and Public Domain Tracts	113
Total	**3,392**

Sources: (USGS, 2012e) (USGS, 2014f)

[97] State land use data for tables and narrative text were derived from specific state sources and may not correspond directly with USGS data that was used for developing maps and figures.
[98] Although the Bureau of Indian Affairs "manages" American Indian lands, the Bureau of Indian Affairs is different than other land management agencies as the lands are held in trust and are sovereign nations.

13.1.7.4. Recreation

North Dakota is located in the Great Plains, with hills and the Badlands in the west, drift prairie and plateau in the center, and grasslands in the east. The state's has several dispersed population centers, while the rest of the state is sparsely populated or unpopulated. On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, and lake or river access points. Availability of community-level facilities is typically commensurate to the population's needs.

This section discusses recreational opportunities available at various locations throughout North Dakota (see Figure 13.1.7-3).[99] For information on visual resources, see Section 13.1.8, Visual Resources, and for information on the historical significance of locations, see Section 13.1.11, Cultural Resources.

- Lake Sakakawea, created by the Garrison Dam on the Missouri River, is the major recreation area for the Northwest Region. Thirty-five recreation areas along the lake include the American Legion Park on the Missouri River, the Lewis and Clark State Park on Sakakawea Lake, and the Audubon National Wildlife Refuge on Lake Audubon. Activities within the recreational areas in the Lake Sakakawea system include hiking, bicycling, wildlife viewing, and other trail use; camping and picnicking; fishing, boating, and other water activities; and licensed, seasonal hunting (Recreation.gov, 2015a).
- The conglomeration of Devils Lake, Lake Alice, Lake Irvine, and smaller lakes within the area are primary recreation locations in the Northeast Region. The Devils Lake Wetland Management District[100] Complex consists of nine wildlife refuges and one national game preserve; recreational activities include hiking, wildlife viewing, and other trail use; fishing; and licensed, seasonal hunting of big game, upland game, and waterfowl (USFWS, 2015n). Grahams Island State Park is located on the west side of the lake; recreational activities include hiking, cross-country skiing, and other trail use; camping; and fishing, boating, and other water activities (NDPRD, 2015c). To the south of the lake is the Spirit Lake Casino and Resort, with adjacent camping facilities (Spirit Lake Casino and Resort, 2015).

[99] Recreational area data was retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive data set that contains large quantities of information relevant to the Proposed Action. The data was queried to show the Primary Designation Type of area. To show these in the map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for recreational resources. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

[100] A Wetland Management District is an administrative organization that manages all the waterfowl production areas in a multi-county area (USFWS, 2008).

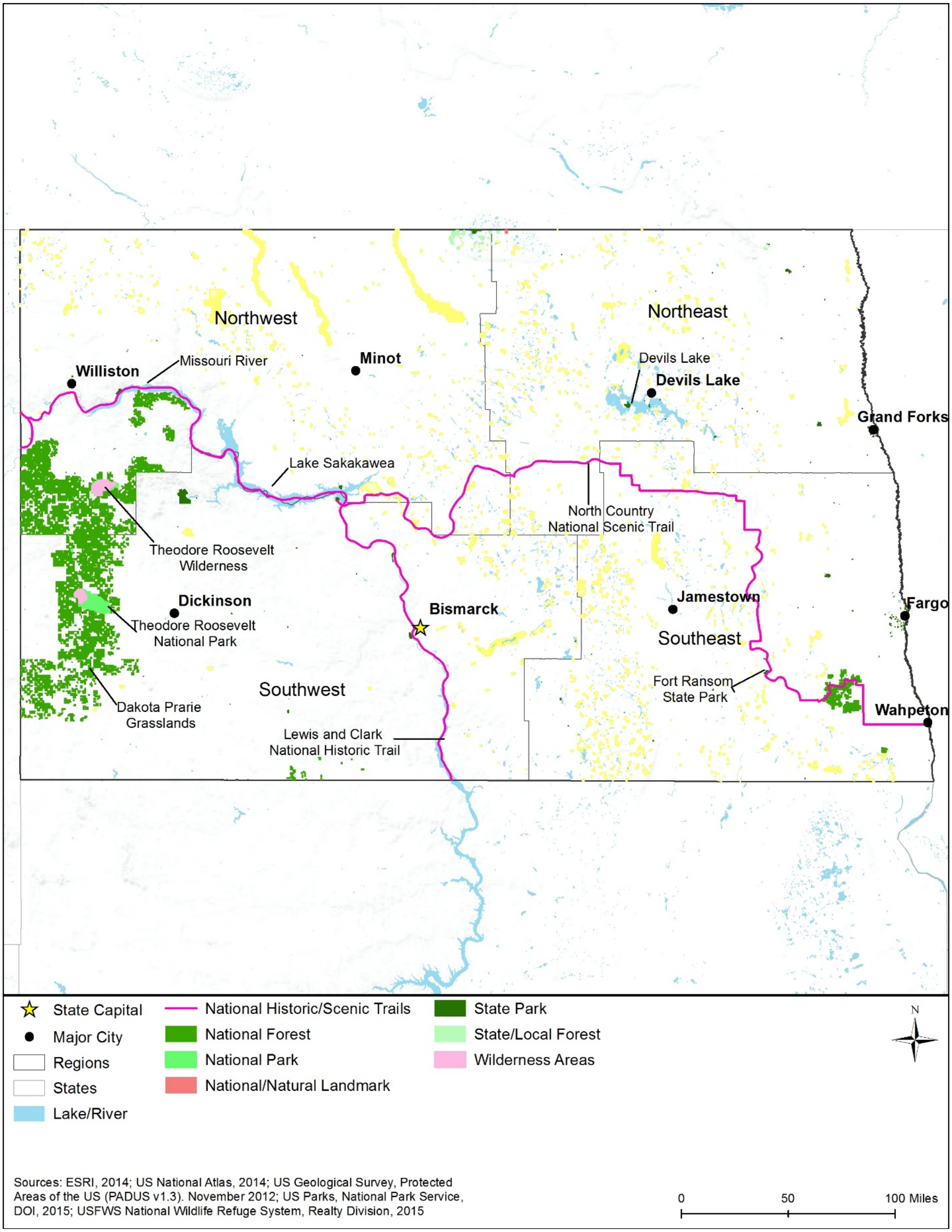

Figure 13.1.7-3: North Dakota Recreation Resources

- The Dakota Prairie Grasslands is located primarily in North Dakota's Southwest Region, with portions in the Northwest and Southeast Regions, and are interspersed with other federal, state, and private lands. The grasslands are known for the tall prairie grass and the wildlife residing there; recreational activities include hiking, bicycling, horseback riding, wildlife viewing, geocaching, snowmobiling, cross-country skiing, and other trail use; camping and picnicking; ice, lake, and river fishing, boating, and other water activities; and licensed, seasonal hunting of big game, small game, game birds, and waterfowl (USFS, 2015).
- The Theodore Roosevelt National Park is located in the Badlands, and is known for hiking areas such as the Painted Canyon and Oxbow Overlook. Recreational activities include hiking, bicycling, horseback riding, wildlife viewing, snowmobiling, cross-country skiing, and other trail use; camping; and river fishing, canoeing, kayaking, and other water activities (NPS, 2015a).
- The Jamestown Reservoir is a known fishing area, with several popular fishing species; other activities include hiking, bicycling, horseback riding, and other trail use; areas for recreational vehicle use; camping; and boating, and other water activities (Recreation.gov, 2015b).
- Fort Ransom State Park is popular for canoeing and kayaking; trails are open for hiking, bicycling, horseback riding, cross-country skiing, and snowshoeing (NDPRD, 2015d).
- Doyle Memorial State Recreation Area has camping, picnicking, boating, and fishing (NDPRD, 2015e).

13.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas:

- 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.
- 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 13.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[101] service is based on the airspace classification (FAA, 2008).

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

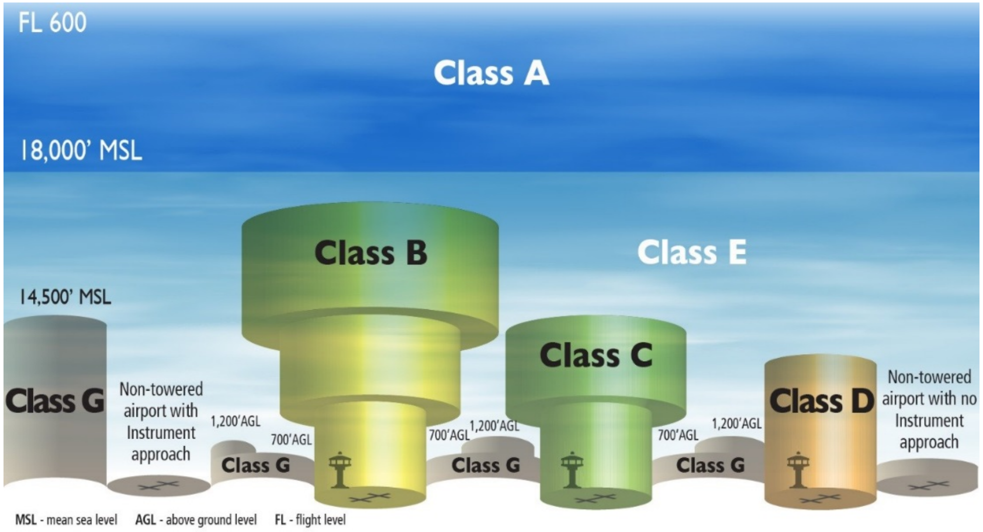

Figure 13.1.7-4: National Air Space Classification Profile

Source: (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[102]. 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).[103]
- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

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

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 13.1.7-6).

Table 13.1.7-6: SUA Designations

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

Source: (FAA, 2015b) (FAA, 2008)

Other Airspace Areas

Other airspace areas 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 13.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute (5,280 feet/mile) miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the State of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of “permanent” are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Source: (FAA, 2015b) (FAA, 2008)

13.1.7.6. 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 First Edition).

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

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.

13.1.7.7. Obstructions to Airspace Considerations

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

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

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.

13.1.7.8. North Dakota Airspace

The North Dakota Aeronautics Commission (NDAC) is a state agency with a mission, “To serve the public by providing economic and technical assistance for the aviation community while ensuring the safe and cost effective advancement of aviation in North Dakota” (North Dakota Aeronautics Commission, 2016). There is one FAA FSDO located in Fargo, North Dakota (FAA, 2015d).

North Dakota 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 associated with their airports. (NASAO, 2015). Table 13.1.7-8 presents the different aviation airports/facilities located in North Dakota, while Figures 13.1.7-6 and 13.1.7-7 present the breakout by public and private airports/facilities. There are approximately 271 airports within North Dakota as presented in Table 13.1.7-8 and Figures 13.1.7-5 through 13.1.7-7 (USDOT, 2015a).

Table 13.1.7-8: Type and Number of North Dakota Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	80	167
Heliport	0	15
Seaplane	0	0
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	**89**	**182**

Source: (USDOT, 2015a)

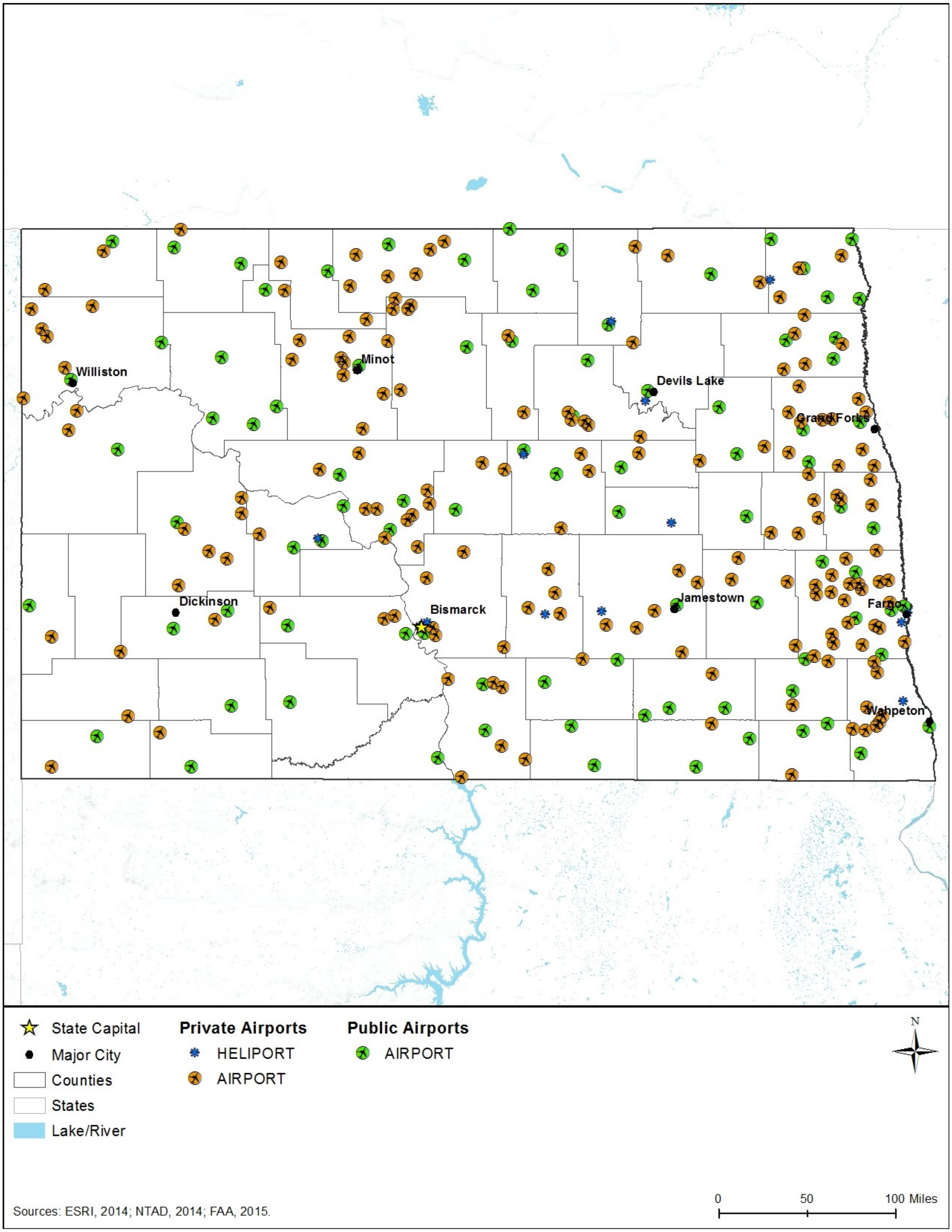

Figure 13.1.7-5: Composite of North Dakota Airports/Facilities

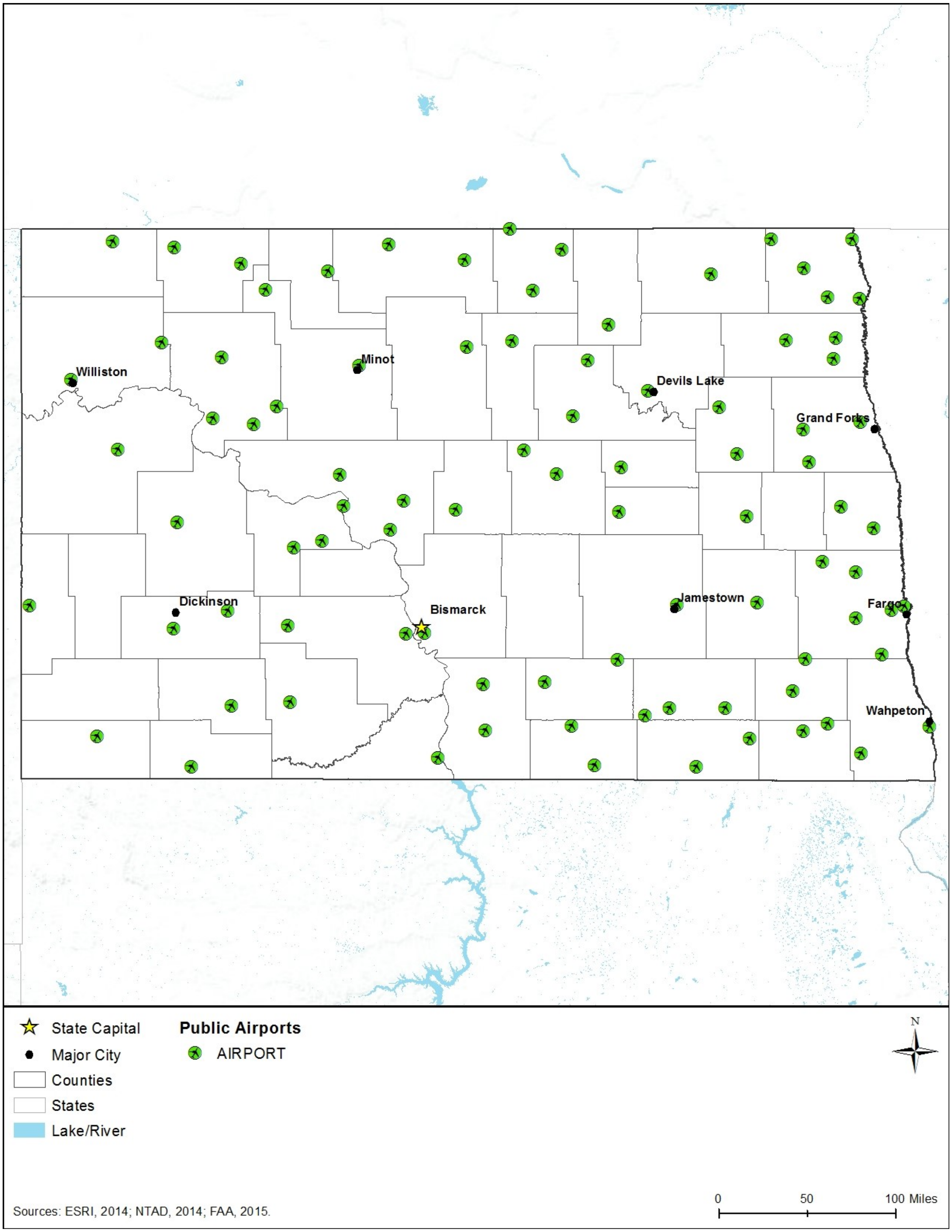

Figure 13.1.7-6: Public North Dakota Airports/Facilities

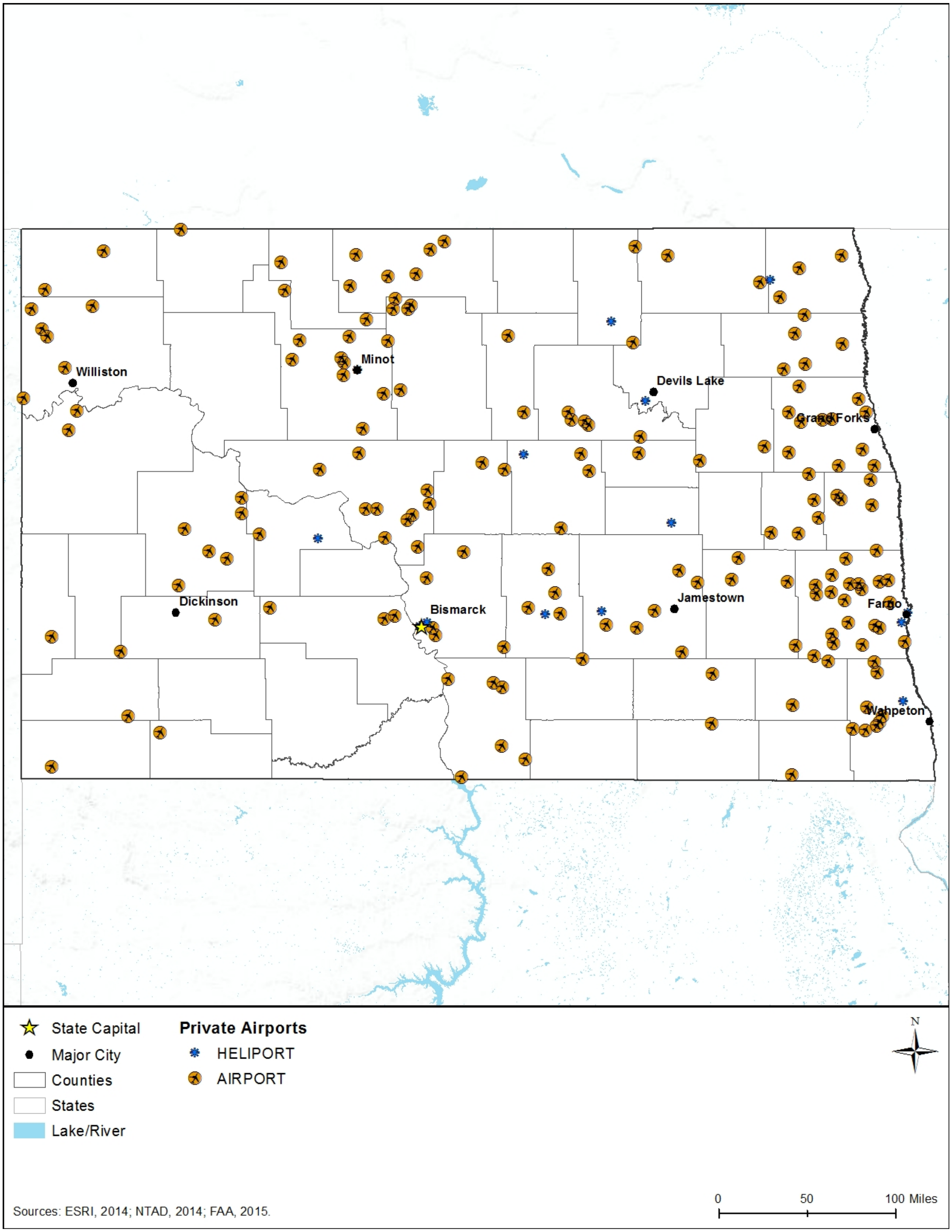

Figure 13.1.7-7: Private North Dakota Airports/Facilities

There are no Class B or Class C airports in North Dakota; Class D controlled airports are as follows:

- Six Class D –
  - Bismarck Municipal, Bismarck
  - Hector International, Fargo
  - Grand Forks Air Force Base (AFB), Grand Forks
  - Grand Forks International, Grand Forks
  - Minot International, Minot
  - Minot, Minot AFB, Minot (FAA, 2015e)

SUAs (i.e., eight restricted areas and four MOAs) located in North Dakota are as follows:

- Devils Lake (Restricted)
  - R-5401 - Surface to 5,000 feet MSL,
  - R-5402 - 500 feet Above Ground Level (AGL) to, but not including, 10,000 feet MSL
  - R-5403A - 8,000 feet MSL to, but not including, 10,000 feet MSL
  - R-5403B - 10,000 feet MSL to, but not including, 14,000 feet MSL
  - R-5403C - 14,000 feet MSL to, but not including, FL 180
  - R-5403D - 10,000 feet MSL to, but not including, 12,000 feet MSL
  - R-5403E - 12,000 feet MSL to, but not including, 14,000 feet MSL
  - R-5403F - 14,000 feet MSL to, but not including, FL 180 (FAA, 2016b)

The four MOAs for North Dakota are as follows:

- Devils Lake –
  - East – 3,500 feet MSL to, but not including, FL 180
  - West – 4,000 feet MSL to but not including, FL 180
- Tiger –
  - North – 300 feet AGL to, but not including FL 180; Excluding the airspace at and below 1,500 feet AGL within a 3 NM radius of the Rollete, Rolla, and Robertson Airports; Excluding the airspace below 3,000 feet AGL within that portion of the MOA north of lat. 48°55'00”N. and west of long. 99°41'02”W
  - South – 6,000 feet MSL to, but not including, FL 180 (FAA, 2016b)

The SUAs for North Dakota are presented in Table 13.1.7-8. There are no TFRs (FAA, 2015f). MTRs in North Dakota, presented in Figure 13.1.7-9, consist of six Instrument Routes.

UAS Considerations

The NPS signed a policy memorandum on June 20, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014h). Three NPS units (designated as one National Park and two National Historic Sites) within the state of North Dakota have to comply with this agency directive (NPS, 2014c).

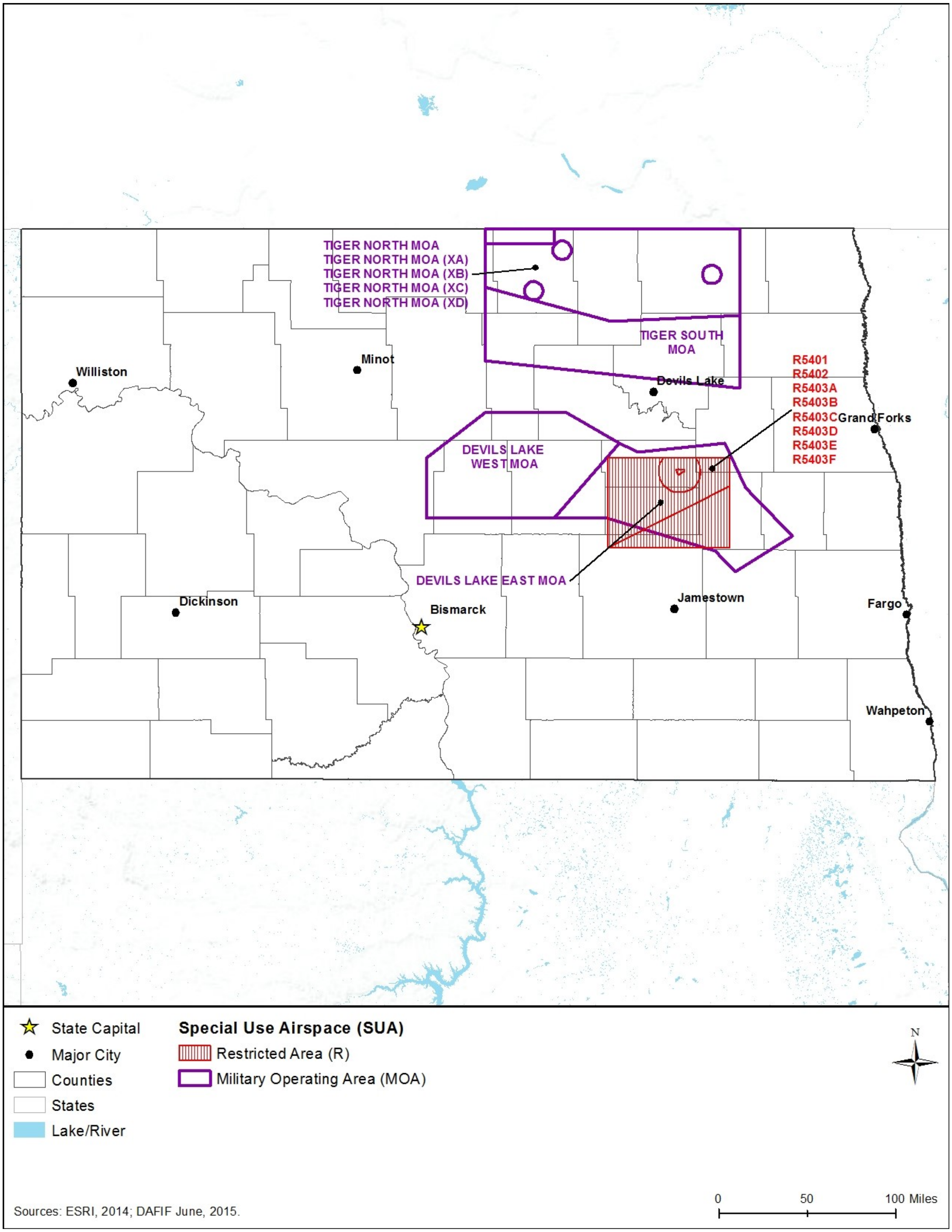

Figure 13.1.7-8: SUAs in North Dakota

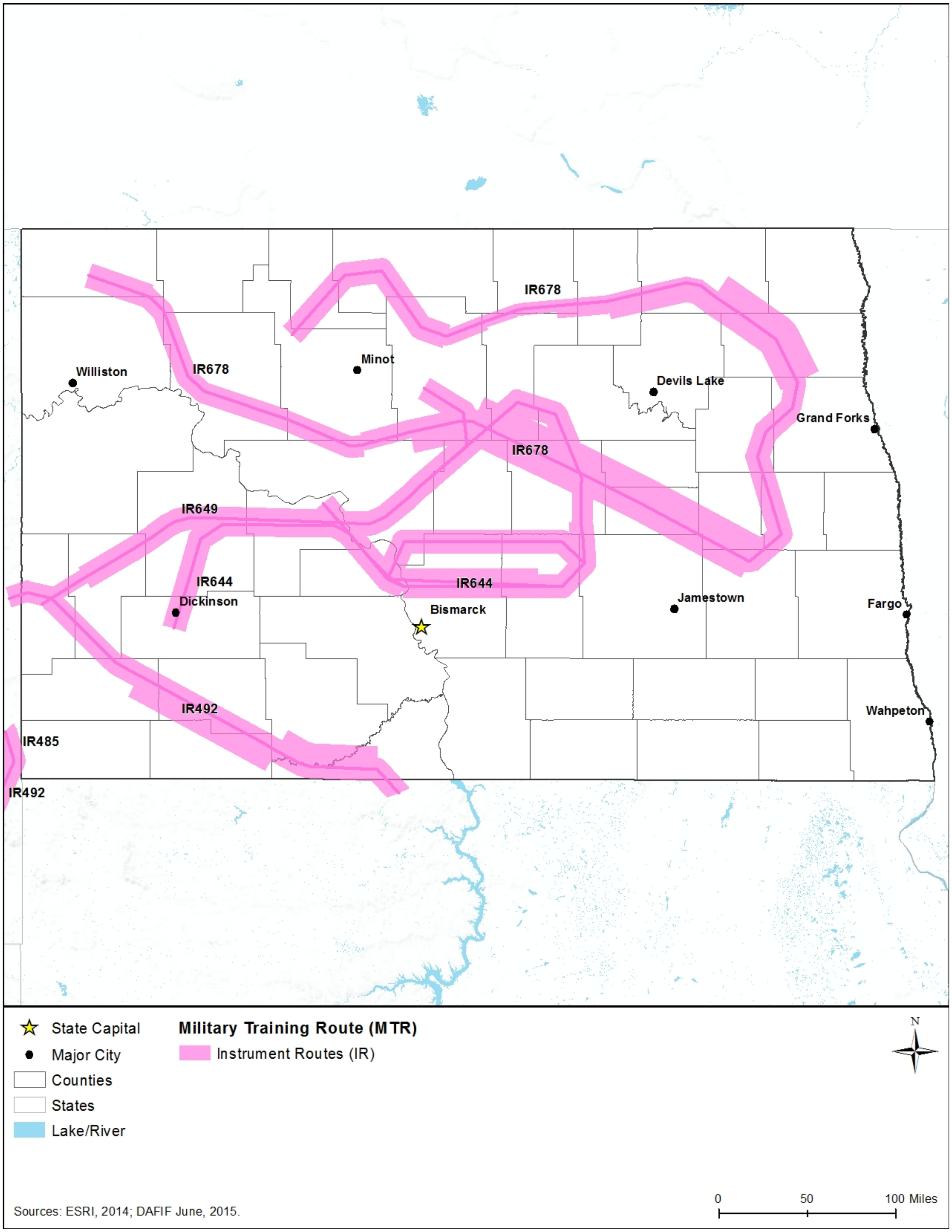

Figure 13.1.7-9: MTRs in North Dakota

Obstructions to Airspace Considerations

Chapter 2-04 of the North Dakota Century Code (Airport Zoning Act) addresses airspace hazards. As defined in Chapter 2-204, an airport hazard is "any structure or tree or use of land which obstructs the airspace required for the flight of aircraft in landing or taking‒off at any airport or is otherwise hazardous to such landing or taking‒off of aircraft." (North Dakota Government, 2015) Chapter 2-02-04, Airports and Landing Fields, of the Century Code provides the authority to regulate structures, as it obtains to potential impacts to navigable airspace.

13.1.8. Visual Resources

13.1.8.1. 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, view 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 National Historic Preservation Act (NHPA) compliance. The federal government does not have a definition of what constitutes a visual resource; therefore, this PEIS will use the general definition of visual resources used by the Bureau of Land Management, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)." (BLM, 1984).

13.1.8.2. Specific Regulatory Considerations

Table 13.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 13.1.8-1: Relevant North Dakota Visual Resources Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
North Dakota Little Missouri State Scenic River Act	Little Missouri River Commission	Established to "afford the protection adequate to maintain the scenic, historic, and recreational qualities of the Little Missouri River and its tributary streams."
North Dakota Century Law, Chapter 24-17, Advertising Adjacent to Highways	Department of Transportation	Provides authority to "the right and control over the erection, location, or maintenance of billboards, signs, or any form of advertising adjacent to the state highway system, to determine and designate such areas adjacent to the state highway system as are necessary for the restoration, preservation, and enhancement of scenic beauty and to vacate to the owner such property rights acquired in areas not so determined and designated."
North Dakota Century Code, Chapter 55-11, Nature Preserves	NDPRD	Establishes system of nature preserves "to promote understanding and appreciation of the aesthetic, cultural, and spiritual values of such natural areas by the people of the state of North Dakota."

State Law / Regulation	Regulatory Agency	Applicability
North Dakota Century Code, Chapter 20.1-16, Interstate Wildlife Violator Compact	NDGFD	Applies provision for the "preservation, protection, management, and restoration of wildlife contributes immeasurably to the aesthetic, recreational, and economic aspects of such natural resources."
North Dakota Century Code, Chapter 55-03, Protection of Prehistoric Sites and Deposits	NDGFD	Establishes procedure for mitigating adverse effects on prehistoric sites in order to preserve "a record of the existence and scientific, historical, architectural, engineering, educational, or aesthetic value of a cultural resource, historic building, structure, or object."

In addition to the state laws and regulations, local zoning laws may apply related to visual resources. Viewsheds and scenic vistas are increasingly important to the state's towns and cities, as they look at the future planning of their municipalities.

Where counties, cities, or towns have planning documents that address scenery, character, or visual resources, the placement of towers or temporary transmission structures would be required to comply with the management or provide mitigation measures to meet compliance.

13.1.8.3. Character and Visual Quality of the Existing Landscape

North Dakota has a wide range of visual resources. The vast majority of the state is characterized as agricultural, grassland, or undeveloped (Figure 13.1.7-1 in Section 13.1.7, Land Use, Recreation, and Airspace). Lake Sakakawea in the central portion of the state offers scenic vistas of water, sky, grasslands, and wooded areas. The Devils Lake area in the northeastern area of the state is home to several wildlife refuges containing ecologically important wetlands. Theodore Roosevelt National Park, located in the west central area of the state offers spectacular views of the Badlands natural geological features, as well as scenic grassland vistas.

Agricultural areas are located throughout the state with the majority located in the eastern and northern parts of the state. These areas generally have few tall structures (aside from grain silos and some trees) and lack major urban centers. Lakes, rivers, wetlands, and waterfront lands in North Dakota vary from vegetated riparian areas (areas located on the bank of a watercourse or lake) to wide lakeside vistas. The consistency, continuity, and lack of view obstructions from major constructed features characterizes the visual attributes of these areas.

One aspect of importance for visual resources is to maintain the character of the area. For example, in a rural community, keeping the character of the town consistent with farm-style houses, barns, and ranches 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 13.1.7 discusses land use and contains further descriptions of land cover within the state.

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

13.1.8.4. 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 (NASA, 2013). Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 13.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In North Dakota, there are 441 NRHP listed sites, which include one National Heritage Area, six National Historic Landmarks, and two National Historical Sites. Some state Historic Sites may also be included in the NRHP, whereas others are not designated at this time.

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* addresses four aspects: preservation, rehabilitation, restoration, and reconstruction, whereas *The Guidelines for the Treatment of Cultural Landscapes*, both authored by the NPS, provides guidance for applying protections to all aspects of the historic and cultural landscape, such as forests, gardens, trails, structures, ponds, and farming areas, to meet the Standards (NPS, 1995). The Standards "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 historic properties and the visual resources therein. (NPS, 1995).

National Heritage Areas

National Heritage Areas (NHAs) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011a). There are 49 NHAs managed by the NPS to help tell the history of the United States (NPS, 2015b). Based on this criteria, NHAs may contain scenic or aesthetic areas considered visual resources or visually sensitive. There is one NHA in North Dakota: the Northern Plains, NHA (Figure 13.1.8-1). The Northern Plains NHA includes the homestead of General Custer and the 7th Cavalry, the homeland of the Mandan-Hidatsa, and Chief Looking's Village (NPS, 2015b).

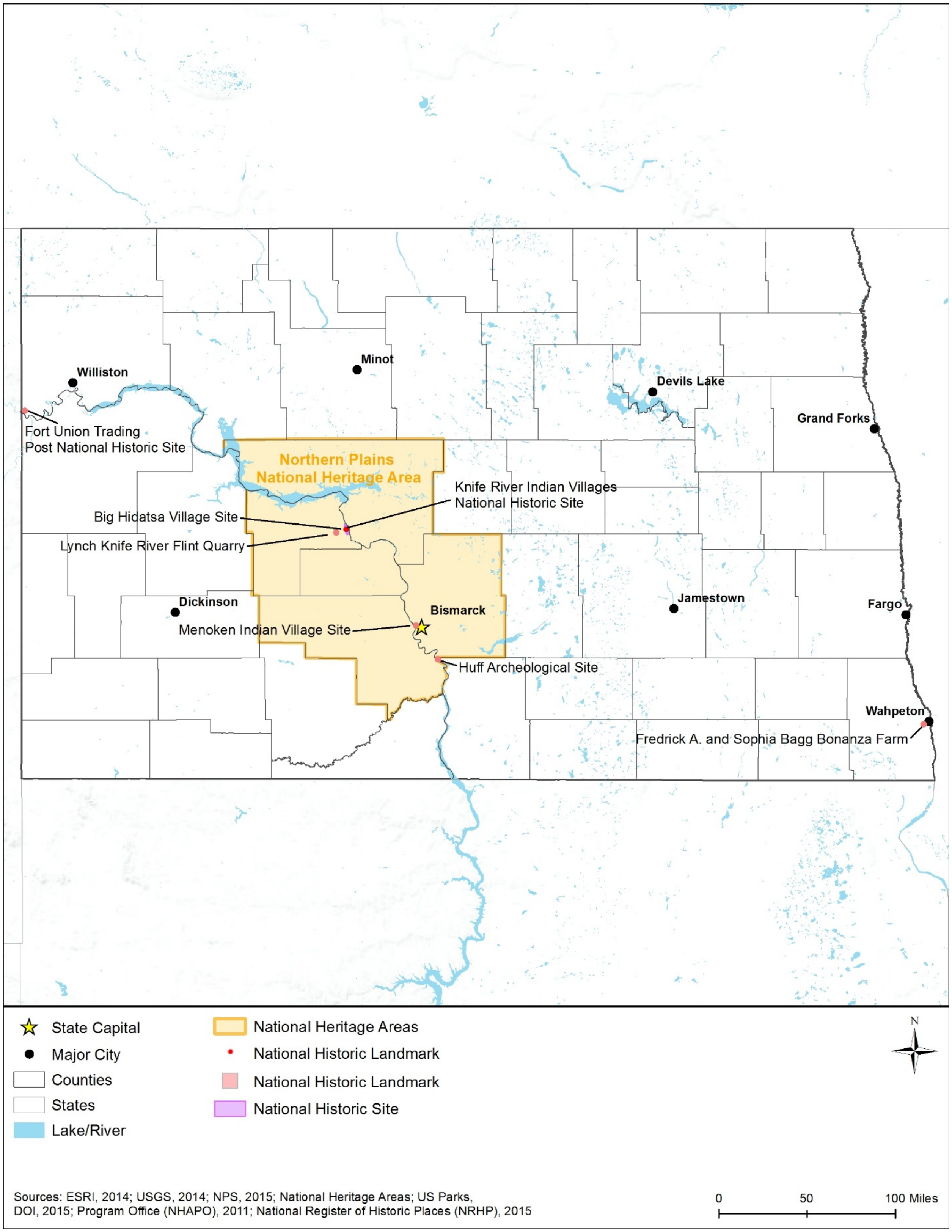

Figure 13.1.8-1: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive

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, 2015c). NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016a). Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. In North Dakota, there are six NHLs (Figure 13.1.8-3) (NPS, 2015d):

- Big Hidatsa Village Site,
- Fort Union Trading Post,
- Frederick A. and Sophia Bagg Bonanza Farm,
- Huff Archeological Site,
- Lynch Knife River Flint Quarry, and
- Menoken Indian Village Site.

By comparison, there are over 2,500 NHLs in the United States (NPS, 2015e). Figure 13.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

State Historic Sites

State historic sites are likely to contain scenic or aesthetic components that may be considered visual resources or visually sensitive. There are 57 designated historic sites throughout the state from rural to urban areas (State Historical Society of North Dakota, 2015b). Examples of historic sites include the Crowley Flint Quarry, Fort Rice, and the Welk Farmstead. For additional information regarding these properties and resources, see Section 13.1.11, Cultural Resources. In addition, the State Historical Society of North Dakota maintains an online property database to locate state historic sites at http://www.history.nd.gov/historicsites/index.html

13.1.8.5. Parks and Recreation Areas

Parks 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. Figure 13.1.7-1 identifies parks and recreational resources that may be visually sensitive in North Dakota.[104] For additional information about recreation areas, including national and state parks, see Section 13.1.7, Land Use, Recreation, and Airspace.

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[104] The natural areas data were retrieved from the Protected Areas Database of the United States (PAD-US), produced by USGS (http://gapanalysis.usgs.gov/padus/). This dataset categorizes lands across the U.S. by conservation, land management, planning, recreation, and ownership, as well as other uses. It is an extensive data set that contains large quantities of information relevant to the Proposed Action. The data was queried and further combined by the Primary Designation Type into classifications that fit the multiple types of land applicable for Natural Areas. For this map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for natural areas. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to North Dakota residents and visitors. There are 13 state parks throughout North Dakota (Figure 13.1.8-3), most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (NDPRD, 2015f). Table 13.1.8-2 lists these parks and their associated visual attributes. Figure 13.1.8-2 shows a view at Fort Ransom.

Table 13.1.8-2: Examples of North Dakota State Parks and Associated Visual Attributes

State Park	Visual Attributes
Beaver Lake	Lake views, scenic landscapes
Cross Ranch	Cultural and historic sites, river views, forest and woodland views
Fort Abraham Lincoln	Cultural and historic sites, woodland, vistas of the Missouri River
Fort Ransom	Picturesque views of the Sheyenne River Valley, forested areas
Fort Stevenson	Lake views, wildlife viewing, scenic vistas
Grahams Island	Lake views, wildlife viewing, scenic grass prairies
Icelandic	Lake views, historic sites, wooded areas
Lake Metigoshe	Lake views, scenic rolling hills,
Lake Sakakawea	Lake views, scenic vistas, woodlands, wildlife viewing
Lewis and Clark	Lake views, prairie vistas, wildlife viewing
Little Missouri	Scenic views of the Badlands, natural rock formations
Sully Creek	Scenic views of the Badlands natural formations, river views
Turtle River	River views, woodland scenery, wildlife viewing

Source: (NDPRD, 2015f)

Figure 13.1.8-2: Fort Ransom State Park

Source: (NDPRD, 2015g)

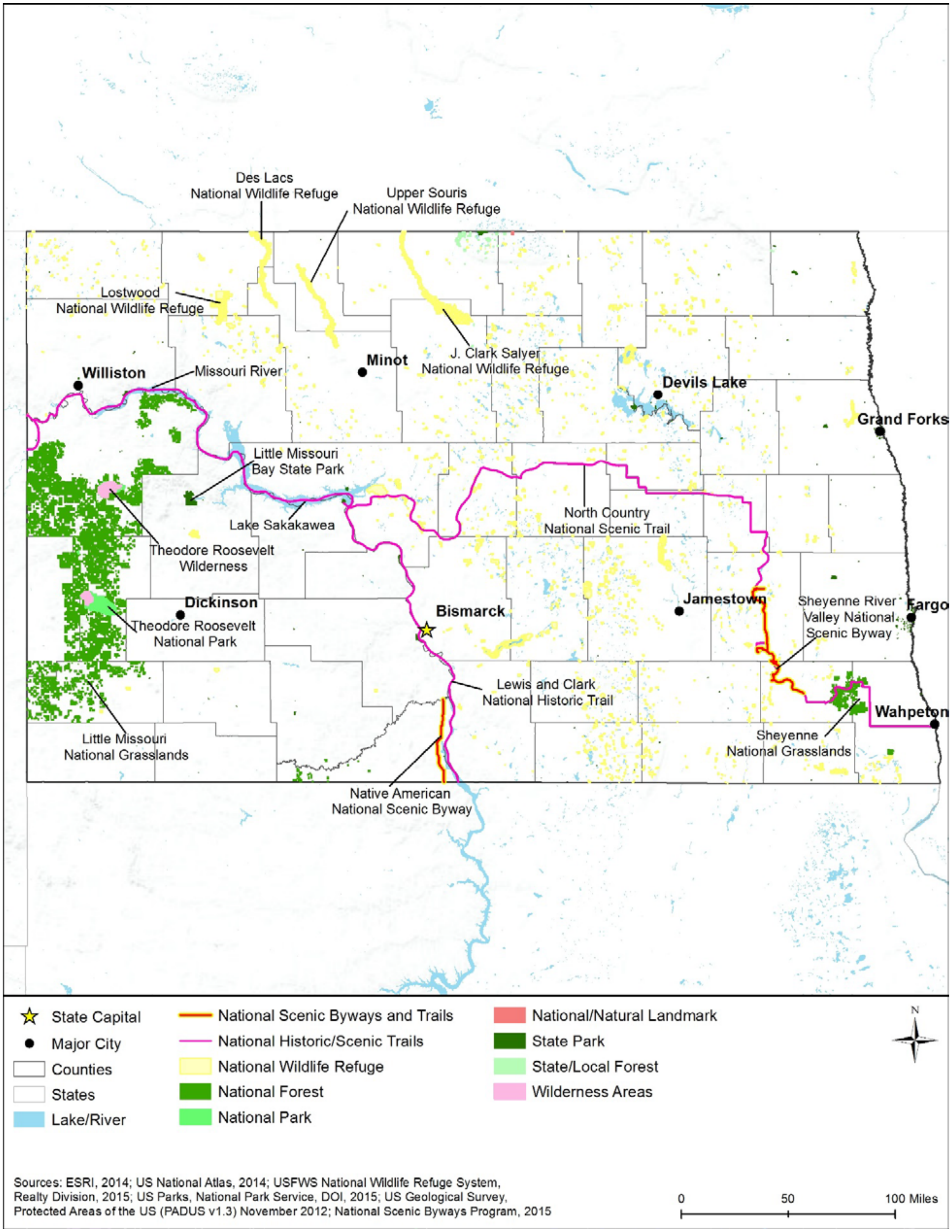

Figure 13.1.8-3: Natural Areas that May be Visually Sensitive

National Park Service

NPS units are managed by the NPS and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation for the public's use. There are one National Park (Theodore Roosevelt National Park) and two National Historic Sites (Fort Union Trading Post and Knife River Indian Villages) in North Dakota, as well as other NPS affiliated areas, such as a NHA (Figure 13.1.8-4). For additional information regarding parks and recreation areas, see Section 13.1.7, Land Use, Recreation, and Airspace.

Source: (NPS, 2015f)

Figure 13.1.8-4: Theodore Roosevelt National Park

National Forests

The U.S. Department of Agriculture (USDA) Forest Service owns and manages National Forests that may contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation for the public's use. In North Dakota, the Forest Service maintains one National Prairie Grassland, the Dakota Prairie Grassland (Figure 13.1.8-4).

Federal Scenic Trails

Designated federal scenic trails may contain visual resources such as historic views, forest and woodland views, and scenic vistas of valleys and gorges. Across North Dakota, there are many trails that offer views within state parks, forested areas, across the plains, and along river and lake shores.

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails (NSTs) are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass"

(NPS, 2012b). There is one NST passing through North Dakota, the 3,200-mile long North Country Trail extending from eastern New York to North Dakota. Administered by the NPS, the portion of the NST through North Dakota is 475 miles in length (NPS, 2014d).

In addition, the National Trails System Act also created the National Historic Trails and National Recreational Trails (American Trails, 2016a). These trails may contain visual or scenic resources. The approximately 3,700 mile long Lewis & Clark National Historic Trail crosses through North Dakota (NPS, 2016b). There are 16 identified National Recreational Trails in North Dakota (American Trails, 2016b).

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 in the United States. Twenty-five percent of these federal lands are in 47 NPS units (44 million acres) and part of National Park System. These designated wilderness areas are managed by the USFS, BLM, USFWS, and NPS (Wilderness.net, 2015).

North Dakota is home to three federally managed wilderness areas: Lostwood Wilderness, Chase Lake Wilderness, and Theodore Roosevelt Wilderness (which contains three separate units, for a total of five units within the state) (Figure 13.1.8-3) (Wilderness.net, 2015). The Lostwood Wilderness is comprised of northern mixed grass prairie encompassing 5,577 acres. Managed by the USFWS, these grasslands are home to an abundance of breeding waterfowls, songbirds, sparrows, and over 100 species of grasses. Also managed by the USFWS, the Chase Lake Wilderness is comprised of the lake and two islands that are home to more than 20,000 white pelicans, ducks, geese, swans, sharp-tailed rouse, white-tailed deer and many other mammals. The Theodore Roosevelt Wilderness is comprised of three separate units along the Little Missouri River managed by the NPS. Encompassing 70,000 acres in the center of the North Dakota badlands, the park preserves the geology of the badlands area, along with mixed-grass prairie and wildlife (Wilderness Institute, University of Montana College of Forestry and Conservation, 2015).

State Nature Preserves and Natural Areas

The North Dakota Nature Preserves Act of 1975 allows for the creation of Nature Preserves "for the benefit of North Dakota citizens" (NDPRD, 2015h). These areas contain some of the state's outstanding scenic resources including forests, wetlands, lakes, hills, and rivers. North Dakota has designated five State Nature Preserves and two State Natural Areas (Figure 13.1.8-3), each with distinct visual attributes:

- Cross Ranch Nature Preserve (5,593 acres);
- Gunlogson Nature Preserve (200 acres);
- Head of the Mountain Nature Preserve (100 acres);
- H.R. Morgan Nature Preserve (40 acres);
- Sentinel Butte Nature Preserve (240 acres);
- Missouri River Natural Area (157 acres); and
- Smoky Lake Natural Area (276 acres).

National Wildlife Refuges (NWRs) and State Wildlife Management Areas (WMAs)

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" (USFWS, 2015o). There are 24 NWRs in North Dakota (Table 13.1.8-3). Visual resources within the NWRs include scenic lakes, wetlands, and rivers.

Table 13.1.8-3: North Dakota NWRs

Arrowwood National Wildlife Refuge	Lake Alice National Wildlife Refuge
Arrowwood Wetland Management District	Lake Ilo National Wildlife Refuge
Audubon National Wildlife Refuge	Lake Zahl National Wildlife Refuge
Chase Lake National Wildlife Refuge	Long Lake National Wildlife Refuge
Chase Lake Wetland Management District	Lostwood National Wildlife Refuge
Des Lacs National Wildlife Refuge	Shell Lake National Wildlife Refuge
Devils Lake Wetland Management District	Slade National Wildlife Refuge
Florence Lake National Wildlife Refuge	Sullys Hill National Game Preserve
J. Clark Salyer National Wildlife Refuge	Tewaukon National Wildlife Refuge
J. Clark Salyer Wetland Management District	Tewaukon Wetland Management District
Kellys Slough National Wildlife Refuge	Upper Souris National Wildlife Refuge
Kulm Wetland Management District	Valley City Wetland Management District

Source: (USFWS, 2015o)

State WMAs are lands owned by North Dakota for the management and preservation of wildlife and may contain visually sensitive natural resources. WMAs are under administered by the NDGFD. These areas are open to hunting, fishing, and trapping (unless otherwise specified by the department). There are 220 WMAs covering just under 196,000 acres scattered throughout the state (NDGFD, 2015). For additional information on wildlife refuges and management areas, see Section 13.1.6.4, Terrestrial Wildlife.

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014e). These landmarks may be considered visual resources or visually sensitive. In North Dakota, four NNLs exist entirely or partially within the state:

- Fischer Lake (522 acres);
- Rush Lake (1,593 acres);

- Two-Top Mesa and Big Top Mesa (41 acres); and
- Sibley Lake (2,451 acres).

Some of the natural features located within these areas include "undisturbed prairie pothole lakes, which provide important staging and breeding habitat for diverse waterbird populations, and features representative of the glacial moraine and pitted outwash plain surface of North Dakota." (NPS, 2012c). As an example, Two-Top Mesa and Big Top Mesa (Figure 13.1.8-5) are in a "badlands terrain of sandstones, siltstones, and clay. The mesas are characterized by an unbroken cover of grass on flat relief' (NPS, 2012d).

Figure 13.1.8-5: Two-Top Mesa and Big Top Mesa NNL

Source: (NPS, 2012d)

13.1.8.6. Additional Areas

State and National Scenic Byways and Backways

National Scenic Byways are roadways designated because of their vistas, scenic, or aesthetic landscapes. The National Scenic Byways Program is managed by the USDOT, FHWA. North Dakota has two designated National Scenic Byways: the Native American Scenic Byway and the Sheyenne River Valley Scenic Byway (Figure 13.1.7-1 in Section 13.1.7 Land Use, Recreation, and Airspace) (USDOT, 2015b).

Similar to National Scenic Byways, North Dakota Scenic Byways are transportation corridors that are of particular statewide interest. There are 8 State Scenic Byways and Backways and 2 National Scenic Byways (Figure 13.1.7-1 in Section 13.1.7 Land Use, Recreation, and Airspace), which include:

- Chan SanSan Scenic Backway (32 miles);
- Des Lacs National Wildlife Refuge Backway (13.5 miles);
- Killdeer Mountain Four Bears Scenic Byway (64 miles);
- Old Red Old Ten Scenic Byway (108 miles);
- Rendezvous Regions Scenic Backway (33.5 miles);
- Sakakawea Scenic Byway (23 miles);

- Sheyenne River Valley National Scenic Byway (63 miles);
- Standing Rock National Native American Scenic Byway (35 miles);
- Theodore Roosevelt National Park North Unit Scenic Byway (13.7 miles); and
- Turtle Mountain Scenic Byway (53 miles). (NDPRD, 2015i)

State Scenic Rivers

The Little Missouri River is a designated North Dakota State Scenic River. Designated in 1982, the entire 26-mile segment of the Little Missouri River lies within Theodore Roosevelt National Park (NPS, 2009).

13.1.9. Socioeconomics

13.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. § 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures (BLM, 2005). When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects, and in addition, FirstNet projects may affect the socioeconomic conditions of a region.

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

The financial arrangements for deployment and operation of the FirstNet network may 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.

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. This PEIS addresses environmental justice in a separate section (Section 13.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land use, Recreation, and Airspace (Section 13.1.7), Infrastructure (Section 13.1.1), and Visual Resources (Section 13.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau[105] (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 (U.S. Census Bureau, 2016).

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.

13.1.9.2. Specific Regulatory Consideration

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.

13.1.9.3. Communities and Populations

This section discusses the population and major communities of North Dakota (ND) and it includes the following topics:

[105] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g. "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g. "United States – 010" or "State – 040" or "..... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g. "DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. In many cases, the FirstNet PEIS report tables contain data from multiple Census Bureau tables and sometimes incorporate other sources.

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

Statewide Population and Population Growth

Table 13.1.9-1 presents the 2014 estimated population and population density of North Dakota in comparison to the Central region[106] and the nation. The estimated population of North Dakota in 2014 was 739,482. The population density was 11 persons per square mile (sq. mi.), which was considerably lower than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, North Dakota was the fifth smallest state by estimated population among the 50 states and the District of Columbia, 17th largest by land area, and had the fourth smallest population density (U.S. Census Bureau, 2015d; U.S. Census Bureau, 2015e).

Table 13.1.9-1: Land Area, Estimated Population, and Population Density of North Dakota

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
North Dakota	70,678	739,482	11
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

Sources: (USGS, 2011) (U.S. Census Bureau, 2015d; U.S. Census Bureau, 2015e)

Estimated population growth is an important subject for this PEIS, given FirstNet's mission. Table 13.1.9-2 presents the population growth trends of North Dakota from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth increased substantially in the 2010 to 2014 period compared to 2000 to 2010, from 0.46 percent to 2.40 percent. The growth rate of North Dakota in the latter period was considerably higher than both the rate of the region (0.45 percent) and the nation (0.81 percent) (U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015d).

[106] The Central region is comprised of the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, North Dakota, Ohio, South Dakota, Utah, Wisconsin, and Wyoming. Throughout the socioeconomics section, figures for the Central region represent the sum of the values for all states in the region, or an average for the region based on summing the component parameters. For instance, the population density of the Central region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

Table 13.1.9-2: Recent Population Growth of North Dakota

Geography	Estimated Population			Numerical Estimated Population Change		Rate of Estimated Population Change (AARC)	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
North Dakota	642,200	672,591	739,482	30,391	66,891	0.46%	2.40%
Central Region	72,323,183	76,273,123	77,651,608	3,949,940	1,378,485	0.53%	0.45%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015d)
AARC = Average Annual Rate of Change (compound growth rate)

Demographers prepare future estimated population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use estimated 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 13.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service (ProximityOne, 2015) (University of Virginia Weldon Cooper Center, 2015). 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 North Dakota's estimated population will increase by approximately 48,053 people, or 6.5 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.39 percent, which is considerably lower than the historical growth rate from 2010 to 2014 of 2.40 percent, but in line with the growth rate from 2000 to 2010 of 0.46 percent. The projected growth rate of the state is lower than that of the region (0.60 percent) and the nation (0.80 percent) (U.S. Census Bureau, 2015d; UVA Weldon Cooper Center, 2015) (ProximityOne, 2015).

Table 13.1.9-3: Projected Estimated Population Growth of North Dakota

Geography	Population 2014 (estimated)	Projected 2030 Estimated 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
North Dakota	739,482	680,998	894,071	787,535	48,053	6.5%	0.39%
Central Region	77,651,608	83,545,838	87,372,952	85,459,395	7,807,787	10.1%	0.60%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

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

Population Distribution and Communities

Figure 13.1.9-1 presents the distribution and relative density of the estimated population of North Dakota. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 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 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015h). 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 general lack of groupings of dots in Figure 13.1.9-1 outside of the 10 largest population concentrations indicates that most of North Dakota is very sparsely populated.

Table 13.1.9-4 provides the populations of the 10 largest population concentrations in North Dakota, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[107] In 2010, the largest population concentration was the North Dakota portion of the Fargo area, which had 134,149 people. The state had no other population concentrations over 100,000. The smallest of these 10 population concentrations was the Valley City area, with a 2010 population of 6,689. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Fargo area (North Dakota portion), with an annual growth rate of 2.33 percent. Four of these population concentrations (i.e., Devils Lake area, Jamestown area, Valley City area, and the North Dakota portion of the Wahpeton area) experienced population declines during this period (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015c).

Table 13.1.9-4 also shows that the top 10 population concentrations in North Dakota accounted for 56.7 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 150.8 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 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015c).

[107] 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.

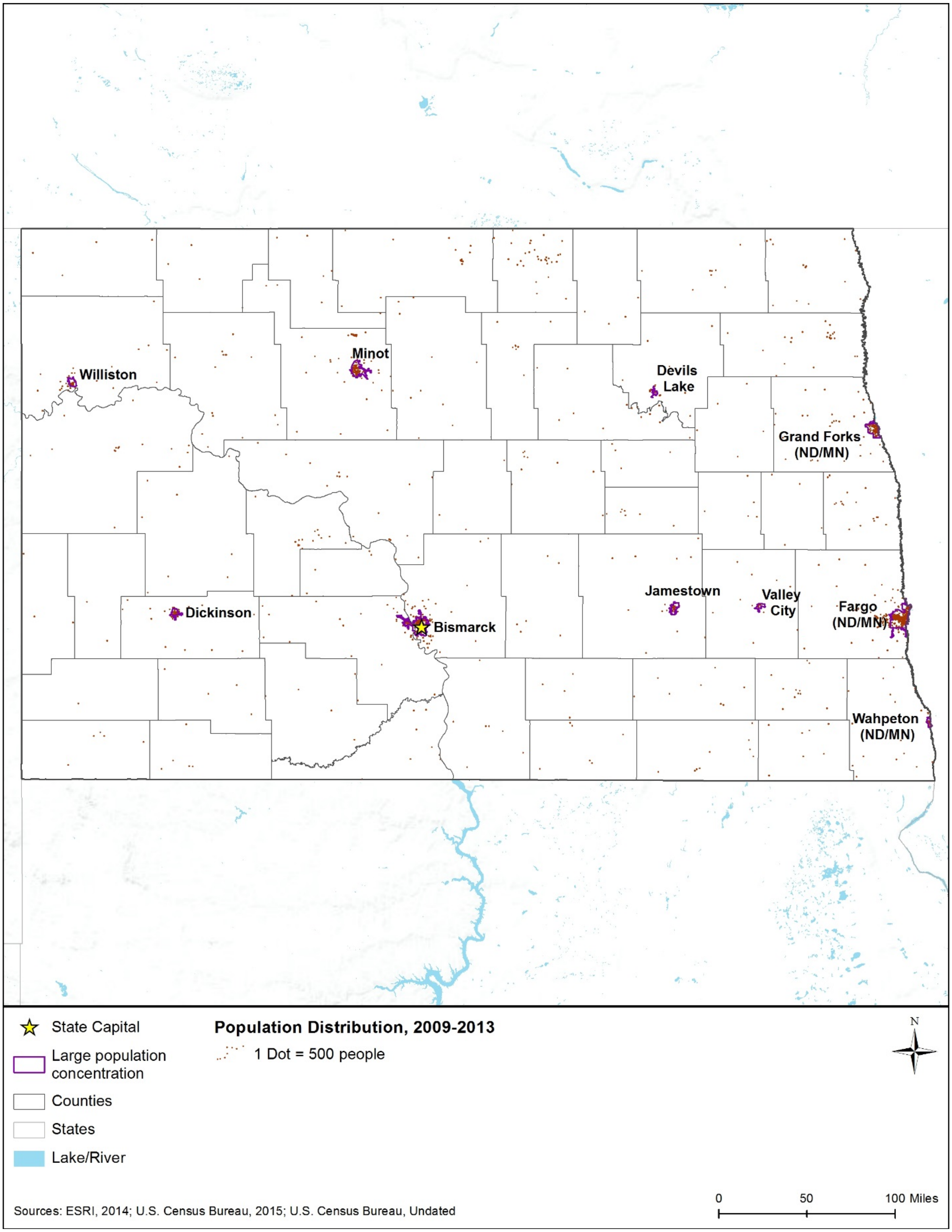

Figure 13.1.9-1: Estimated Population Distribution in North Dakota, 2009–2013

Table 13.1.9-4: Population of the 10 Largest Population Concentrations in North Dakota

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Bismarck	74,991	81,955	84,353	2	6,964	0.89%
Devils Lake	7,454	7,444	7,386	9	(10)	-0.01%
Dickinson	15,920	17,586	18,294	5	1,666	1.00%
Fargo (ND/MN) (ND Portion)	106,577	134,149	137,719	1	27,572	2.33%
Grand Forks (ND/MN) (ND Portion)	49,229	52,952	53,564	3	3,723	0.73%
Jamestown	15,488	15,284	15,128	6	(204)	-0.13%
Minot	37,679	42,650	44,250	4	4,971	1.25%
Valley City	6,790	6,689	6,740	10	(101)	-0.15%
Wahpeton (ND/MN) (ND Portion)	8,658	7,834	7,842	8	(824)	-1.00%
Williston	13,054	15,127	17,240	7	2,073	1.48%
Total for Top 10 Population Concentrations	**335,840**	**381,670**	**392,516**	**NA**	**45,830**	**1.29%**
North Dakota (statewide)	**642,200**	**672,591**	**689,781**	**NA**	**30,391**	**0.46%**
Top 10 Total as Percentage of State	**52.3%**	**56.7%**	**56.9%**	**NA**	**150.8%**	**NA**

Sources: (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015c)
AARC = Average Annual Rate of Change (compound growth rate)

13.1.9.4. Economic Activity, Housing, Property Values, and Government Revenues

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

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

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 13.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 13.1.9-5 compares several economic indicators for North Dakota to the Central region and the nation. The table presents two indicators of income[108] – 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 13.1.9-5, the per capita income in North Dakota in 2013 ($30,855) was $3,327 higher than that of the region ($27,528), and $2,671 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 13.1.9-5 shows that in 2013, the MHI in North Dakota ($56,800) was $4,755 higher than that of the region ($52,045), and $4,550 higher than that of the nation ($52,250).

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

Table 13.1.9-5 compares the unemployment rate in North Dakota to the Central region and the nation. In 2014, North Dakota's statewide unemployment rate of 2.8 percent was considerably lower (approximately half) than the rate for the region (5.7 percent) and the rate for the nation (6.2 percent).[109]

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

[109] Unemployment rates can change quarterly.

Table 13.1.9-5: Selected Economic Indicators for North Dakota

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
North Dakota	$30,855	$56,800	2.8%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

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

Figure 13.1.9-2 and Figure 13.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015j) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 13.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015h). Following these two maps, Table 13.1.9-6 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 North Dakota.

Figure 13.1.9-2 shows that the majority of counties in the western portion of North Dakota have a MHI above the national median, with a few exceptions in the southern region of the state. The majority of the counties in the east-central portion of the state have a MHI below the national median, with exceptions including counties around the Fargo and Wahpeton areas (North Dakota portion). Table 13.1.9-6 shows that MHI in the 10 largest population concentrations in North Dakota ranged from $40,631 in the Devils Lake area to $75,766 in the Williston area, compared to the state average of $53,741.

Figure 13.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that the majority of counties had unemployment rates below the national average (that is, better employment performance). Only two counties in the north of North Dakota had unemployment rates above the national average. Table 13.1.9-6 is consistent with this observation. When comparing unemployment in the population concentrations to the state average, most areas had a 2009–2013 unemployment rate that was similar or lower than the state average (3.3 percent). Unemployment was highest in the North Dakota portion of the Grand Forks area (4.7 percent).

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 13.1.9-7 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 lower in North Dakota than in the Central region and the nation. The percentages of government workers and self-employed workers were higher in the state than in the region and nation.

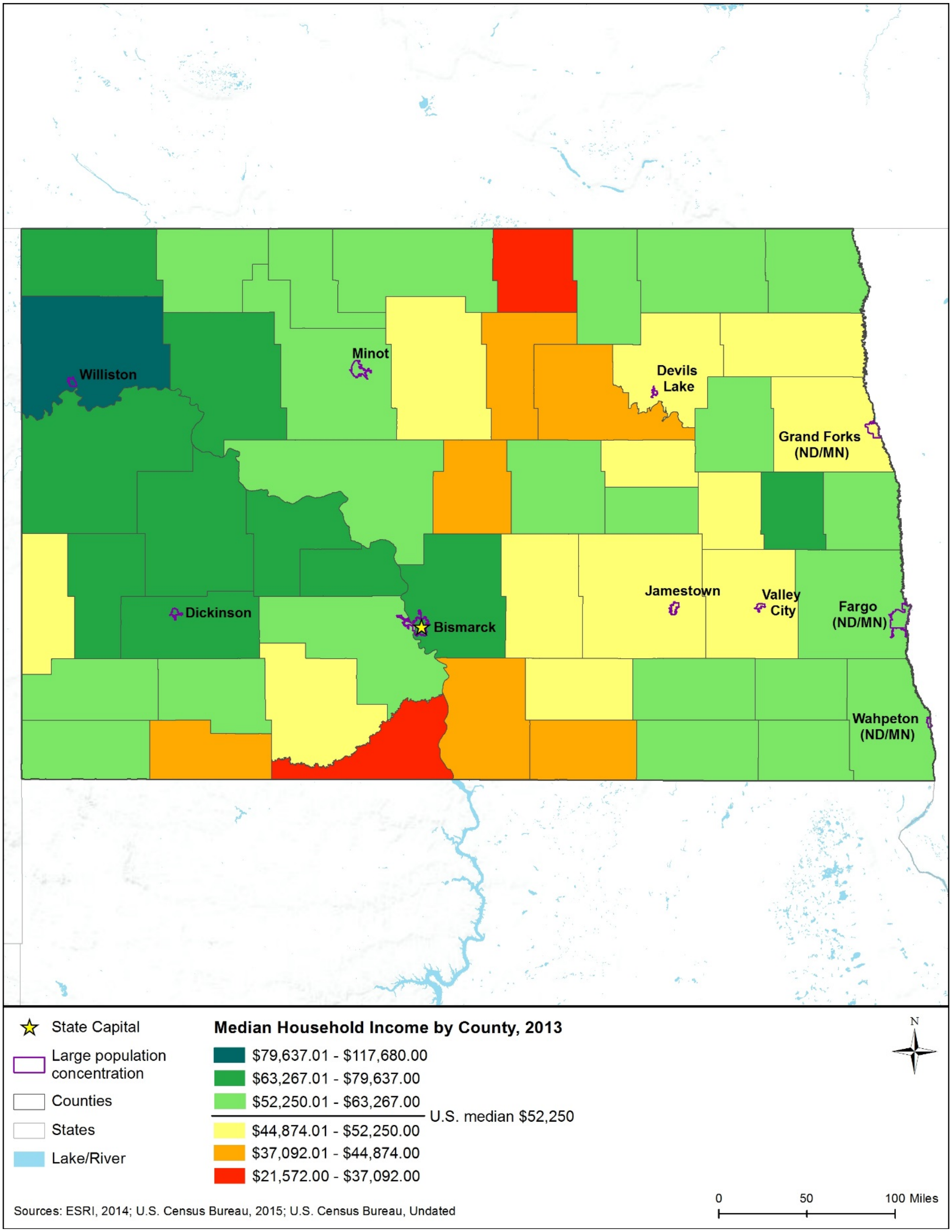


Figure 13.1.9-2: Median Household Income in North Dakota, by County, 2013

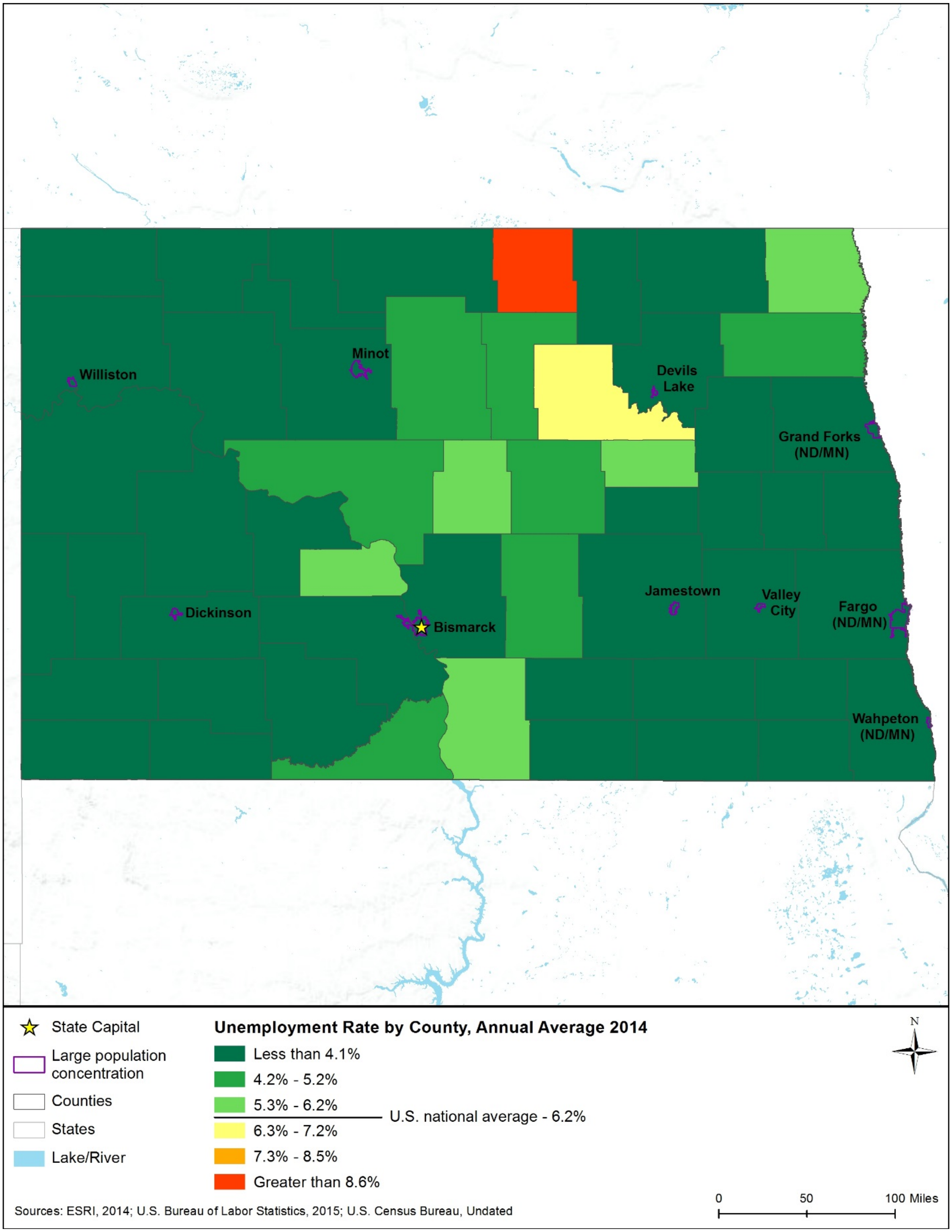


Figure 13.1.9-3: Unemployment Rates in North Dakota, by County, 2014

Table 13.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in North Dakota, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Bismarck	$56,448	2.6%
Devils Lake	$40,631	2.2%
Dickinson	$61,411	2.6%
Fargo (ND/MN) (ND Portion)	$50,058	4.2%
Grand Forks (ND/MN) (ND Portion)	$43,559	4.7%
Jamestown	$47,638	3.0%
Minot	$54,304	3.0%
Valley City	$47,023	1.2%
Wahpeton (ND/MN) (ND Portion)	$46,958	4.4%
Williston	$75,766	0.8%
North Dakota (statewide)	$53,741	3.3%

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

Table 13.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	North Dakota	Central Region	United States
Civilian Employed Population 16 Years and Over	390,647	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	75.6%	81.7%	79.7%
Government workers	16.1%	12.8%	14.1%
Self-employed in own not incorporated business workers	7.9%	5.3%	6.0%
Unpaid family workers	0.4%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	9.0%	2.2%	2.0%
Construction	8.0%	5.6%	6.2%
Manufacturing	7.1%	14.0%	10.5%
Wholesale trade	3.3%	2.7%	2.7%
Retail trade	11.5%	11.5%	11.6%
Transportation and warehousing, and utilities	5.4%	4.9%	4.9%
Information	1.4%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	5.9%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	6.6%	9.7%	11.1%
Educational services, and health care and social assistance	24.7%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	7.7%	9.1%	9.7%
Other services, except public administration	4.7%	4.6%	5.0%
Public administration	4.8%	3.9%	4.7%

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

By industry, North Dakota has a mixed economic base and some notable figures in the table are as follows. North Dakota in 2013 had considerably lower percentages of persons working in "manufacturing" and "professional, scientific, management, administrative, and waste management services" than did the region or the nation. It had a considerably higher percentage of workers in "agriculture, forestry, fishing and hunting, and mining" than the region or nation. It also had a higher percentage in "construction" than the region or nation.

Table 13.1.9-8 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 13.1.9-7 for 2013.

Table 13.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in North Dakota, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Bismarck	7.7%	6.2%	1.9%	9.1%
Devils Lake	5.4%	4.5%	2.9%	2.6%
Dickinson	7.0%	5.4%	1.1%	7.5%
Fargo (ND/MN) (ND Portion)	6.8%	3.8%	2.0%	8.7%
Grand Forks (ND/MN) (ND Portion)	6.0%	4.0%	1.5%	6.2%
Jamestown	5.3%	5.2%	1.8%	6.2%
Minot	9.3%	4.9%	1.7%	6.1%
Valley City	6.2%	4.6%	0.5%	5.4%
Wahpeton (ND/MN) (ND Portion)	5.6%	3.7%	1.2%	2.7%
Williston	9.9%	7.0%	0.4%	7.3%
North Dakota (statewide)	7.4%	5.4%	1.5%	6.4%

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

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 13.1.9-9 compares North Dakota to the Central region and nation on several common housing indicators.

As shown in Table 13.1.9-9, in 2013 North Dakota had a slightly lower percentage of housing units that were occupied (87.9 percent) than the region (88.4 percent) and similar to that of the nation (87.6 percent). Of the occupied units, North Dakota had a slightly lower percentage of owner-occupied units (64.8 percent) than the region (67.6 percent) and slightly higher than the nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in North Dakota in 2013 was 60.2 percent, lower than both the region (67.7 percent) and the nation (61.5 percent). The homeowner vacancy rate in North Dakota (1.5 percent) was slightly lower than both the rate for the region (1.8 percent) and the nation (1.9 percent). This rate reflects “vacant units that are ‘for sale only’” (U.S. Census Bureau, 2015o). The vacancy rate among rental units was somewhat higher in North Dakota (6.4 percent) than in the region (6.0 percent) and nearly matched the nation’s rate (6.5 percent).

Table 13.1.9-9: Selected Housing Indicators for North Dakota, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
North Dakota	339,293	87.9%	64.8%	1.5%	6.4%	60.2%
Central Region	33,580,411	88.4%	67.6%	1.8%	6.0%	67.7%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

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

Table 13.1.9-10 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 13.1.9-10 shows that during this period the percentage of occupied housing units exceeded the state average of 88.5 percent in all areas, except for the North Dakota portion of the Wahpeton area, and ranged between 87.9 to 95.0 percent across these population concentrations.

Table 13.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in North Dakota, 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
Bismarck	38,371	94.4%	68.0%	1.8%	4.0%	51.8%
Devils Lake	3,502	89.6%	52.9%	4.7%	13.3%	48.6%
Dickinson	8,251	91.8%	67.0%	0.3%	7.0%	61.3%
Fargo (ND/MN) (ND Portion)	62,805	95.0%	50.1%	1.1%	4.7%	40.1%
Grand Forks (ND/MN) (ND Portion)	23,957	93.9%	48.2%	1.6%	7.3%	40.0%
Jamestown	6,991	91.7%	63.1%	1.9%	5.2%	57.7%
Minot	20,563	90.3%	62.0%	2.8%	6.2%	51.1%

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Valley City	3,310	92.9%	59.5%	1.4%	9.7%	58.0%
Wahpeton (ND/MN) (ND Portion)	3,548	87.9%	57.6%	0.0%	12.4%	52.1%
Williston	8,113	90.7%	63.7%	0.9%	2.5%	54.4%
North Dakota (statewide)	324,712	88.5%	66.1%	1.4%	5.9%	61.3%

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

Property Values

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

Table 13.1.9-11 provides indicators of residential property values for North Dakota and compares these values to values for the Central region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015o).

The table shows that the median value of owner-occupied units in North Dakota in 2013 ($155,400) was slightly higher than the corresponding value for the Central region ($151,200) and lower than the nation's value ($173,900).

Table 13.1.9-11: Residential Property Values in North Dakota, 2013

Geography	Median Value of Owner-Occupied Units
North Dakota	$155,400
Central Region	$151,200
United States	$173,900

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

Table 13.1.9-12 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. The median property value in the top 10 population concentrations ranged from $85,100 (Devils Lake area) to $170,300 (Dickinson area), compared to the state value of $132,400. The lowest value occurred in the area – Devils Lake – that had the lowest median household income (Table 13.1.9-6).

Table 13.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in North Dakota, 2009–2013

Area	Median Value of Owner-Occupied Units
Bismarck	$160,900
Devils Lake	$85,100
Dickinson	$170,300
Fargo (ND/MN) (ND Portion)	$158,300
Grand Forks (ND/MN) (ND Portion)	$155,900
Jamestown	$98,500
Minot	$153,300
Valley City	$88,300
Wahpeton (ND/MN) (ND Portion)	$107,400
Williston	$147,300
North Dakota (statewide)	$132,400

Source: (U.S. 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 are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and Internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 13.1.9-13 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 figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure. General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 13.1.9-13 shows that the state government in North Dakota received more total revenue (more than double) in 2012 on a per capita basis than its counterpart governments in the region and nation. Local governments in North Dakota received more revenue than their regional counterparts and slightly less than their counterparts in the nation. Additionally, North Dakota state and local governments had higher levels per capita of intergovernmental revenues[110] from

[110] Intergovernmental revenues are those revenues received by one level of government from another level of government, such as shared taxes, grants, or loans and advances (U.S. Census Bureau, 2006).

the federal government. The state government in North Dakota obtained very little revenue per capita from property taxes. Local governments in North Dakota obtained higher levels of property taxes per capita than local governments in the region and slightly lower levels than their counterparts in the nation. North Dakota state and local governments reported higher revenue from general sales taxes than their counterparts in the region and nation. The North Dakota state government reported higher revenue per capita from selective sales taxes, and public utility taxes specifically, than its counterparts in the region and nation. Local governments in North Dakota reported similar levels of per capita general sales taxes and public utility taxes revenues to those reported by local governments in the region, and lower levels than their counterparts in the nation. The North Dakota state government reported lower levels of individual income tax revenues (on a per capita basis) than its counterparts in the region and nation. The state government in North Dakota reported higher levels of corporate income tax revenues, on a per capita basis, than its counterparts in the region and nation. Local governments in North Dakota did not report any individual or corporate income tax revenues.

Table 13.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		North Dakota		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$9,246	$3,421	$463,192	$231,980	$1,907,027	$1,615,194
	Per capita	$13,216	$4,889	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal	($M)	$1,750	$223	$125,394	$9,383	$514,139	$70,360
	Per capita	$2,502	$318	$1,630	$122	$1,638	$224
Intergovernmental from State	($M)	$0	$1,327	$0	$76,288	$0	$469,147
	Per capita	$0	$1,896	$0	$992	$0	$1,495
Intergovernmental from Local	($M)	$47	$0	$2,721	$0	$19,518	$0
	Per capita	$67	$0	$35	$0	$62	$0
Property Taxes	($M)	$2	$790	$3,626	$61,015	$13,111	$432,989
	Per capita	$3	$1,129	$47	$793	$42	$1,379
General Sales Taxes	($M)	$1,123	$159	$58,236	$6,920	$245,446	$69,350
	Per capita	$1,605	$228	$757	$90	$782	$221
Selective Sales Taxes	($M)	$472	$22	$33,313	$2,191	$133,098	$28,553
	Per capita	$674	$31	$433	$28	$424	$91
Public Utilities Taxes	($M)	$40	$10	$3,627	$1,153	$14,564	$14,105
	Per capita	$58	$14	$47	$15	$46	$45
Individual Income Taxes	($M)	$433	$0	$72,545	$5,148	$280,693	$26,642
	Per capita	$618	$0	$943	$67	$894	$85
Corporate Income Taxes	($M)	$216	$0	$9,649	$310	$41,821	$7,210
	Per capita	$308	$0	$125	$4	$133	$23

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

13.1.10. Environmental Justice

13.1.10.1. Definition of the Resource

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 1.8.11). The fundamental principle of environmental justice 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" (USEPA, 2016b). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (U.S. Department of Commerce, 2013).

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

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

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

13.1.10.2. Specific Regulatory Considerations

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

13.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 13.1.10-1 presents 2013 data on the composition of North Dakota's estimated population by race and by Hispanic origin. The state's estimated population has considerably lower percentages of individuals who identify as Black / African American (1.5 percent), Asian (1.3

percent), or Some Other Race (0.6 percent) than the estimated populations of the Central region and the nation. Those percentages are, for Black / African American, 9.3 percent for the Central region and 12.6 percent for the nation; for Asian, 2.8 percent and 5.1 percent respectively; and for Some Other Race, 2.4 percent and 4.7 percent respectively. North Dakota has a considerably higher percentage of individuals who identify as American Indian/ Alaska Native (5.6 percent) than does the region (0.7 percent) or the nation (0.8 percent). The state's estimated population of persons identifying as White (89.0 percent) is larger than that of the Central region (82.2 percent) or the nation (73.7 percent).

The percentage of the estimated population in North Dakota that identifies as Hispanic (2.4 percent) is considerably smaller than in the Central region (8.5 percent) and in the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

Table 13.1.10-1: Estimated Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities [111]
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
North Dakota	723,393	89.0%	1.5%	5.6%	1.3%	0.1%	0.6%	2.0%	2.4%	12.6%
Central Region	77,314,952	82.2%	9.3%	0.7%	2.8%	0.1%	2.4%	2.5%	8.5%	23.3%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

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

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. North Dakota's All Minorities estimated population percentage (12.6 percent) is considerably lower than both the region and the nation, nearly half when compared to the population in the Central region (23.3 percent) and about a third when compared to the nation's value (37.6 percent).

Table 13.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The figure for North Dakota (11.8 percent) is lower than the figures for both the Central region (14.7 percent) and the nation (15.8 percent).

[111] "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 13.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
North Dakota	11.8%
Central Region	14.7%
United States	15.8%

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

13.1.10.4. 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 13.1.9-2 visually portrays the results of the environmental justice population screening analysis for North Dakota. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x; U.S. Census Bureau, 2015y) and Census Bureau urban classification data (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015z).

Figure 13.1.9-2 shows that North Dakota has many areas with high and moderate potential for environmental justice populations. The distribution of both the high and moderate potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations.

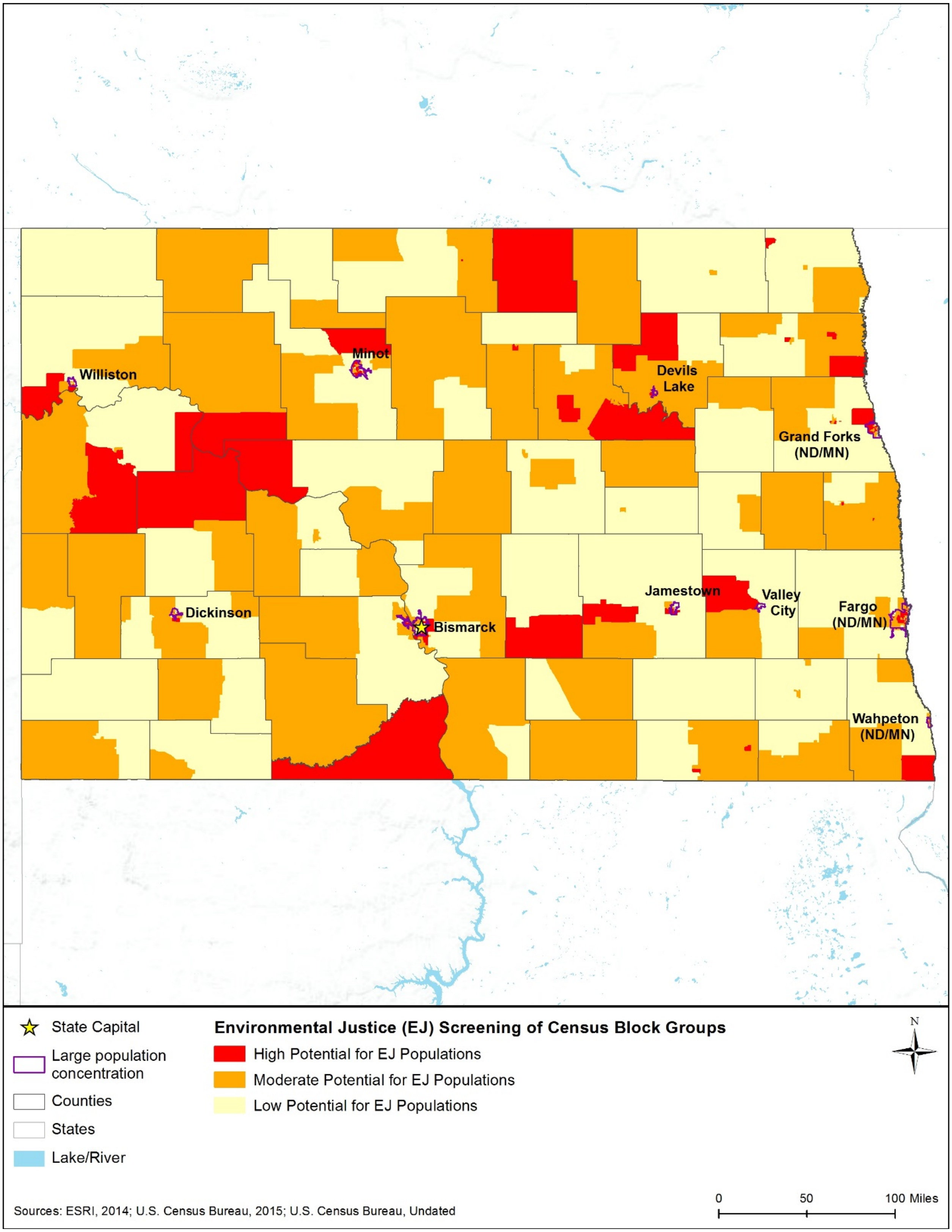


Figure 13.1.10-1: Potential for Environmental Justice Populations in North Dakota, 2009–2013

It is important to understand how these data behind Figure 13.1.9-2 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 13.1.9-2 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). The Environmental Consequences section (Section 13.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

13.1.11. Cultural Resources

13.1.11.1. 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 National Register of Historic Places (NRHP).

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

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2016c); 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).

13.1.11.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 1.8, Overview of the Relevant Federal Laws and Executive Orders), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

North Dakota has state regulations that are similar to the NHPA (refer to Table 13.1.11-1). However, federal regulations supersede these 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 13.1.11-1: Relevant North Dakota Cultural Resources Laws and Regulations

State Law / Regulation	Agency	Applicability
North Dakota Century Code 55-02-07	North Dakota State Historic Preservation Office (SHPO)	This Regulation mirrors the NHPA for actions on state or local government owned land, requiring agencies to consult with SHPO regarding potential impacts to historic properties.

13.1.11.3. Cultural Setting

Human beings have inhabited North Dakota for some 12,000 years (Haynes, Johnson, & Stafford, 1999; Pauketat, 2012; Davis, 2010). The majority of North Dakota's early human habitation evidence comes from the study of archeological sites of pre-European contact and historic populations. In addition to the hundreds of archaeological sites listed in the state's inventory, there are 23 archaeological site listed on the NRHP (NPS, 2016d).

Archaeologists typically divide large study areas into regions. As shown in Figure 13.1.8-1, North Dakota occupies the Interior Plains Region. The Interior Plains are further divided into the Central Lowland and Great Plains Physiographic Provinces.

Archaeological sites "provide important scientific information about where people lived, the resources they utilized, the technology used, and lifeway changes through time." Evidence at most archeological sites in North Dakota are in relatively shallow deposits that are located either on the surface or within one to two feet of the surface. However, in some cases, natural factors have buried sites beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. These deposits can range between 1 and 10 feet below the current surface, with older sites in the deeper sediments. Disturbed ground, including urban areas, may contain archaeological resources in deeper or shallower strata than undisturbed areas (North Dakota Archaeological Association, 2015).

The following sections provide additional detail about North Dakota's prehistoric periods (approximately 9500 B.C. – A.D. 1600) and the historic period since European contact in the 1600s. Section 13.1.11.4 presents an overview of the initial human habitation in North Dakota and the cultural development that occurred before European contact. Section 13.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 13.1.11.6 provides a current list of significant archaeological sites in North Dakota and tools that the state has developed to ensure their preservation. Section 13.1.11.7 document the historic context of the state since European contact, and Section 13.1.11.8 summarizes the architectural context of the state during the historic period.

13.1.11.4. Prehistoric Setting

Archaeologists divide North Dakota's prehistoric past into four periods: The Paleoindian Period (9500 - 5500 B.C.), Archaic Period (5500 - 400 B.C.), Plains Woodland Period (400 B.C. - A.D. 1200), and the Plains Village Period (A.D. 1200 - 1600) (State Historical Society of North Dakota, 2015c). Figure 13.1.11-1 shows a timeline representing these periods of early human habitation of present day North Dakota. It is important to note that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation is prevalent in each of North Dakota's physiographic regions. Due to advancements in techniques and associating artifacts discovered with similar ones previously assigned to a particular range of the archaeological record, the periods associated with a particular time in North American human development continue to become increasingly accurate (Pauketat, 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes, Johnson, & Stafford, 1999; State Historical Society of North Dakota, 2015c; North Dakota Archaeological Association, 2015).

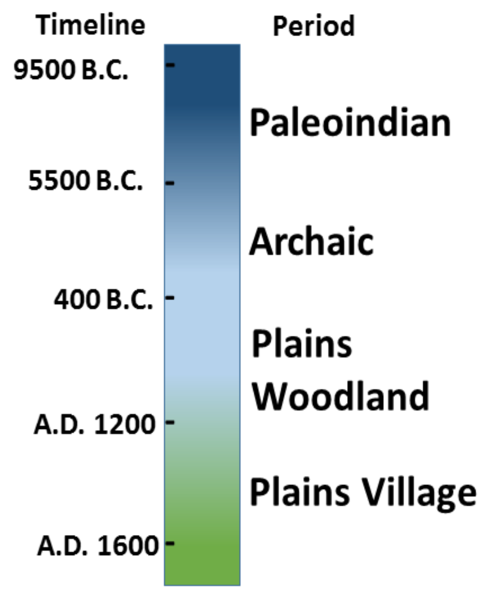


Figure 13.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Institute of Maritime History, 2015; State Historical Society of North Dakota, 2015c)

Paleoindian (9500 - 5500 B.C.)

The Paleoindian Period represents the earliest human habitation North Dakota. 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. Studies show that that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain, prior to human arrival into North America (Charpentier & Inizan, 2002).

Most of the oldest known evidence of human settlement in North Dakota is from the discovery of fluted points found in surface and shallow deposits throughout the state. Archaeologists hypothesize that the people of this period ranged across the state in small bands that followed migratory game such as mammoth, giant bison, and other large game. Early Paleoindian settlers used the Clovis fluted point technology to hunt this large game. These bands established seasonal camps, some of which likely became permanent settlements. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch) (Gregg, Picha, Swenson, & Bleier, 2008).

Around 10,000 to 7,000 years ago, there was a gradual warming trend in this region, and the Folsom culture replaced the Clovis culture. The Folsom culture had more advanced methods for hunting bison, which lead to overhunting in the region. As hypothesized, the sophisticated hunting methods along with the climatological changes that were occurring at the time may have led to the distinction of the gradual extinction of the mammoth and other large animals (Gregg, Picha, Swenson, & Bleier, 2008).

Archaic Period (5500 - 400 B.C.)

The Archaic Period in North Dakota, also referred to as the "Plains Archaic" was experiencing a warming trend and the animal and plant life in the region were more diverse. Several sites in North Dakota provide evidence of the habitation of people in this region. The Logan Creek-Mummy Cave and Oxbow complexes represent the early archaic; McKean Lanceolate and Duncan sites are part of the Middle Archaic; and Hanna, Yonkee, Pelican Lake complexes are examples of the Late Archaic periods (Gregg, Picha, Swenson, & Bleier, 2008).

During the Archaic, the manufacturing of tools became more sophisticated and much more diversified than in the Paleoindian Period. Much of what we know today about tool manufacturing during this period come from studies that have been conducted in the northeastern plains of North Dakota. Knife River flint resources were used to develop tools throughout the Paleoindian, Archaic and into the Woodlands periods (Gregg, 1987). Plains Archaic people were mainly hunters and gathers exploiting whatever types of food they could catch or harvest (Gregg, Picha, Swenson, & Bleier, 2008). The people of this period sought out places close to woodland or places of higher elevation for foraging and shelter. They tended not to occupy areas close to wetlands, where the land is far less inhabitable (Dooley, 2004).

Plains Woodland Period (400 B.C. - A.D. 1200)

During the Plains Woodland Period, subsistence patterns included a combination of agriculture and hunting and gathering. The patterns of subsistence were much like those of the greater Northeastern Plains of North America. Mound building was prevalent throughout North Dakota as through the northeastern plains. People buried their deceased in these large earthen mounds, which were very labor intensive to construct. The use of ceramic pottery was an indication that people were becoming more sedentary during this period. Many of the vessels were used for ceremonial purposes, and is evidence of a technological advancing culture (State Historical Society of North Dakota, 2015c; Gregg, Picha, Swenson, & Bleier, 2008).

The Naze archaeological site is the first Plains Woodland site found in North Dakota, and is an example of a dwelling structure site. Burned daub, burned earth, charred post fragments, post molds, charcoal smears, and other artifacts found are evidence of the house from this period. The posts from the Naze site served as the center structure for the dwelling (Gregg, 1990). Cord-roughed pottery found at two separate sites in Souris Basin, North Dakota, provide evidence that the Plains Woodland people were more widespread throughout the state than was previously recognized. The area contained a dense population of closely related groups of people, as the variations in the pottery types suggest (Wood, 1962). Two complete vessels discovered in the northern plains are housed among the collections of the North Dakota State Historical Society. The Sydna vessel is a variation of other found in this region and was found in the Nelson Mounds in Sydna, North Dakota. The Crosby vessel was found along the east side of Long Creek near Crosby, North Dakota. (Wood, 1959)

Plains Village (A.D. 1200 - 1600)

Farming became the primary method of subsistence during this period. There is a wealth of evidence of this activity-taking place, including hoes made out of bison shoulder bones (scapula hoes) used for tilling the soil. The making and use of pottery is evince that the people were processing and cooking food. Pits were built in the floors of the lodges (homes) for storing food for later consumption, much as we store food in our pantries today. Hunting and fishing were being practiced and the use of the bow and arrow continued throughout the period. They made bone hooks for fishing in the streams and rivers, as fish became a more important part of the diet (Toom, 2004; Wood, 1974).

North Dakota State Cultural Resources Database and Tools

North Dakota State Historic Preservation Office (SHPO)

The North Dakota State Historic Preservation Office is an excellent resource for users looking for information on regional history. The SHPO website contains several resources including preservation news, publications, museum information, and a free online exhibit titled, "People of the Upper Missouri." Users may also obtain information on and the forms necessary for gaining access to the state's archaeological collections (State Historical Society of North Dakota, 2015c).

North Dakota Archaeological Association (NDAA)

The North Dakota Archaeological Association is a non-profit organization open to the public for those interested in preserving and promoting regional archaeology. The NDAA website provides users with preservation news, an event calendar, and information on purchasing the Association journal, *North Dakota Archaeology*. The association also runs a library-lending program, which allows members to borrow items from the NDAA Library for two weeks at a time. Requests forms are available for download through their website (NDPRD, 2015c).

13.1.11.5. Federally Recognized Tribes of North Dakota

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are five federally recognized tribes in North Dakota: the Spirit Lake Tribe, the Standing Rock Sioux Tribe, the Sisseton Wahpeton Oyate of the Lake Traverse Reservation, the Three Affiliated Tribes of the Fort Berthold Reservation (Mandan, Hidatsa and Arikara Nation) and the Turtle Mountain Band of Chippewa Indians of North Dakota (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015). The location of federally recognized tribes are shown in Figure 13.1.11-2. There are several other tribes depicted on the figure below that once lived in North Dakota, but do not retain federal reservation or trust lands here any longer.

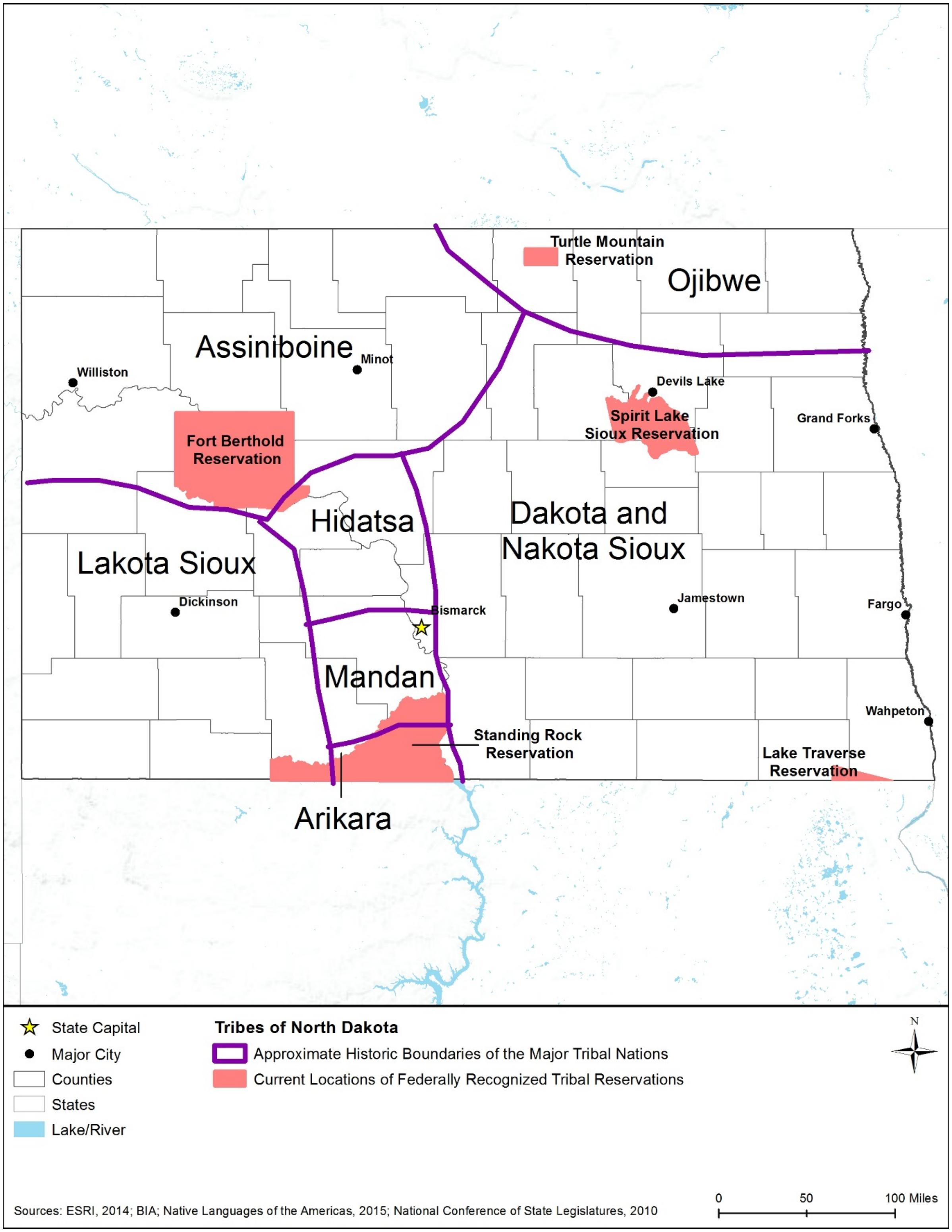


Figure 13.1.11-2: Approximate Historic Boundaries of Tribes in North Dakota

13.1.11.6. Significant Archaeological Sites of North Dakota

As previously mentioned in Section 13.1.11.3 there are 23 archaeological sites in North Dakota listed on the NRHP. Table 13.1.11-2 lists 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 are listed on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2014f).

Table 13.1.11-2: Archaeological Sites on the National Register of Historic Places in North Dakota

Location (Closest city)	Site Name	Type of Site
Abercrombie	Fort Abercrombie	Historic, Military
Bismarck	Camp Hancock Site	Military
Bismarck	Chief Looking's Village site (32BL3)	Prehistoric
Bismarck	Double Ditch State Historic Site	Historic - Aboriginal, Prehistoric
Buford	Fort Union Trading Post National Historic Site	Historic
Embden	Shea Site	Prehistoric
Enderlin	Sprunk Site (32CS04478)	Prehistoric
Heil	Medicine Rock State Historic Site	Prehistoric
Hensler	Cross Ranch Archeological District	Historic, Historic - Aboriginal, Prehistoric
Huff	Huff State Historic Site (32MO11)	Prehistoric
Kensington	Ridge Trail Historic District	Historic, Historic - Aboriginal
Kulm	White Stone Hill	Historic - Aboriginal, Military
Lisbon	Biesterfeldt Site (32RM1)	Historic - Aboriginal
Medora	Custer Military Trail Historic Archeological District	Historic, Military
Medora	Myers School Timbered Lodge (32BI401)	Historic - Aboriginal
Menoken	Menoken Indian Village Site	Prehistoric
Mooreton	Frederick A. and Sophia Bagg Bonanza Farm	Historic
New Town	Evans Site	Historic - Aboriginal, Prehistoric
Redacted	Lynch Quarry Site	Prehistoric
Rhame	Fort Dilts	Military
Riverdale	High Butte Effigy and Village Site (32ME13)	Prehistoric
Stanton	Big Hidatsa Village Site	Historic - Aboriginal
Stanton	Fort Clark Archeological District	Historic, Historic - Aboriginal
Stanton	Knife River Indian Villages National Historic Site Archeological District	Historic - Aboriginal, Prehistoric

Source: (NPS, 2014f)

13.1.11.7. Historic Context

Prior to the 19th century, control of present-day North Dakota fluctuated among France, England, and Spain, as fur trappers were interested in exploiting the area's natural resources. The first known European explorer, the French Canadian, Pierre Gaultier de Varennes, Sieur de La Verendrye, came to North Dakota in 1738. In 1803, most of present-day North Dakota was acquired by the United States as a part of the Louisiana Purchase, and the land was explored and mapped by Lewis and Clark's expedition (1804 to 1806). Trading posts and forts were established to facilitate trade with the indigenous populations, with whom relations were generally good. Fort Union and Fort Clark are two examples located along the Missouri River. The Missouri River served as a major thoroughfare within the region for many years (State Historical Society of North Dakota, 2015d).

During the second half of the 19th century, increasing settlement led to conflict between the U.S. military and the remaining Indian tribes. Numerous forts were established, and Indians were either driven from the area or onto reservations (State Historical Society of North Dakota, 2015e). The Dakota Territory, which included much more than just present-day North Dakota, became an official territory in 1861, with settlement increasing significantly afterwards. The arrival of rail travel aided settlement, as did the Homesteading Act of 1862, and "the first claim west of the Red River was filed in 1868" (State Historical Society of North Dakota, 2015f). Railroad towns served travelers and pioneers, with Bismarck and Fargo being examples that flourished (State Historical Society of North Dakota, 2015f). Many other railroad towns failed to grow as expected and became ghost towns (Martens & Ramsay, 2015).

Settlement increased during the last quarter of the 19th century, with another spike in the early 20th century. Wheat farming was popular and "bonanza farms" were common. These were massive farms meant to grow a large amount of grain. Immigrants made up the majority of the population, and "were…of Scandinavian or Germanic origin. Norwegians were the largest single ethnic group, and after 1885 many Germans immigrated from enclaves in the Russian Ukraine" (State Historical Society of North Dakota, 2015f). Other ethnic groups were also common, with building tradition being affected by the immigrant population (State Historical Society of North Dakota, 2015f). On November 2, 1889, North Dakota became the 39th state to join the Union. Mining, brickmaking, and flour mills were popular, as was large-scale agriculture, with railroad money and political power continuing to influence development (State Historical Society of North Dakota, 2015g).

Political fighting in the state was fierce between social reformers and corporate interests. The Nonpartisan League, a progressive movement with socialist tendencies, gained significant popularity. Following World War I (WWI), grain prices dropped, causing an economic decline that resulted in the closure of banks in the early 1920s. At the same time, road construction expanded as automobiles began to supplant rail dominance (State Historical Society of North Dakota, 2015h). The Great Depression increased resettlement in cities, as dropping farm prices caused farmers to relocate. "Federal relief programs improved highways, state parks, and city services throughout the state" (State Historical Society of North Dakota, 2015i). Public schools reorganized as rural schools were centralized (State Historical Society of North Dakota, 2015i).

During World War II (WWII), North Dakota's economy was revitalized and continued to do well into the post-WWII period. Oil was found in 1951, and lignite coal continued to be mined. Air Force facilities were constructed in North Dakota, coinciding with an increase in passenger air travel, an increase in road construction, and a continuing decrease in the importance of railroads (State Historical Society of North Dakota, 2015j). As the 20th century has progressed, the agriculture and energy industries have declined, resulting in more attention being paid to recreation and heritage tourism (State Historical Society of North Dakota, 2015k).

North Dakota has 441 NRHP listed sites, as well as 6 NHLs (NPS, 2015g). North Dakota contains one National Heritage Area, the Northern Plains National Heritage Area, which is located roughly in the center of the state (NPS, 2015g). Figure 13.1.11-3 shows the location of the NHA and NRHP sites within the state of North Dakota.[112]

13.1.11.8. Architectural Context

Early buildings in North Dakota were generally utilitarian, meant to protect settlers from the harsh environment. Indigenous architecture consisted of earthen dwellings with earthen roofs, some of which have been reconstructed as historical attractions. Immigrants from Eastern Europe built similar structures, modifying them when necessary with traits from their own cultures. Showy behaviors were frowned upon, particularly among Norwegians and other Scandinavian immigrants, so modest dugouts, log structures, or sod houses remained common. Earthen or log buildings were sometimes covered with wood siding as materials became more available with the arrival of the railroad. The Ludwig and Christina Welk House, which dates to the late 19th century, is an example of an earth building that has been sided with wood (Martens & Ramsay, 2015).

For much of the 19th century, buildings in North Dakota remained sparse, consisting of trading posts such as the Gingras Fur Trading Post (reconstructed), built by a fur trader of mixed Indian and French heritage (State Historical Society of North Dakota, 2015l).[113] Forts were also common, and served as a means of protection for settlers and as places of interaction with the indigenous population. Fort Abercrombie is an important example that has been reconstructed and is now interpreted for the public. As settlement progressed, buildings were constructed with a greater degree of architectural detailing. Sandstone was used, as were fieldstones, with granite being common. Episcopal churches were constructed of fieldstones during the late 19th century, and the style was brought back during the public works projects of the Great Depression (Martens & Ramsay, 2015).

[112] See Section 13.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.
[113] Settlers of mixed Indian and French heritage were known as Métis.

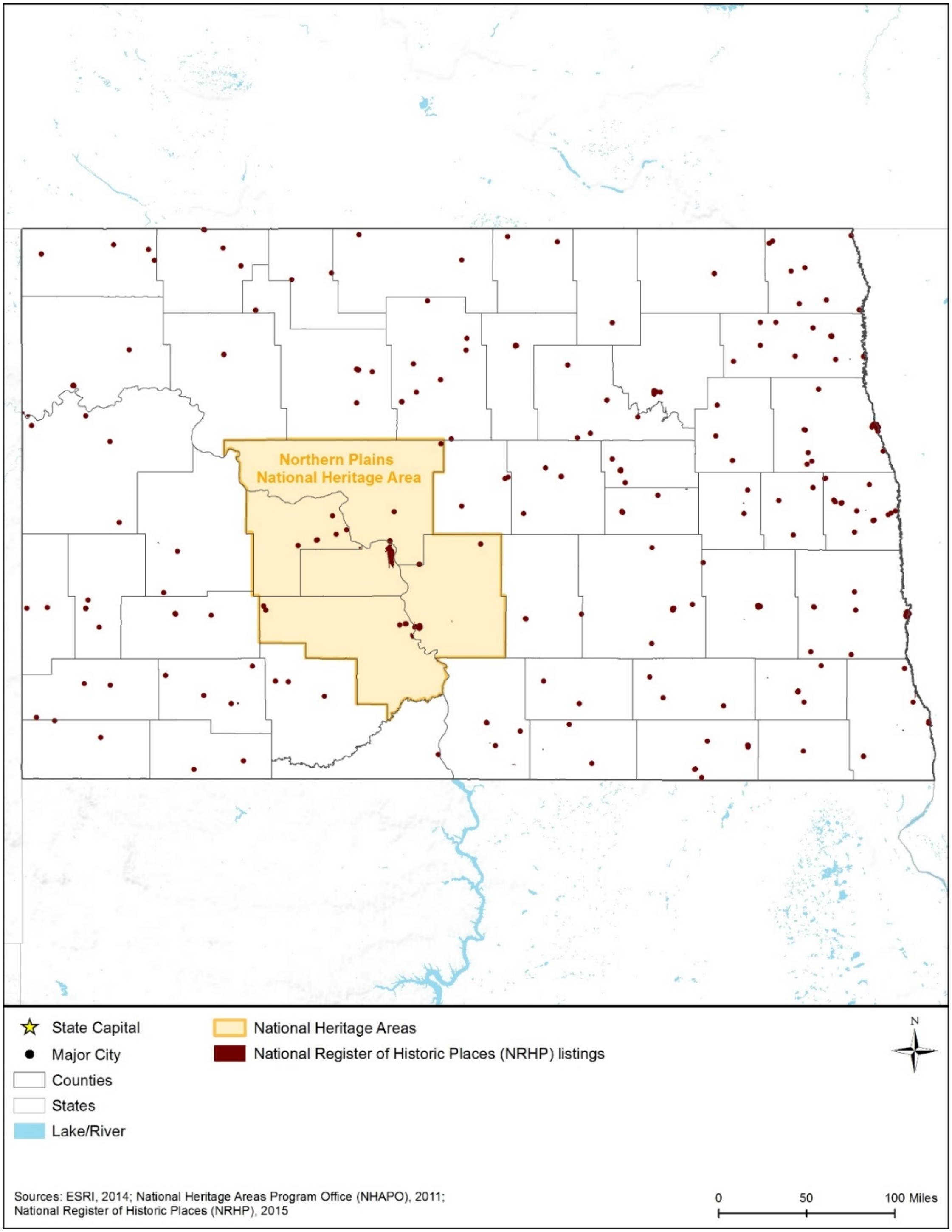


Figure 13.1.11-3: National Heritage Area and National Register of Historic Places Sites in North Dakota[114]

[114] The oddly shaped polygons in this figure are artifacts of available data of NRHP district listings. The accuracy of the location data for these resources varies, resulting in variations in the appearance of each resource.

As the railroad brought increased population, speculative buildings were constructed in a variety of late 19th and early 20th century styles in an attempt to lure settlers to the region (Martens & Ramsay, 2015). As the Northern Pacific and Great Northern railroads vied for dominance in North Dakota, towns were laid out along lines, with hotels, commercial buildings, and schools being established (NRHP, 2016). The population never reached predicted heights, and many of these settlements failed to grow into a lasting communities. Many are now typified by abandoned buildings with poor external access (Martens & Ramsay, 2015). This history is linked closely to the failure of bonanza farms, which worsened the problem as indebted farmers lost their land holdings and left for established urban areas. Architecture associated with bonanza farms is characterized by a variety of working buildings, including housing for farm hands (often one to one-and-a-half stories in height with dormers), livestock barns, and circular silos to hold wheat (NRHP, 1990).

North Dakota has a large collection of civic and institutional buildings, such as schools, courthouses, and jails. Many smaller schools were consolidated during the early 20th century, and a series of grand Beaux-Arts courthouses were built during the first two decades of the 20th century. North Dakota's commitment to public institutional buildings, such as its 13 places of higher education, exemplify the state's history as a center for socially progressive activity. The state also has a collection of Carnegie Libraries dating to the early 20th century (Martens & Ramsay, 2015).

During the Great Depression, numerous public buildings were constructed by workers employed by a variety of New Deal Programs in early Modern styles such as Art Deco and Art Moderne (NRHP, 2010). In recreational areas, Civilians Conservation Corps (CCC) and Works Progress Administration (WPA) laborers built rustic attractions, with fieldstone construction being common. The Colonial Revival style can be seen in post offices and hospitals from the same era. Following WWII, International style and Midcentury buildings were constructed, often in a minimal way that was in keeping with the state's history of sparsely ornamented buildings (Martens & Ramsay, 2015). North Dakota also hosts multiple Air Force installations with plain, utilitarian architectural designs (State Historical Society of North Dakota, 2015j).

Figure 13.1.12-4: Representative Architectural Styles of North Dakota

Top Left – Railroad Station (Fargo, ND) – (Rothstein, 1939)
Top Right – Bismarck Bridge (Bismarck, ND) – (Historic American Engineering Record, 1968)
Bottom Left – Sod House (McKenzie County, ND) – (Lee, R., 1937a)
Bottom Center – House of Bakke (Ambrose, ND) – (Lee, R., 1937b)
Bottom Right – Starkweather (Starkweather, ND) – (Vachon, 1940)

13.1.12. Air Quality

13.1.12.1. 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[115] 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)[116] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[117] This section discusses the existing air quality in North Dakota. USEPA designates areas within the United States as attainment,[118]

[115] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[116] Equivalent to 1 milligram per liter (mg/L).
[117] 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, 2015q).
[118] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015r).

nonattainment,[119] maintenance,[120] or unclassifiable[121] 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.

13.1.12.2. 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[122] or secondary,[123] 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 North Dakota Appendix B, Table B-1.

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, 2016c). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. North Dakota Appendix B, Table B-2 presents a list of federally regulated HAPs.

In conjunction with the federal NAAQS, North Dakota maintains its own air quality standards, the North Dakota Ambient Air Quality Standards (NDAAQS). Table 13.1.12-1 presents an overview of the NDAAQS as defined by NDDH, Division of Air Quality regulations, North Dakota Administrative Code (NDAC) Chapter 33-15-02.

[119] 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, 2015r).
[120] 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, 2015r).
[121] 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, 2015r).
[122] 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, 2014d).
[123] 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, 2014d).

Table 13.1.12-1: North Dakota Ambient Air Quality Standards (NDAAQS)

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
H_2S	Maximum Instantaneous	14,000	10	-	-	Maximum instantaneous (ceiling) concentration not to be exceeded.
	1-hour	280	0.2	-	-	Not to be exceeded more than once per month.
	24-hour	140	0.10	-	-	Not to be exceeded more than once per year.
	3-month	28	0.02	-	-	Maximum arithmetic mean concentration averaged over three consecutive months.
CO	8-hour	10,000	9	-	-	Not to be exceeded more than once per year.
	1-hour	40,000	35	-	-	Not to be exceeded more than once per year.
Lead	3 month	0.15	-	-	-	The maximum 3-month mean concentration for a 3-year period, as determined in accordance with 40 CFR 50, Appendix R, cannot exceed 0.15 micrograms per cubic meter.
NO_2	Annual	100	0.053	-	-	Maximum annual arithmetic mean.
	1-hour	188	0.1	-	-	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentration cannot exceed 0.100 parts per million, as determined in accordance with 40 CFR 50, Appendix S.
O_3	8-hour	147	0.075	-	-	The three-year average of the annual fourth-highest daily maximum 8-hour average concentration at an ambient air quality monitoring site cannot exceed 0.075 ppm, as determined in accordance with 40 CFR 50, Appendix P.
PM_{10}	24-hour	150	-	-	-	Number of days per calendar year with a 24-hour average concentration above 150 micrograms per cubic meter, as determined in accordance with 40 CFR 50, Appendix K, not to exceed one.
$PM_{2.5}$	Annual	12	-	-	-	The annual arithmetic mean concentration, as determined in accordance with 40 CFR 50, Appendix N, not to exceed 12.0 micrograms per cubic meter.
	24-hour	35	-	-	-	The 98th percentile 24-hour concentration, as determined in accordance with 40 CFR 50, Appendix N, not to exceed 35 micrograms per cubic meter.
SO_X	1-hour	196	0.075	-	-	The standard is met when the 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentration is less than or equal to 0.075 parts per million, as determined in accordance with 40 CFR 50, Appendix T.
	3-hour	1,309	0.5	-	-	Not to be exceeded more than once per calendar year.
H_2S	Maximum Instantaneous	14,000	10	-	-	Maximum instantaneous (ceiling) concentration not to be exceeded.
	1-hour	280	0.2	-	-	Not to be exceeded more than once per month.
	24-hour	140	0.10	-	-	Not to be exceeded more than once per year.
	3-month	28	0.02	-	-	Maximum arithmetic mean concentration averaged over three consecutive months.
CO	8-hour	10,000	9	-	-	Not to be exceeded more than once per year.
	1-hour	40,000	35	-	-	Not to be exceeded more than once per year.

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		μg/m³	ppm	μg/m³	ppm	
Lead	3 month	0.15	-	-	-	The maximum 3-month mean concentration for a 3-year period, as determined in accordance with 40 CFR 50, Appendix R, cannot exceed 0.15 micrograms per cubic meter.
NO_2	Annual	100	0.053	-	-	Maximum annual arithmetic mean
	1-hour	188	0.1	-	-	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentration cannot exceed 0.100 parts per million, as determined in accordance with 40 CFR 50, Appendix S.
O_3	8-hour	147	0.075	-	-	The three-year average of the annual fourth-highest daily maximum 8-hour average concentration at an ambient air quality monitoring site cannot exceed 0.075 ppm, as determined in accordance with 40 CFR 50, Appendix P.
PM_{10}	24-hour	150	-	-	-	Number of days per calendar year with a 24-hour average concentration above 150 micrograms per cubic meter, as determined in accordance with 40 CFR 50, Appendix K, not to exceed one.
$PM_{2.5}$	Annual	12	-	-	-	The annual arithmetic mean concentration, as determined in accordance with 40 CFR 50, Appendix N, not to exceed 12.0 micrograms per cubic meter.
	24-hour	35	-	-	-	The 98th percentile 24-hour concentration, as determined in accordance with 40 CFR 50, Appendix N, not to exceed 35 micrograms per cubic meter.
SO_X	1-hour	196	0.075	-	-	The standard is met when the 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentration is less than or equal to 0.075 parts per million, as determined in accordance with 40 CFR 50, Appendix T.
	3-hour	1,309	0.5	-	-	Not to be exceeded more than once per calendar year

Source: (North Dakota Department of Health, Division of Air Quality 2014a)

Title V Operating Permits/State Operating Permits

North Dakota has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2016d). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2016d). Section 13-15-14-01 of NDAC regulation describes the applicability of Title V operating permits. North Dakota 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 13.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014a).

Table 13.1.12-2: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014a)

Exempt Activities

The NDDH, Division of Air Quality (DAQ) has three types of Permits to Operate (PTO), Title V, Synthetic Minor, and True Minor/Minor by Rule. The NDDH, Division of Air Quality (DAQ) exempts the following source categories from the PTO under NDAC 33-15-14-16.2.b (Title V PTO, exemptions):

"In the case of nonmajor sources subject to a standard or other requirement under either section 111 [Standards of performance for new stationary sources] or 112 [National emissions standards for hazardous air pollutants] of the Federal Clean Air Act after July 21, 1992, those the administrator of the United States Environmental Protection Agency determines to be exempt from the requirements…" (NDDH, Division of Air Quality, 2013)Sources that are required to obtain a Title V PTO only due to their potential to emit (as detailed in NDAC 33-15-14-06) may apply for a Synthetic Minor PTO. (NDDH, Division of Air Quality, 2013)

The North Dakota's NDAC 33-15-14-03 exempts sources from obtaining a Minor Sources PTO if the following is met:

- Sources that are required to obtain a Title V permit as per section 33-15-14-16 (Title V PTO).
- Sources that are exempt from NDAC 33-15-14-02.13 (Permit to construct, exemptions), see State Preconstruction Permits below for more detailed information on exemptions (NDDH, Division of Air Quality, 2013).

Temporary Emissions Sources Permits

The North Dakota DAQ has the ability to issue 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. No affected source[124] shall be permitted as a temporary source." (NDDH, Division of Air Quality, 2013)

State Preconstruction Permits

The North Dakota DAQ exempts the following source categories from the Permit to Construct (PTC) under NDAC 33-15-14-02.13 (Permit to construct, exemptions):

"A permit to construct is not required for the following stationary sources provided there is no federal requirement for a permit or approval for construction or operation.

[124] Affected source: "A source that includes one or more affected units that are subject to emission reduction requirements or limitations under Chapter 26 [Acid Rain]" (NDEQ, 2015).

- Maintenance, structural changes, or minor repair of process equipment, fuel burning equipment, control equipment, or incinerators which do not change capacity of such process equipment, fuel burning equipment, control equipment, or incinerators and which do not involve any change in the quality, nature, or quantity of emissions therefrom.
- Fossil fuel burning equipment, other than smokehouse generators, which meet all of the following criteria:
  - The heat input per unit does not exceed ten million British thermal units per hour.
  - The total aggregate heat input from all equipment does not exceed ten million British thermal units per hour.
  - The actual emissions, as defined in chapter 33-15-15, from all equipment do not exceed twenty-five tons [22.67 metric tons] per year of any air contaminant and the potential to emit any air contaminant for which an ambient air quality standard has been promulgated in chapter 33-15-02 is less than one hundred tons [90.68 metric tons] per year.
- Any single internal combustion engine with less than five hundred brake horsepower, or multiple engines with a combined brake horsepower rating less than five hundred brake horsepower.
- Any single internal combustion engine with a maximum rating of less than one thousand brake horsepower, or multiple engines with a combined brake horsepower rating of less than one thousand brake horsepower, and which operates a total of five hundred hours or less in a rolling twelve-month period.
- Any internal combustion engine, or multiple engines at the same facility, with a total combined actual emission rate of five tons [4.54 metric tons] per year or less of any air contaminant for which an ambient air quality standard has been promulgated in [NDAC] section 33-15-02-04 [Ambient Air Quality Standards]…
- Portable brazing, soldering, or welding equipment…" (NDDH, Division of Air Quality, 2013)

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, 2013a). 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*[125] levels. These ton per year (TPY) values are the minimum thresholds for which a conformity determination must be

[125] USEPA states that "40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas" (USEPA, 2016).

performed (see Table 13.1.12-3). No North Dakota counties lie in the Ozone Transport Region (OTR).

Table 13.1.12-3: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

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

If an action does not result in an emissions increase above the *de minimis* levels in Table 13.1.12-3, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 13.1.12-3, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[126], the agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;
- Show the emissions would be fully offset by implementing reductions from another source in the same area; and
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2010).

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

State Implementation Plan Requirements

North Dakota is in attainment for all the six criteria pollutants and comply with the NAAQS. North Dakota does have a SIP for regional haze. A copy of the regional haze SIP can be found on the North Dakota DAQ's website (www.ndhealth.gov/aq/).

13.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Currently all of North Dakota is in attainment. No maintenance, or unclassifiable areas exist in North Dakota.

Air Quality Monitoring and Reporting

The NDDH measures air pollutants at eight sites and industry operates eight pollutant monitoring sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual North Dakota State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. North Dakota DAQ reports real-time pollution levels of PM and O_3 on the AirNOW[127] website (www.airnow.gov) to inform the public (NDDH, 2015n).

The North Dakota DAQ only monitors SO_x, NO_x, O_3, and PM. Throughout 2013, there were no exceedances of any monitored pollutant in North Dakota (NDDH, 2014).

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) (42 U.S.C. 7470). These are different from the air quality classification levels defined in Table 13.1.12-1 as part of the NDAAQS. 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 (42 U.S.C. 7470).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (USEPA, 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[128] 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

[127] AirNow is a government website that posts daily Air Quality Index for more than 400 cities.
[128] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.

Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[129] (the normal useful range of USEPA-approved Gaussian plume models (USEPA, 1992)).

North Dakota contains two federal Class I areas and the rest of the land within the state is classified as Class II (USEPA, 2012a). If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Montana does have a Class I area where the 100-kilometer buffer intersects a few North Dakota counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 13.1.12-2 provides a map of North Dakota 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 13.1.12-2 correspond to the numbers and Class I areas listed in Table 13.1.12-4.

Table 13.1.12-4: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Theodore Roosevelt NP	69,675	ND
2	Lostwood Wilderness	5,557	ND
3	Medicine Lake Wilderness	11,366	MT

Source: (USEPA, 2012a)
[a] The numbers correspond to the shaded regions in Figure 13.1.12-2

[129] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

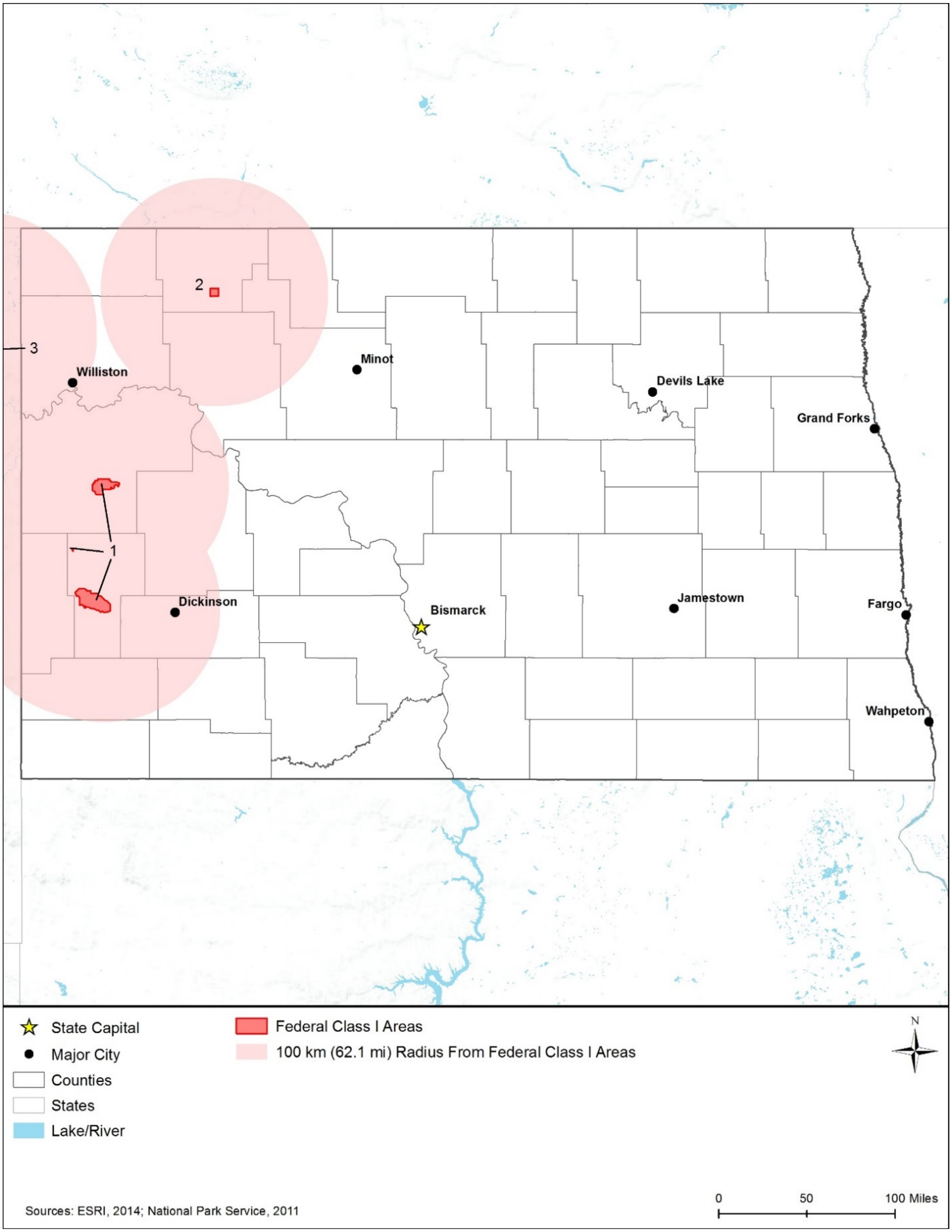


Figure 13.1.12-1: Federal Class I Areas with Implications for North Dakota

13.1.13. Noise

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

13.1.13.1. Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012b). 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") (OSHA, 2016a). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (FTA, 2006). 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, 2016a).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 2006):

- 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 13.1.13-1 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.

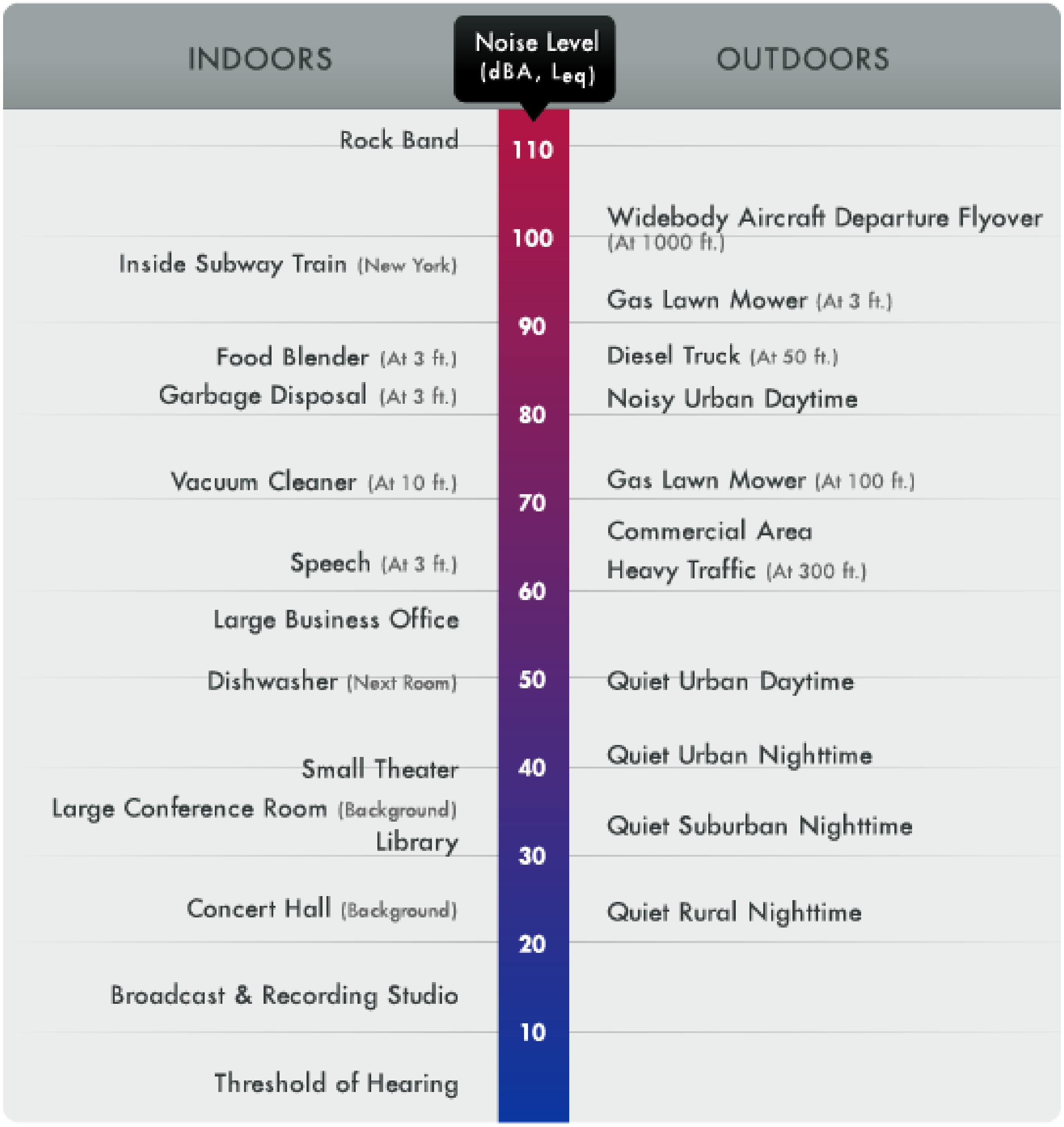


Figure 13.1.13-1: Sound Levels of Typical Sounds

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

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.

13.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, Environmental Laws and Regulations, 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.

North Dakota has several statewide noise regulations written into its current laws as part of the North Dakota Century Code. These laws mainly apply to motor vehicle functions, such as engine running, mufflers, and horns. Table 13.1.13-1 provides a brief summary of these regulations.

Table 13.1.13-1: Relevant North Dakota Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
39-21-18	North Dakota Legislative Assembly	Authorizes a minimum noise limit for sirens from emergency vehicles.
39-21-37	North Dakota Legislative Assembly	Requires the use of a muffler in good working order to prevent unusual noise.

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Fargo and Bismarck, are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011).

13.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in North Dakota varies widely based on the area and environment of the area. The population of North Dakota can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 13.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of North Dakota may experience on a day-to-day basis.

These noise levels represent a wide range and are not specific to North Dakota. As such, this section describes the areas where the population of North Dakota 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 Fargo and Bismarck as the two most populated cities (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015c).
- **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, 2012a). 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 North Dakota, Hector International Airport (FAR) has annual operations of more than 76,000 flights (FAA, 2015g). These operations result in increased ambient noise levels in the surrounding communities. See Section 13.1.1, Infrastructure, and Figure 13.1.1-1 for more information about airports in the state.
- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015e). 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 (FHWA, 2015e). See Section 13.1.1, Infrastructure, and Figure 13.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (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, 2015c). North Dakota has one passenger rail corridor; the North Dakotan section of the Empire Builder extends from Fargo to Grand Forks and Williston (NDDOT, 2007). See Section 13.1.1, Infrastructure, and Figure 13.1.1-1 for more information about rail corridors in the state.
- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas, which are regions that are

given legal safeguards in order to maintain biological diversity and natural resources (NPS, 2013a). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014g). North Dakota has three NPS units (designated as one National Park and two National Historic Sites) and four National Natural Landmarks (NPS, 2015h). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 13.1.8, Visual Resources, and Figure 13.1.8-1 for more information about national and state parks for North Dakota.

13.1.13.4. Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities in North Dakota 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 North Dakota.

13.1.14. Climate Change

13.1.14.1. 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, 2012c). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent[130] (MT CO_2e), 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

[130] 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, 2016a)

(ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 13.2, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; and 3) severe weather events (flooding, strong winds, tornadoes, and blizzards).

13.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. North Dakota has not established goals and regulations to reduce GHG emissions to combat climate change.

13.1.14.3. North Dakota Greenhouse Gas Emissions

Estimates of North Dakota's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as methane (CH_4) and nitrous oxide (NO_x), 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, 2015f). 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 are 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 are described and cited.

According to the EIA, North Dakota emitted a total of 56.6 MMT of CO_2 in 2013 from fossil fuels, with the electric power sector as the highest emitter, accounting for 51 percent of total CO_2 emissions from fossil fuels and almost all of the emissions from coal. The next largest sector is the industrial sector, emitting 28 percent of total CO_2, most of which is from petroleum products and coal, with a small quantity from natural gas (Table 13.1.14-1) (EIA, 2015c). Annual emissions between 1980 and 2013 are presented in Figure 13.1.14-1 (EIA, 2015c). Between 1980 and 2013, North Dakota's CO_2 emissions from fossil fuels more than doubled. Almost all of the emissions increases came from coal, which went from 15.3 MMT in 1980 to 40.7 MMT in 2008. Since 2008, coal emissions have declined slightly while petroleum emissions increased from the transportation and industrial sectors (EIA, 2015c). North Dakota the second-ranked oil-producing state in the U.S. and the recent increases in emissions from petroleum products can be attributed to the oil boom taking place there, although most of the oil produced is consumed out of state (EIA, 2014b). North Dakota was ranked 35th in the U.S. for total CO_2 emissions in 2013, but 2nd overall for per capita CO_2 emissions (EIA, 2015d).

Table 13.1.14-1: North Dakota CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	37.1	Residential	1.1
Petroleum Products	15.1	Commercial	1.5
Natural Gas	4.4	Industrial	16.1
		Transportation	9.2
		Electric Power	28.7
TOTAL	**56.6**	**TOTAL**	**56.6**

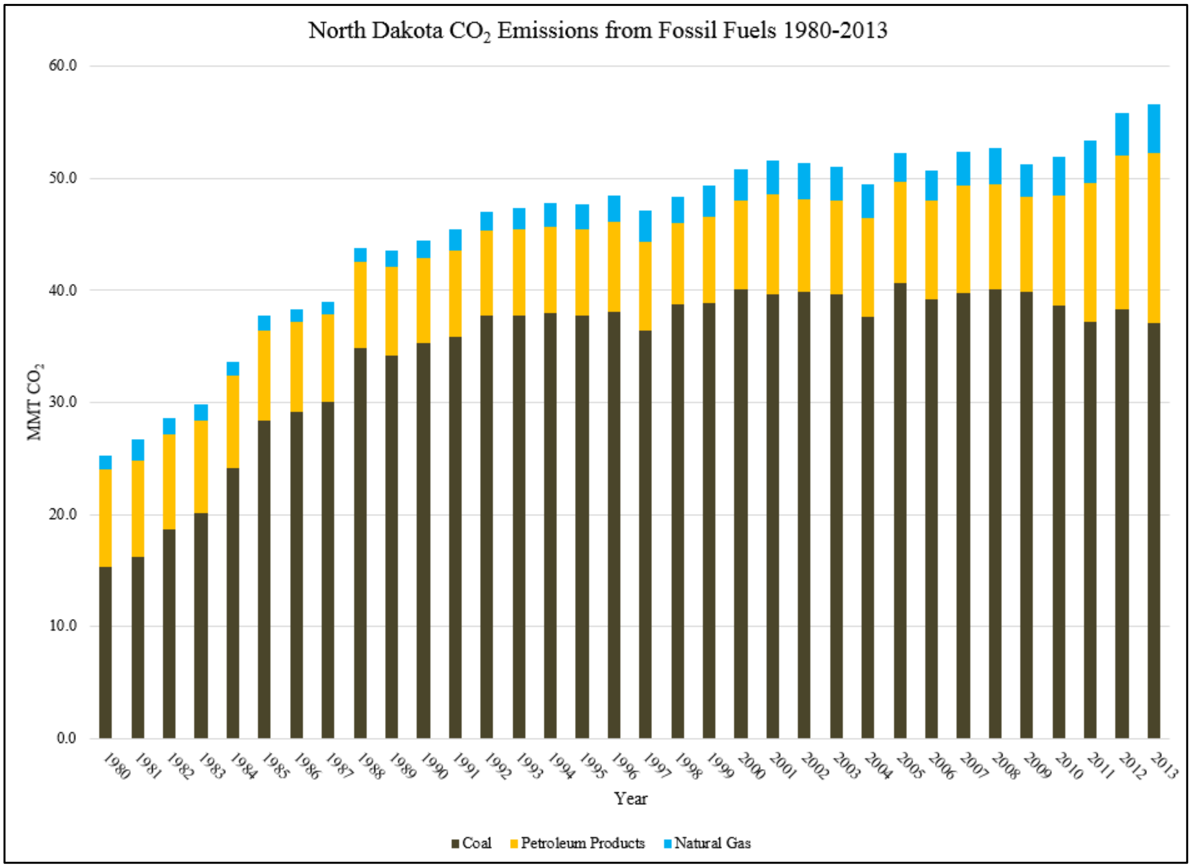


Figure 13.1.14-1: North Dakota CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015c)

The majority of North Dakota's GHG emissions is CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly petroleum products used in the industrial sector and for home heat, and a growing proportion of natural gas for heat and hot water in residential and commercial buildings (EIA, 2015c). Other GHGs emitted in North Dakota are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons (USEPA, 2015g). However, North Dakota does not have an official state-level GHG inventory and these emissions have not been quantified.

North Dakota's small population and large number of coal-fired power plants means that North Dakota produces more electricity than it uses and a majority of it is sold interstate, and per-capita emissions are very high. Because of the large agriculture and petroleum industries, the industrial sector contributes the most to greenhouse gas emissions in the state. North Dakota has one of the largest oil fields and is the second largest crude-oil producing state after Texas. Crude oil production in North Dakota increased in 2013 due to the production from the Bakken Shale, horizontal drilling improvements and, hydraulic fracturing technologies. More refineries are currently being constructed, including the first American Indian-owned refinery, which will most likely result in increased GHG emissions (EIA, 2014b).

13.1.14.4. 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).

Across the U.S., the five most common climate groups are (A), (B), (C), (D), and (E). The majority of North Dakota falls into climate group D (see Figure 13.1.14-2). 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 (^{o}F), 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). Whereas the majority of North Dakota falls into climate group D, areas of northwestern and southwestern North Dakota, fall into the climate group B. Climates classified as (B) are dry climates, "in large continental regions of the mid-latitudes often surrounded by mountains" (NWS, 2011a). "The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation" (NWS, 2011a). North Dakota has three sub-climate categories, which are described in the following paragraphs.

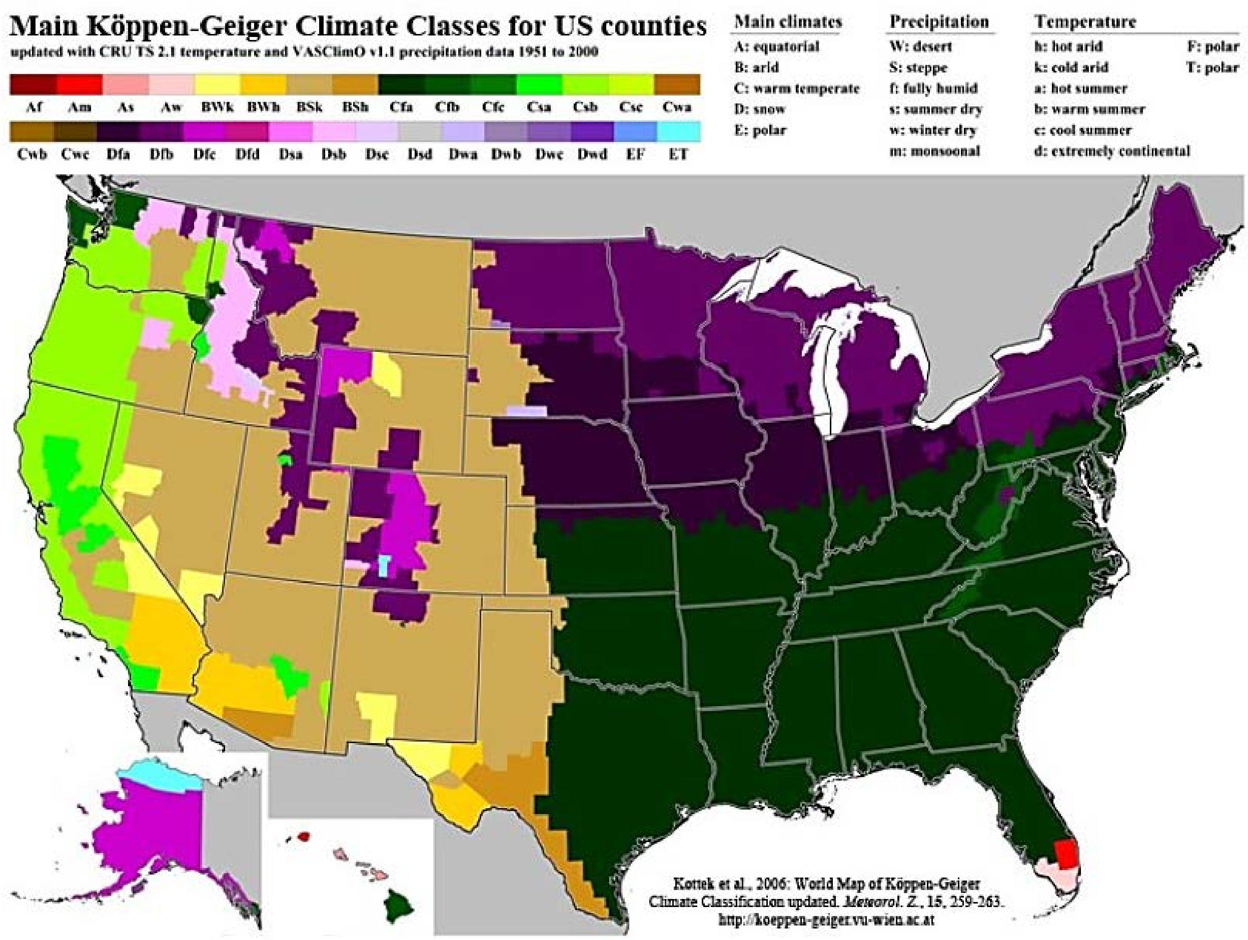


Figure 13.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, M., 2006)

Dfb – The Köppen-Geiger climate classification system classifies the majority of North Dakota, including northern, eastern, southern, and central regions, as Dfb. Climates classified as Dfb are characterized as humid, with warm summers and snowy winters. In this climate classification zone, the secondary classification indicates substantial precipitation during all seasons. In this climate classification zone, the tertiary classification indicates that at least four months out of the year averaging above 50 °F. (NWS, 2011a) (NWS, 2011b)

Dwb – Climates classified as Dwb are humid continental, with severe, dry winters and warm summers (NWS, 2011b). Dwb climate typically experience at least one month with temperatures that drop below 26.6 °F. Dbf climates also typically experience wet summers. (NWS, 2011a) (NWS, 2011b) (GLOBE SRC, 2011)

Bsk – Climates classified as Bsk are mid-latitude and dry. “Evaporation exceed precipitation on average but is less than potential evaporation” (NWS, 2011b). Average temperatures in Bsk climate zones are less than 64 °F. (NWS, 2011a) (NWS, 2011b)

This section discusses the current state of North Dakota's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., flooding, strong winds, tornadoes, and blizzards) in North Dakota's three climate regions, Dfb, Dwb, and Bsk.

Air Temperature

Geographically, North Dakota is situated in the middle of the North American continent, which creates a "strong continental climate, which is exacerbated by the mountains to the west" (Enz, 2015). For example, the mountains in North Dakota reduce the effects of the Pacific Ocean by blocking the "cool, moist" Pacific air, and "by extensively modifying the temperature and water content" of air masses not moving eastward (Enz, 2015). Although there are mountainous barriers in the west, there are "are no barriers to the north or south, so air masses from these directions easily overflow the state with little temperature or water content modification" (Enz, 2015). Due to these barriers, or lack thereof, North Dakota experiences regular and nearly continuous wind flow throughout each season. This wind flow also leads to "large day-to-day temperature fluctuations in all seasons" (Enz, 2015). These topographic climactic variations are arguably the "most important feature of North Dakota's climate" (Enz, 2015). Overall, the climate of North Dakota is "characterized by large temperature variations across all time scales, light to moderate, irregular precipitation, plentiful sunshine, low humidity, and nearly continuous wind" (Enz, 2015).

Average annual temperatures in North Dakota range from approximately 37 °F in northeastern areas of the state to 44 °F in southern areas of the state, along the South Dakota border. January is typically the coldest month in North Dakota, with temperatures ranging from near zero in northeastern areas of the state, to 15 °F in southwestern areas of the state. July is typically the warmest month in North Dakota. Temperatures range from 65 °F in northeastern areas of the state, to 72 °F in southern areas of the state. Such a large temperature variation between the north and south details the distinct continental climate of North Dakota. The highest temperature to occur in North Dakota was on July 6, 1936 with a record high of 121 °F (SCEC, 2015). The lowest temperature to occur in North Dakota was on February 15, 1936 with a record low of negative 60 °F (SCEC, 2015) (Enz, 2015).

The following paragraphs describe annual temperatures as they occur within North Dakota's various climate classification zones:

Dfb **–** Fargo, located along the eastern border of North Dakota, is within the climate classification zone Dfb. The average annual temperature in Fargo is approximately 42.4 °F; 12.6 °F during winter months; 68.8 °F during summer months; 43.0 °F during spring months; and 44.5 °F during autumn months (NOAA, 2015b). Bismarck, located within central North Dakota, is also within the climate classification zone Dfb. The average annual temperature in Bismarck is approximately 43.0 °F; 15.6 °F during winter months; 68.5 °F during summer months; 43.1 °F during spring months; and 44.2 °F during autumn months (NOAA, 2015b).

Dwb **–** Hettinger, located in southwestern North Dakota, is within the climate classification zone Dwb. The average annual temperature in Hettinger is approximately 42.3 °F; 18.5 °F during winter months; 66.2 °F during summer months; 41.3 °F during spring months; and 42.9 °F during autumn months (NOAA, 2015b).

Bsk – Bowman, also located in southwestern North Dakota, is within the climate classification zone Bsk. The average annual temperature in Bowman is approximately 42.8 °F; 18.9 °F during winter months; 66.9 °F during summer months; 41.6 °F during spring months; and 43.4 °F during autumn months (NOAA, 2015b).

Precipitation

Precipitation in North Dakota ranges from 14 inches in northwestern North Dakota to 22 inches in southeastern North Dakota. "This increase reflects the decreasing distance to the Gulf of Mexico, which is the water source for most of the state's precipitation" (Enz, 2015). Approximately 75 percent of the state's annual rainfall falls during April and September, the state's crop-growing season. Approximately 50 to 60 percent of the state's annual rainfall falls during April and July. The coldest months in North Dakota, November through February, "average only above 0.50 inches per month, mostly as snow" (Enz, 2015). "Measureable precipitation (0.01 inches or more) occurs on an average of 65 to 100 days during the year, but over 50 percent of these events produce less than 0.10 inches" (Enz, 2015).

With regard to snowfall, North Dakota receives an annual average of 25 to 45 inches. Winter snowpack in North Dakota averages approximately 9 to 15 inches from southwest to northeast regions. The greatest 24-hour precipitation accumulation to occur was on June 29, 1975 with a record of 8.1 inches (SCEC, 2015). The greatest 24-hour snowfall accumulation to occur was on April 27, 1984 with a record of 27 inches (SCEC, 2015).

The following paragraphs describe annual precipitation accumulation as it occurs within North Dakota's various climate classification zones:

Dfb – Fargo, located along the eastern border of North Dakota, is within the climate classification zone Dfb. The average annual temperature in Fargo is approximately 42.4 °F; 12.6 °F during winter months; 68.8 °F during summer months; 43.0 °F during spring months; and 44.5 °F during autumn months (NOAA, 2015b). Bismarck, located within central North Dakota, is also within the climate classification zone Dfb. The average annual temperature in Bismarck is approximately 43.0 °F; 15.6 °F during winter months; 68.5 °F during summer months; 43.1 °F during spring months; and 44.2 °F during autumn months (NOAA, 2015b).

Dwb – Hettinger, located in southwestern North Dakota, is within the climate classification zone Dwb. The average annual temperature in Hettinger is approximately 42.3 °F; 18.5 °F during winter months; 66.2 °F during summer months; 41.3 °F during spring months; and 42.9 °F during autumn months (NOAA, 2015b).

Bsk – Bowman, also located in southwestern North Dakota, is within the climate classification zone Bsk. The average annual temperature in Bowman is approximately 42.8 °F; 18.9 °F during winter months; 66.9 °F during summer months; 41.6 °F during spring months; and 43.4 °F during autumn months (NOAA, 2015b).

Severe Weather Events

Blizzards are not common in North Dakota, with an average of two to three blizzards occurring per year. If a blizzard does occur, "conditions seldom last more than two days, although a few famous ones have persisted for four days" (Enz, 2015). In addition to heavy snowfall, blizzards in North Dakota are typically accompanied "by strong winds that quickly fill the air with fine snow that reduces visibility to only a few feet at times" (Enz, 2015). Typically, if a blizzard is expected, "travelers and snowplowers seek shelter as major highways are closed" (Enz, 2015). During the winter of 1996 through 1997, there was a record occurrence of nine blizzards and four winter storms, "producing all-time record snowfalls of 60 to 120 inches over most of the state" (Enz, 2015).

In addition to blizzards, strong prevailing winds from "the north to north-northwest during winter and from the south to south-southeast during summer" contribute to other significant and sometimes severe weather in North Dakota (Enz J. , 2003). During the summer, winds that blow from the south transport moist air throughout the state, with wind speeds that can range from 10 miles per hour (mph) to 13 mph. Although this wind speed appears low, the Northern Great Plains are typically very calm. Therefore, even a slight disturbance of winds greater than 10 mph can be significant to the region. The windiest months in North Dakota are typically April and May, while July and August are typically the calmest. (Enz J. , 2003)

River flooding occurs frequently in North Dakota, particularly along the Red River. Flooding along the Red River can occur during any season of the year, "with the exception of winter, when freeze-up occurs" (Godon & Godon, 2002). The National Weather Service (NWS) has "established 17 feet as the flood state in Fargo" (Godon & Godon, 2002). Two particularly destructive floods that occurred along the Red River were in April 1897 and April 1997. Both floods occurred as a result of rapid and excessive snowmelt (Godon & Godon, 2002).

During the 1997 flooding event, floodwaters inundated approximately 85 percent of Grand Forks. In addition to Grand Forks, the floodwaters also severely damaged East Grand Forks and Fargo. In 2009, another Red River flooding event resulted in "the most wide spread flooding during a single spring since statehood" (NWS, 2015a). Several cities, including Fargo, Valley City, Jamestown, Linton, Beulah, Hazen, and Mandan "all suffered when water reached record, or near record flood levels" (NWS, 2015a). Rural areas of North Dakota also suffered losses, with over 80,000 livestock lost to high floodwaters. Several dams throughout North Dakota were also "nearly lost due to erosion of the earthen dam from flood waters" (NWS, 2015a). Ice jams are another leading cause of flooding in North Dakota. During a more recent flooding event in 2011, flooding along the Missouri River displaced over 4,000 people. (NWS, 2015a)

13.1.15. Human Health and Safety

13.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential

FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicular traffic. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 13.1.1, Infrastructure.

13.1.15.2. Specific Regulatory Considerations

Federal organizations, such as OSHA, USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In North Dakota, this resource area is regulated by the North Dakota Department of Labor and Human Rights (NDDLHR) and the NDDH, Environmental Health Section. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. North Dakota does not have an OSHA-approved "State Plan." Therefore, private and public sector occupational safety and health programs in the state are enforced by OSHA. Health and safety of the general public is regulated by the NDDH.

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations. Table 13.1.15-1 below summarizes the major North Dakota laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 13.1.15-1: Relevant North Dakota Human Health and Safety Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
North Dakota Century Code: Title 23-29	NDDH	Regulates the storage, collection, transportation, resource recovery, and disposal of solid waste for the protection of the public health and the environment.
North Dakota Administrative Code: Chapter 33-16-02.1	NDDH	Provides a system for the classification and protection of waters of the state, and establishes water quality standards.
North Dakota Administrative Code: Chapter 38-08-04.4	North Dakota Department of Mineral Resources	Authorizes the North Dakota Industrial Commission to reclaim or remediate oil and gas-related pipelines and associated facilities if a leak occurs or is likely to occur that would threaten pollution or injury to public health or safety.

State Law / Regulation	Regulatory Agency	Applicability
North Dakota Administrative Code: Chapter 43-02-03	NDDH	Regulates oil and gas industries with regards to public health and safety impacts, including requirements for facility perimeter fencing, hazardous waste characterization, and shutdown requirements in the event of a serious threat of pollution or injury to the public health or safety.

13.1.15.3. 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 may also be 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, 2016b). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

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

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility man-ways are examples of when trenching or confined space work is necessary. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. The general public can be at risk of stepping or driving motor vehicles into open trenches, or falling into uncovered confined spaces. (OSHA, 2016b)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials, and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016b)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work (International Finance Corporation, 2007a).

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, 2007a). 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 13.1.13, 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 wetlands and waterways, including lakes, rivers, ponds, and 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 both 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, there were 300 telecommunication line installers and repairers, and 430 telecommunication equipment installers and repairers working in North Dakota (BLS, 2015c). North Dakota is one of eight states that do not report to the BLS Survey of Occupational Injuries and Illnesses database (BLS, 2015d). According to a 2015 North Dakota Workforce Safety & Insurance report, between Fiscal Years 2010-2014, North Dakota had a 5-year total of 305 workers' compensation claims for telephone and cable line construction (insurance rate class code 7601), representing 0.3 percent of total claims for the same period (North Dakota Workforce Safety & Insurance, 2015). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013a).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013b). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). In North Dakota, no fatalities in the telecommunication line installers and repairers or telecommunication equipment installers and repairers occupations were reported since 2003, when data are first available. In the broader installation, maintenance, and repair occupations (SOC code 49-0000) North Dakota had four fatalities in 2003, three in 2006, and five fatalities in in 2010 (BLS, 2015f).

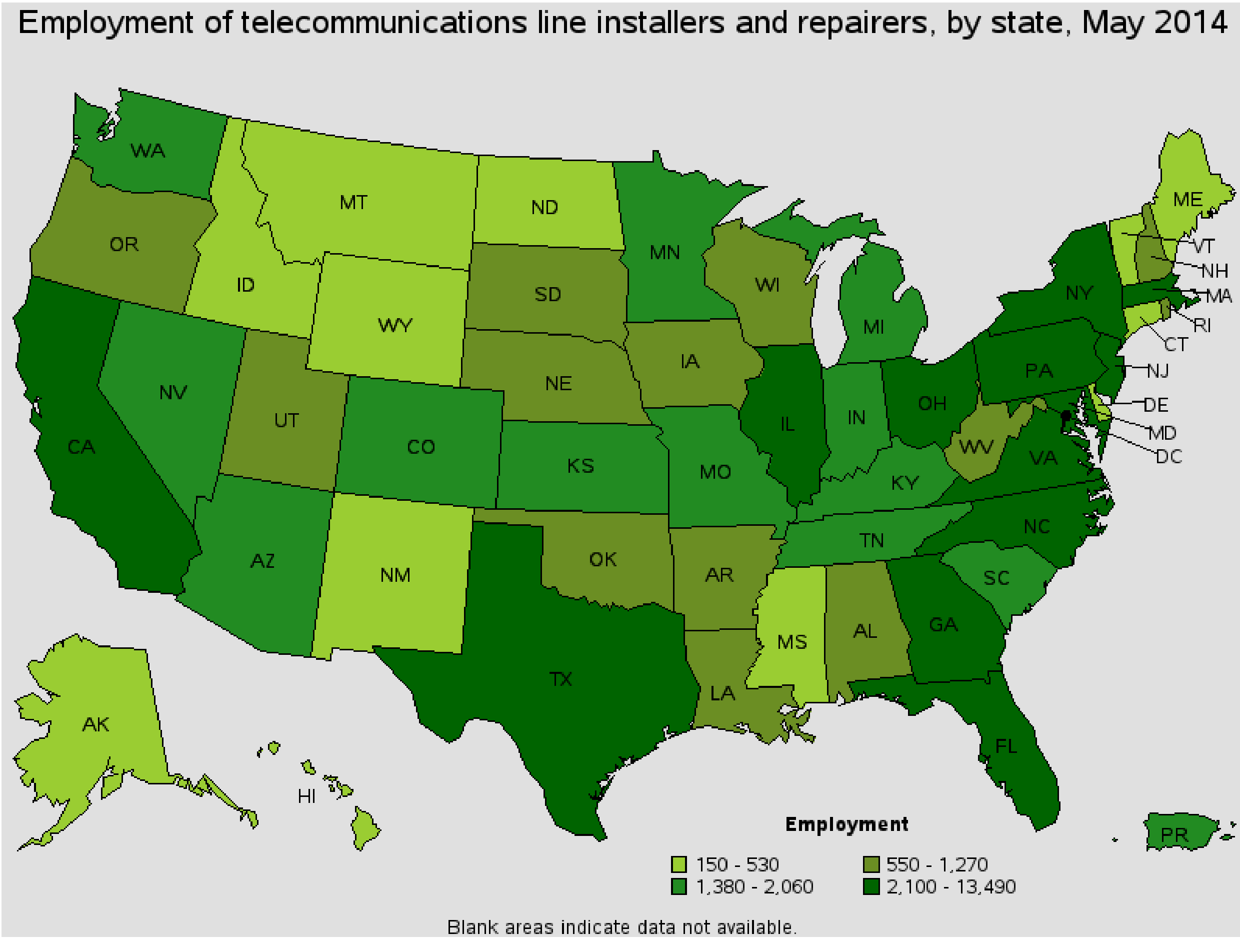


Figure 13.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per state, May 2014

Source: (BLS, 2015e)

Public Health and Safety

The general public are not likely to encounter occupational hazards at telecommunication sites, due to limited access. NDDH, Environmental Health Section, provides publicly available environmental incident reports, including the number of injuries and fatalities, and potential environmental impacts (NDDH, 2015o). The same data are reported with more specificity at the federal level through the Center for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, in North Dakota, between 1999 and 2013, there were 23 fatalities due to a fall from, out of or through a building or structure; 0 fatalities due to being caught, crushed, jammed or pinched in or between objects; and 0 fatalities due to exposure to electric transmission lines (CDC, 2015). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

13.1.15.4. 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 telecommunication site occupants, including practices before current 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[131] 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.

North Dakota does not have a state Superfund Program or hazardous waste cleanup program. As of October 2015, North Dakota had 8 RCRA Corrective Action sites[132], 138 brownfields, and no proposed or final Superfund/NPL sites (USEPA, 2015h). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, there are two delisted Superfund sites in North Dakota (Arsenic Trioxide Site, near Hankinson, ND; and Minot Landfill, in Minot, ND) (USEPA, 2015i). Brownfield sites in North Dakota are managed through the North Dakota Brownfields Program, which uses federal grants from the USEPA to clean up contaminated sites (NDDH, 2015p).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of September 2015, North Dakota had 73 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing

[131] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C, Environmental Laws and Regulations (USEPA, 2011b).

[132] Data gathered using the USEPA's Cleanups in My Community (CIMC) search on October 6, 2015, for all sites in the State of North Dakota, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013d).

to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2013, the most recent data available, North Dakota released 51.4 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases. This accounted for 1.25 percent of nationwide TRI releases, ranking North Dakota 28 of 56 U.S. states and territories based on total releases per square mile (USEPA, 2014b).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of October 8, 2015, North Dakota had 26 major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015j).

The National Institutes of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 13.1.15-2 provides an overview of potentially hazardous sites in North Dakota.

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 also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of October 2015, there is one USEPA-regulated telecommunications site in North Dakota (DCN-Dakota Carrier Network Ops Center in Bismarck, ND) (USEPA, 2015k). This site is regulated for stationary sources of air pollution under the State Implementation Plan, New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants.

North Dakota had three fatalities each in 2005, 2009, and 2014 from exposure to "harmful substances or environments," although these were not specific to the telecommunications industry or telecommunications occupations (BLS, 2015d). Nationwide, BLS reported three fatalities in 2011 and three fatalities[133] in 2014 within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015g). In 2014, BLS also reported four fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (BLS, 2014).

[133] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data are expected to be released in spring 2016 (BLS, 2015h).

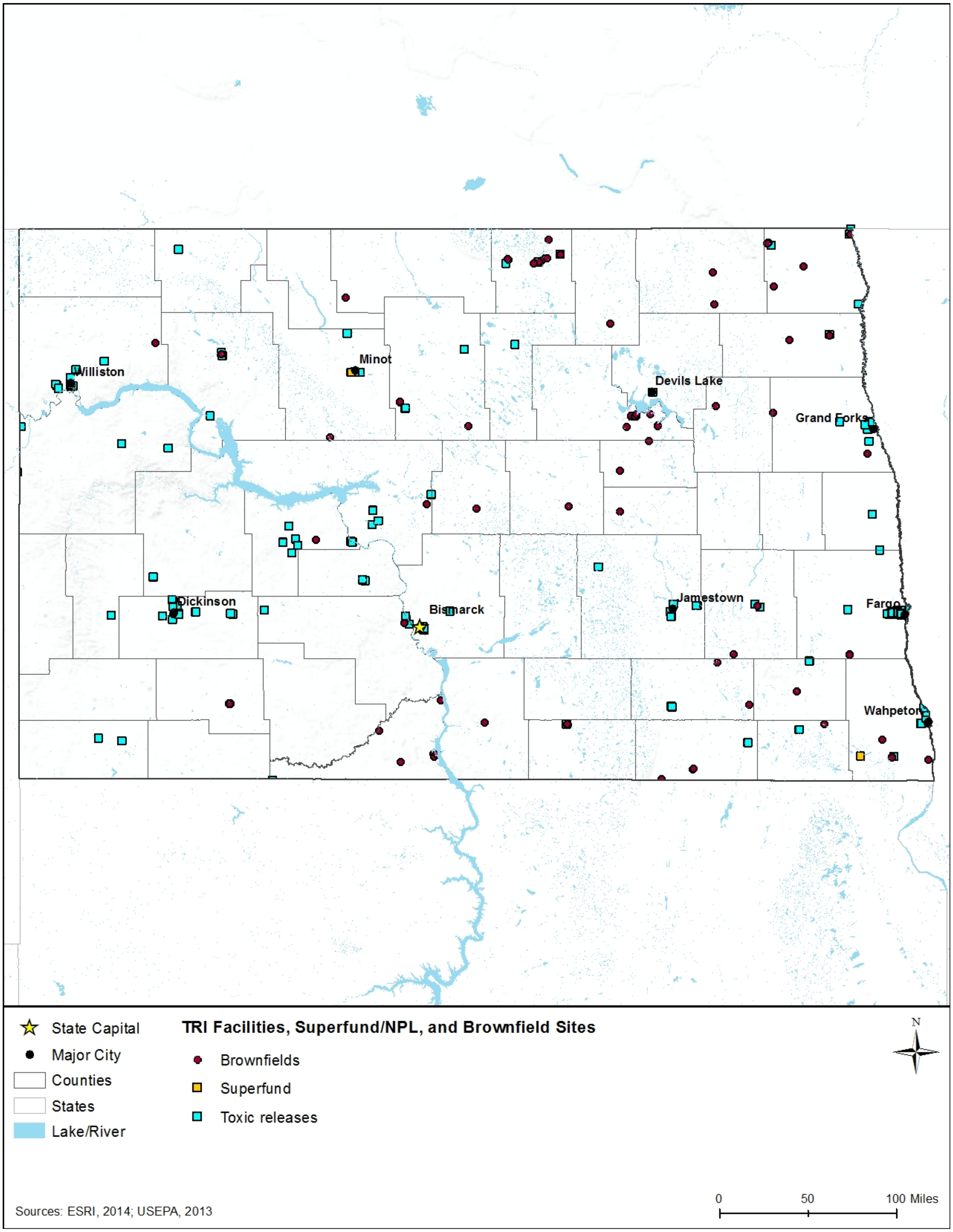


Figure 13.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in North Dakota (2013)

Source: (NIH, 2015b)

Spotlight on North Dakota Superfund Sites: Minot Landfill

The 26-acre Minot Landfill, in Minot, ND, is one of two delisted Superfund/NPL sites in North Dakota. The municipal and industrial waste landfill operated between 1961 and 1971, receiving used oil, spent battery casings, calcium carbide, and lime sludge.

In 1985, after years of erosion, NDDH and USEPA investigated odors and gasses emitting through the soil cap and found contamination in the groundwater, air, soil, surface water, and surface water sediments. Immediate threats to human health were mitigated through several removal actions and short-term cleanups. Long-term remedies included the construction of a new landfill cap to control runoff, decrease the infiltration of precipitation, divert leachate, and vent landfill gasses. Cleanup was completed in 1996 and the site was removed from the Superfund/NPL in 1997. The USEPA conducted several 5-year reviews and continues to monitor the site for risks to public health and the environment. (USEPA, 2015t)

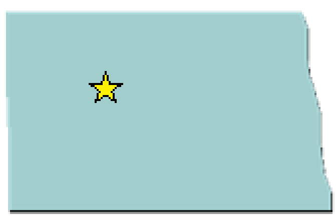


Figure 11.1.15-3 Minot Landfill Cap

Source: (USEPA, 2013e)

Public Health and Safety

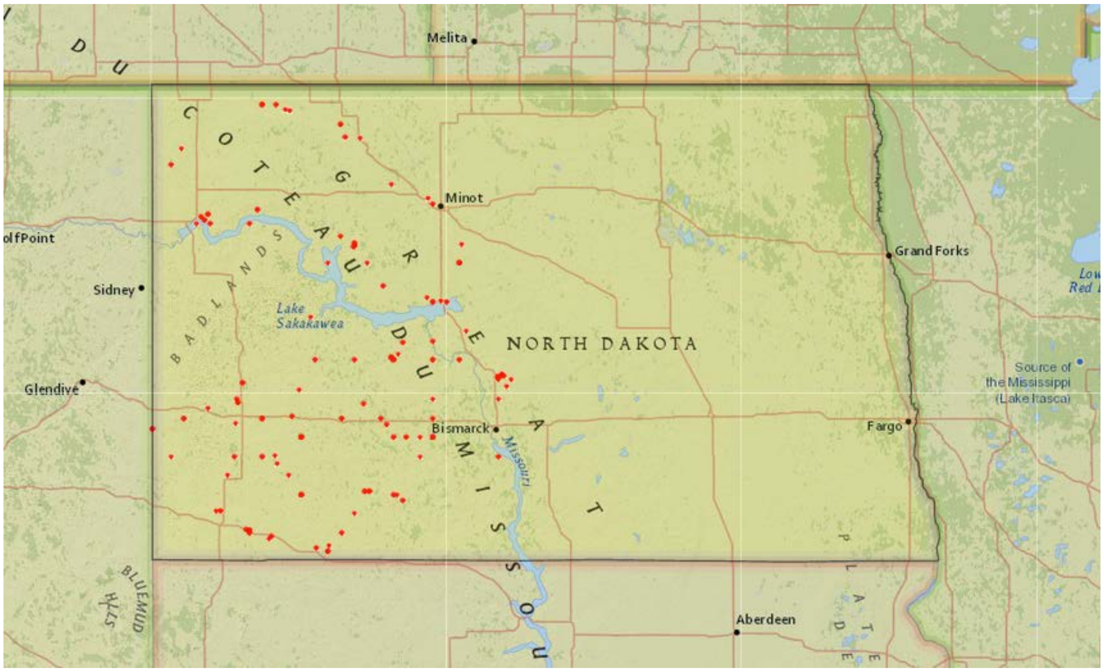
As described earlier, access to telecommunications sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunications sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

The NDDH is responsible for collecting public health data resulting from exposure to environmental contamination and provides publicly available health assessments and consultations for documented hazardous waste sites (NDDH, 2015q). At the federal level, the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography.

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

Another health and safety hazard in North Dakota includes surface and subterranean mines. In 2014, the North Dakota mining industry ranked 42nd for non-fuel minerals (primarily sand and gravel, lime, crushed stone, and clays), generating a value of $243 million (USGS, 2016a). That same year, North Dakota ranked 17th in the United States, behind Montana, for the number of coalmining operations (5 surface and no underground) (EIA, 2013). Health and safety hazards known at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (BLM, 2015).

The North Dakota Public Service Commission, Abandoned Mine Lands Division administers the state's Abandoned Mine Lands Program, and is responsible for managing AML health and safety hazards resulting from pre-1977 coalmining operations (North Dakota Public Service Commission, 2015a). Since the start of North Dakota’s AML Program, more than 155 vertical openings, 100,000 linear feet of dangerous highwalls, and 1,800 acres of subsidence issues or other hazardous features caused by abandoned mines have been mitigated (Federal Mining Dialogue, 2015). Figure 13.1.15-3 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in North Dakota, where Priority 1 and 2 sites pose a significant risk to human health and safety, and Priority 3 sites pose a risk to the environment. As of October 2015, North Dakota had 111 Priority 1 and 2 AMLs, with 99 unfunded problem areas (USDOI, Office of Surface Mining Reclamation and Enforcement, 2014).



Source: (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015a)

Figure 13.1.15-3: High Priority Abandoned Mine Lands in North Dakota (2015)

Additional hazards found in North Dakota include contamination from the oil and gas industry. North Dakota ranks second in the United States for oil production, generating 12 percent of U.S. crude oil, primarily from the Bakken formation. However, production growth between 2010 and 2013 was the fastest in the nation, at 177 percent (EIA, 2014c). Health and safety hazards associated with oil and gas exploration include both direct and indirect groundwater contamination, as well as hazardous air emissions from both stationary and mobile sources.

For example, in September 2010, a blowout occurred at an oil well in Killdeer, ND, during the hydraulic fracturing process, releasing hydraulic fracturing fluids and flowback water at the site and potentially into the Killdeer drinking water aquifer. The USEPA selected this site to conduct a retrospective case study, as part of a broader assessment of the potential human health impacts from hydraulic fracturing, and found tert-butyl alcohol (TBA) and brine in two monitoring wells as a result of the blowout. (USEPA, 2015l) In June 2015, the USEPA released the final draft assessment[134] and noted that "the potential public health impact of hydraulic fracturing processes is not well understood," and that multiple studies have shown that "with the recent increase in hydraulic fracturing operations there may be an increasing potential for significant public health and environmental impacts via ground and surface water contamination" (USEPA, 2015m).

[134] The USEPA Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources is an external review draft, and is distributed solely for the purpose of pre-dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by EPA. It does not represent and should not be construed to represent any Agency determination or policy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use. (USEPA, 2015s)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near AMLs or mine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. 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 deployment and maintenance operations.

Public Health and Safety

North Dakota is the 10th largest coal producer in the nation (North Dakota Public Service Commission, 2015b). Subterranean mines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires 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. (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015b)

13.1.15.6. 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.

Telecommunication Worker Occupational Health and Safety

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

Spotlight on North Dakota Natural Disasters: 2009 Statewide Flooding

In the spring of 2009, snowmelt and severe storms caused widespread flooding along the Red and Missouri Rivers in North Dakota. Record high-water levels were observed statewide, including Fargo, ND, where the Red River exceeded flood stage for two months. Melting snow combined with ice jams on the Missouri River forced residential evacuations in southwest Bismarck, ND (USGS, 2011).

Ice jams were so significant; explosives were used to break jams near Bismarck, ND. Several dams were nearly breached due to erosion. Damage to communication and transportation, as well as loss of 80,000 head of livestock caused substantial economic impact to the state (NWS, 2011a). On March 24, 2009, North Dakota was declared a major disaster, and subsequently received $116 million in public assistance grants (FEMA, 2009).

Figure 11.1.15-5 Sorlie Bridge in Grand Forks, ND

Source: (USGS, 2009)

Currently, NDDH and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. Of the 93 NRC-reported incidents for Illinois in 2015 with known causes, three incidents were attributed to natural disaster (e.g., natural phenomenon), while 90 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (USCG, 2015). In Bowman County, for example, during a period of heavy flooding in April 2009, a discharge of crude oil and drilling mud were released when a drilling pit flooded due to snowmelt (U.S. Coast Guard, 2009). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, North Dakota had no weather-related fatalities and 14 injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (NWS, 2015b).

13.2. 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 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, as a result of construction activity. 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.

13.2.1. Infrastructure

13.2.1.1. Introduction

This section describes potential impacts to infrastructure in North Dakota associated with construction, deployment, and operation of the Proposed Action and alternatives. Chapter 19, Best Management Practices and Mitigation Measures provides 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.

13.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 13.2.1-1. 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

Table 13.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments).	Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments).	No effect on traffic congestion or delay, or transportation incidents.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Persisting indefinitely.		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase.	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the project activities.	Effect is potentially significant, but with mitigation is less than significant.	Minor delays to access to care and emergency services that do not impact health outcomes.	No impacts on access to care or emergency services.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Duration is constant during construction and deployment phase.		Rare event during construction and deployment phase.	NA

Type of Effect	**Effect Characteristics**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal change in the ability to communicate with and between public safety entities.	No perceptible change in existing response times or the ability to communicate with and between public safety entities.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service.		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service.	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities.	Effect that is potentially significant, but with mitigation is less than significant.	Minor changes in level of service and communications while transitioning to the new system	No perceptible effect to level of service or communications while transitioning to the new system.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service.		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems.	Effect that is potentially significant, but with mitigation is less than significant.	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services.	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase.		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase.	NA

NA = Not Applicable

potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

13.2.1.3. 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 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., North Dakota Department of Roads, airport authorities, and railway companies) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 13.2.1-1, such impacts would be less than significant due to the temporary nature of the construction activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the construction phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

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

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services 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 13.2.1-1, potential negative impacts would be less than significant. Substantial beneficial impacts are likely to result from implementation.

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 13.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would 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 complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus the 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. Any negative impacts would be expected to be less than significant given the short-term nature of the deployment activities.

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

North Dakota operates a statewide, multipurpose network, which supports public safety, state agencies, and education called the North Dakota Statewide Technology Access for Government and Education Network (STAGEnet). There are close to 1,000 commercial towers in North Dakota. 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. [135] Anticipated impacts would be less than significant due to the limited extent and temporary nature of the deployment.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The North Dakota Public Service Commission (PSC) regulates private investor-owned public utilities such as electric, water, and sewage companies. Among PSC's responsibilities are activities proposed by FirstNet that would have less than significant to negligible 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

[135] 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.

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.

13.2.1.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs)136, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new, or replacement of existing telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact. 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.

[136] Points of Presence are connections or access points between two different networks, or different components of one network.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could 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 may require connection 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 utilized but 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 19, BMPs and Mitigation Measures provides 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. 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[137]

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables Chapter 19, BMPs and Mitigation Measures provides a listing of BMPs and mitigation measures

[137] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

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 from deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

13.2.2. Soils

13.2.2.1. Introduction

This section describes potential impacts to soil resources in North Dakota associated with deployment and operation of the Proposed Action and alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 13.2.2-1. As described in Section 13.1.2, 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 soil resources addressed in this section are presented as a range of possible impacts.

Table 13.2.2-1: Impact Significance Rating Criteria for Soils

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
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

13.2.2.3. 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 North Dakota 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 North Dakota that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Albolls, Aqualfs, Aquerts, Aquolls, Fluvents, Hemists, Orthents, Psamments, Udalfs, Uderts, Udolls, Ustalfs, Ustepts, and Ustolls (see Section 13.1.2.6, Soil Erosion and Figure 13.1.2-2).

Based on the impact significance criteria presented in Table 13.2.2-1, building of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 19).

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 13.2.2-1, 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 19), minimal topsoil mixing is anticipated.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 5.1.2.3, Soil Suborders). Based on impact significance criteria presented in Table 13.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant due to the extent of susceptible soils in the state.

Heavy equipment could 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 13.1.2.4, Soil Suborders). The most compaction susceptible soils in North Dakota are hydric soils with poor drainage conditions, which include Albolls, Aqualfs, Aquerts, Aquolls, and Hemists. These suborders constitute approximately 31 percent of North Dakota's land area, [138] and are found throughout most of the state, except the southwestern portion (Figure 13.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

13.2.2.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of proposed action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand holes, pulling vaults, junction boxes, huts, and POP, structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite

[138] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

phones, and video cameras would not impact soil resources because those activities would not require ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel, or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in or near bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including

associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures are needed, they may require ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 19, BMPs and Mitigation Measures provides 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. These impacts are expected to be less than significant due to the temporary nature and small scale of operations with the potential to create impacts. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.2.5. 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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.2, Soils.

13.2.3. Geology

13.2.3.1. Introduction

This section describes potential impacts to North Dakota geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 13.2.3-1. As described in Section 13.2, 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.

13.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, and landslides, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

A concern related to deployment is placement of equipment in highly active seismic zones. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 13.1.3.8, areas of greatest seismicity in North Dakota are concentrated in the northwest portions of the state (Figure 13.1.3-6), though North Dakota is at minimal risk of experiencing a significant earthquake event. Based on the impact significance criteria presented in Table 13.2.3-1, 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 or active fault zones. Given the potential for minor earthquakes in or near North Dakota, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Volcanic Activity

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

Table 13.2.3-1: 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
Potential 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
Potential 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 13.1.3.8, the potential for widespread landslides in North Dakota is minimal; most landslides occur in the southwestern portion of the state. Based on the impact significance criteria presented in Table 13.2.3-1, 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. Anthropogenic[139] disturbances to the landscape or heavy precipitation events both increase the likelihood of landslide events in North Dakota. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 13.1.3.8, land subsidence is not considered a major risk in North Dakota. Based on the impact significance criteria presented in Table 13.2.3-1, 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 mining areas. 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. Land subsidence is generally attributed to subsidence over formerly mined areas and burned underground coal beds. To the extent practicable, FirstNet would avoid deployment in known or abandoned mined areas. However, where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

As discussed in Section 13.1.3.7, North Dakota produces crude oil and natural gas from the Bakken Shale Formation. Equipment deployment near mineral and fossil fuel resources would have less than significant effects on these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 13.2.3-1, 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.

[139] Anthropogenic: "Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities." (USEPA, 2016)

Potential 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 13.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations were to cause impacts to paleontological resources. As discussed in Section 13.1.3.6., marine fossils are found throughout the state in glacial deposits. 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 19) could further help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that require modification or removal of the surrounding terrain could cause irreparable damage to that area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 13.2.3-1, 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 19) could further help avoid or minimize the potential impacts.

13.2.3.4. 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 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 geologic resources, it is anticipated that this activity would have no impact on geologic 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 fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in

locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic resources including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas

(depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock or mineral and fuel resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale, as a result, these potential impacts are expected to be less than significant. Chapter 19, BMPs and Mitigation Measures provides 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 geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.3.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 19, BMPs and Mitigation Measures provides 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 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 subject to increased seismic activity, landslides, and land subsidence. Chapter 19, BMPs and Mitigation Measures provides 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 13.2.3, Geology.

13.2.4. Water Resources

13.2.4.1. Introduction

This section describes potential impacts to water resources in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 13.2.4-1. As described in Section 13.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

13.2.4.3. 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 1303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Table 13.2.4-1: 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.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		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.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		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

All of the surface waters in the state have been degraded to some extent. About 73 percent of the assessed lakes, reservoirs, and ponds are impaired due to mercury and nutrients (see Table, Figure 13.1.4-3). Designated uses of the impaired rivers and streams and lakes include agriculture water supply, aquatic life, and primary contact recreation (USEPA 2015b). Groundwater quality within the state is generally good for most domestic uses (NDDH, 1999).

Deployment activities could 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 could 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 could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a state or USEPA Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs and mitigation measures, where practicable and feasible, would reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal, 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 13.2.4-1, water quality impacts would likely be less than significant and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[140] 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 North Dakota 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.

Based on the impact significance criteria presented in Table 13.2.4-1, groundwater quality impacts could be potentially significant if the majority of FirstNet's deployment locations resulted in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer. There is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, 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 13.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would 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,[141] 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 that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

[140] 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).
[141] 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, 2016c)

Implementation of BMPs and mitigation measures would reduce the risk of additional impacts to floodplain degradation (see Chapter 19).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could change drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing could change drainage patterns. Clearing or grading activities, or the creation of walls or berms could alter water flow in an area or cause changes to drainage patterns. Drainage could be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns could be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 13.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Activities designed so that stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river, create a substantial and measurable increase in the rate and amount of surface water, or change the hydrologic regime, and any effects would be short-term, impacts to 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 could 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 could 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 13.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of stormwater previously.
- 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 13.1.4.7, the majority of North Dakota's drinking water (over 55 percent) comes from groundwater for irrigation, 18 percent for municipal use, 9 percent for rural domestic and livestock use, 5 percent for rural water systems use, and 4 percent for industrial use (NDDH 1999). 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.
- Bulk Storage of petroleum or chemical products.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should, as practicable and feasible, be considered to avoid areas that would extract groundwater from potable groundwater sources in the area.

13.2.4.4. 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 Infrastructure, 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 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.

- 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 water resources. However, if the onsite delivery of additional power units, structural hardening, and physical security measures required ground disturbance, impacts to water resources could occur, including increased suspended solids leading to impaired water quality and impacts to groundwater from excavation.
- 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 19, 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. Chapter 19, BMPs and Mitigation Measures provides 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, 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 construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.4.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if the deployment occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Chapter 19, BMPs and Mitigation Measures provides 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 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, however, due to the limited and temporary nature of the deployment activities, it is anticipated that these potential impacts would be less than significant. 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. 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.4, Water Resources.

13.2.5. Wetlands

13.2.5.1. Introduction

This section describes potential impacts to wetlands in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 13.2.5-1. As described in Section 13.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

13.2.5.3. 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 could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Table 13.2.5-1: 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 1304 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 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 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 wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands

[2] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[3] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

In North Dakota, palustrine (freshwater) wetlands, in particular prairie pothole wetlands, found on river floodplains across the state are the main type of wetlands, as shown in Figure 13.1.5-1 and Figure 13.1.5-2, western and eastern North Dakota respectively. North Dakota has over 2,300,000 acres of palustrine wetlands (USFWS, 2014a), as shown in Figure 13.1.5-2.

Based on the impact significance criteria presented in Table 13.2.5 1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would be unlikely to violate applicable federal, state, and local regulations. Additionally, the deployment activities would be unlikely to violate applicable federal, state, and local regulations.

As discussed in Wetlands, Section 13.1.5.4, wetlands of special concern include peatlands. If any of the proposed deployment activities were to occur in these wetlands, potentially significant impacts could occur. Peatlands are rare throughout the state, and are not always included on state maps; therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands.

Potential Other Direct Effects

Direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 13.2.5-1, 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 wetlands within a watershed or multiple watersheds could be 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 could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Examples of activities that could have other direct effects to wetlands in North Dakota include:

- Vegetation Clearing: removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.

- Ground Disturbance: Increased amounts of stormwater runoff in wetlands could alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- Direct Hydrologic Changes (flooding or draining): Greater frequency and duration of flooding could destroy native plant communities, as could depriving them of their water supply. Hydrologic changes could make a wetland more vulnerable to pollution. Increased water depths or flooding frequency could distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.
- Direct Soil Changes: Changes in soil chemistry could lead to degradation of wetlands that have a specific pH range and/or other parameters).
- 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) could reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff could interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[142] Changes in Function(s)[143] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to both 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 could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Examples of functions related to wetlands in North Dakota 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 could lower flood peaks by providing detention of storm flows. Correspondingly,

[142] 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.
[143] 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.

disturbance of the wetlands (e.g., dredging or filling) could proportionately reduce water storage function.

- 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 could 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 could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- Recreational Value: Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- Groundwater Recharge: Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 13.2.5-1, 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 wetlands in North Dakota are not considered wetlands of concern, deployment activities could have less than significant indirect impacts on wetlands in the state. Avoidance, BMPs, and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands. In areas of the state with 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 could help to mitigate impacts.

13.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands 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 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. Any ground disturbance could cause direct and/or indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures (see Chapter 19) 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, including coastal environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
- Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur

near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures (see Chapter 19) could reduce impact intensity.

- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, blimps, or piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures provides 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 could be ongoing other 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.5.5. 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/or 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. Chapter 19, BMPs and Mitigation Measures provides 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 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 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.5, Wetlands.

13.2.6. Biological Resources

13.2.6.1. Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in North Dakota associated with deployment and operation of the Proposed Action and its Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.6.2. 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 13.2.6-1. As described in Section 13.2, *Environmental Consequences*, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 13.2.6.3, 13.2.6.4, and 13.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 13.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in North Dakota.

Table 13.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	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 BMPs and mitigation measures 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 North Dakota 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 Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures 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 North Dakota 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 Characteristics	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 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 BMPs and mitigation measures 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 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 North Dakota for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to 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 BMPs and mitigation measures 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 North Dakota 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 Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures 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 North Dakota for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning or stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures 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 North Dakota.		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

13.2.6.1. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in North Dakota 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 13.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances 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 help 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 could include stress related to disturbance. The alteration of soils or hydrology within a localized area could 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 could have a dramatic effect on natural resources and biodiversity. The North Dakota Noxious Weed Control Act (NDCC 63-01.1-01 through 01-17) requires that every person do all things necessary and proper to control the spread of noxious weeds. In addition, the Act further stipulates that no one may "distribute, sell or offer for sale" any noxious weeds. In addition to the Noxious Weed Control Act, North Dakota regulates other plants considered pests through the Plant Pests Act (NDCC 4-33-01 through 12). This act allows the NDDA to "suppress, control, or eradicate the spread of plant pests in the state."

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 could sometimes dramatically increase. The unnaturally large population numbers could then have severe impacts to the environment, local economy, and human health. Invasive species could out-compete the native species for food and habitats and sometimes even cause their extinction. A total of 11 state-listed noxious weeds/complexes are regulated in North Dakota as set forth in the Administrative Rules of North Dakota (Title 7, Article 6). None of these species occur on the Federal Noxious Weed List (USDA, 2014). Of these species/complexes, 10 of them are terrestrial and 1 is an aquatic species (NDDA, 2015). Even if natives are not completely eliminated, the ecosystem often becomes much less diverse (USFWS, 2012b).

The potential to introduce invasive plants within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to 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[144], and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not 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

[144] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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 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 shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching,

and/or land clearing, such disturbance could result in direct or indirect injury to plants, 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 above mentioned 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. Chapter 19, BMPs and Mitigation Measures provides 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 be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected 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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 could vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.6.3, Terrestrial Vegetation.

13.2.6.2. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in North Dakota (i.e., less than two miles from the edge of the coast) are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 13.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in North Dakota. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors (FHWA, 2015f). 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 and would be dependent on the location and type of deployment activity, and tree removal. Site avoidance measures could be implemented to help avoid disturbance to bats.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and could violate MBTA and BGEPA. Generally, collision events occur to night-migrating birds, "poor" fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (FAA, 2012b) (Gehring, Kerlinger, & Manville, 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation, and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, D. et al., 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 North Dakota 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 19), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

North Dakota is limited in reptile and amphibian diversity due to the cold climate (Johnson, 2015). Species present typically occur in the arid plains, seasonal wetlands, or forested riparian areas in the state. Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Terrestrial Invertebrates

The terrestrial invertebrate populations of North Dakota 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 disturbances 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. Areas near urban areas such as Bismarck and Fargo have experienced land use changes. Remaining portions of the state have experienced land used changes from agriculture or remain forested.

Additionally, habitat loss could 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 North Dakota's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout North Dakota and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., elk, 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 mammals (e.g., squirrels, rabbits) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by implementing BMPs and mitigation measures.

Birds

The direct removal of migratory bird nests are prohibited under the MBTA. The USFWS and the NDGFD provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could 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 in IBAs within the state as birds may temporarily avoid these areas provide them with essential habitat that supports various life stages (Hill, D. et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[145] 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 could 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

Important habitats for North Dakota's amphibians and reptiles typically consist of wetlands and, in some cases as with the timber rattlesnake, 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 19) could help to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 13.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on North Dakota's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[146]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 13.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

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[145] 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.

[146] See Section 8.2.5, Wetlands, for a discussion of BMPs for wetlands.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur result to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, D. et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Terrestrial invertebrates could 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 North Dakota’s amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula[147]. 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 could 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.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group, shorebirds migrating through North Dakota undertake some of the longest-distance migrations of all animals. North Dakota is located within the Central Flyway. The eastern edge of the Central Flyway is in line with the North Dakota eastern border. Covering the entire state, the Central Flyway spans from the Gulf Coast of Texas to the Canadian boreal forest. According to the Audubon Society, a total of 39 IBAs, providing over 2 million acres of land, have been identified in North Dakota, including breeding ranges[148], migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/riparian[149] areas. These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the eastern half of the state, within Northern Glaciated Plains and the Lake Agassiz Plains. IBAs in North Dakota are mostly prairie and/or wetland communities that are key habitats for many migrating birds. The Turtle Mountains IBA is a unique area to the state and provides woodlands, lakes, and wetlands which provide habitat for the greatest number of species in the state of North Dakota. Other IBAs such as the Lostwood National Wildlife Refuge provides pothole wetlands critical for many breeding migratory birds including piping plover (*Charadrius melodus*) (The Audubon Society, 2015). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in North Dakota. 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 (UND, 2015). 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

147 A location chosen by an animal for hibernation.

148 Breeding range: “The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared” (USEPA, 2015p).

149 Riparian: “Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands” (USEPA, 2015p).

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 (Berven & Grudzien, 1990) (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of North Dakota'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 could affect the overall population of individuals.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as the elk and white-tailed deer, has the potential to negatively affect body condition and reproductive success of mammals in North Dakota. For example, moose 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, D. et al., 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 snapping turtle (*Chelydra serpentina*) leaves its breeding pool in the spring and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. North Dakota maintains a list of prohibited animals (NDCC 48-12-01.1-02), which includes raccoons, skunks, and any animal deemed to be “a significant threat to human or animal health in North Dakota.”

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 North Dakota’s wildlife are described below.

Terrestrial Mammals

In North Dakota, feral swine could adversely impact several native large and small mammals, including bear, turkey, waterfowl, and deer (West, Cooper, & Armstrong, 2009). They feed on reptiles and amphibians, destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans.

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. 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.

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. No invasive birds are regulated in North Dakota; although non-native birds are known to occur there. For example, some non-native birds could impact native birds by causing nest abandonment or impacts to rearing young due to aggressive behavior. 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. Although 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 North Dakota; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and could threaten native wildlife by competing with them for food sources and also spread disease.

"Although FirstNet 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 reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers during deployment operations"

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects pose a large threat to forest and agricultural resources. Species such as the gypsy moth (Lymantria dispar dispar), Asian longhorn beetle (Anoplophora glabripennis), and emerald ash borer (Agrilus planipennis) represent emerging concerns in the region (NDSU, 2014). Currently, there are no established invasive insect populations in North Dakota; however, several invasive species may be found in bordering states. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance could 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 (see Chapter 19) would help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. 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 and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife (see Section 13.2.4, 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 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/or 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, or SOWs could result in direct injury/mortalities to wildlife on roadways from vehicular movement. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. Deployment of drones, balloons, blimps, or 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. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, 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. Chapter 19, BMPs and Mitigation Measures provides 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 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 have less than significant impacts. Chapter 19, BMPs and Mitigation Measures provides 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.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Chapter 19, BMPs and Mitigation Measures provides 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 could vary greatly among species and geographic region. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.6.4, Terrestrial Wildlife.

13.2.6.3. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in North Dakota are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012d).

Based on the impact significance criteria presented in Table 13.2.6-1, 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 disturbances 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 to sensitive aquatic habitats could 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 13.2.4, 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 could 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 could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to fisheries 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 that support

fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs and mitigation measures are not implemented.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, 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 shore to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats.

However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. 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. 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 significant due to the small scale of deployment activities and the limited number of aquatic species expected to be impacted. Chapter 19, BMPs and Mitigation Measures provides 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 that might include accidental spills from maintenance equipment or pesticide runoff near fish habitat are anticipated to result in less than significant effects to fisheries and aquatic habitats due to the limited nature of such activities and the likely small quantities of potentially harmful liquids used.

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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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

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 could vary greatly among species and geographic region. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.6.5, Fisheries and Aquatic Habitats.

13.2.6.4. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in North Dakota 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. Chapter 19, BMPs and Mitigation Measures provides 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.

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 13.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 13.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristics	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 Characteristics	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.	

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 13.2.6-2, 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, fish, invertebrates, and plants with known occurrence in North Dakota are described below.

Terrestrial Mammals

Direct mortality or injury to the federally listed Northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to this species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015p).

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Birds

Two endangered and two threatened bird species are federally listed for North Dakota. The least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and whooping crane (*Grus americana*) occur along riverine habitats, lakes and wetlands. 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, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Fish

The federally listed pallid sturgeon (*Scaphirhynchus albus*) occurs in the Missouri River throughout North Dakota. Direct mortality or injury to the endangered pallid sturgeon species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action but 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. Chapter 19, BMPs and Mitigation Measures provides 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.

Reptiles and Amphibians

No federally listed amphibians or reptiles would be affected by the Proposed Action in North Dakota. Therefore, no injury or mortality effects to federally threatened and endangered reptiles or amphibian species are expected as a result of the Proposed Action.

Invertebrates

Two federally listed terrestrial invertebrate species (*Hesperia dacotae* and *Oarisma poweshiek)* occur in North Dakota. The Dakota Skipper (*Hesperia dacotae*) occurs in prairies throughout North Dakota. The Poweshiek Skipperling (*Oarisma poweshiek*) occurs in prairies and meadows in the southeastern corner of North Dakota. 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. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Plants

One threatened plant species is federally listed for North Dakota. The western prairie fringed orchid (*Platanthera praeclara*) occurs within prairies and bogs in the southeastern corner of North Dakota. Direct mortality to the federally listed plant 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 this species is limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

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 could affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, fish, invertebrates, and plants with known occurrence in North Dakota 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. Chapter 19, BMPs and Mitigation Measures provides 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.

Birds

The least tern utilizes sandbars and islands as breeding areas along the Missouri and Yellow Stone Rivers in North Dakota (USFWS, 1990). Nesting of piping plovers often occurs in palustrine wetlands[150] in the Northern Great Plains (USFWS, 2003). The majority of FirstNet deployment activities would not occur on beaches; therefore, impacts to these bird species are not anticipated. Noise, light, or human disturbance within nesting areas could cause nesting birds to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Fish

Deployment activities in the Missouri River resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 13.2.4, Water Resources, for a discussion of potential impacts to water resources). Impacts to reproduction for the endangered pallid sturgeon 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. Chapter 19, BMPs and Mitigation Measures provides 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.

Invertebrates

Impacts to food supplies for the two federally listed butterflies could result in reduced survival and reproduction. Deployment activities are not expected to cause changes to water quality that could result in impacts. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation

[150] Palustrine wetlands: "Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens" (USEPA, 2015p).

Measures provides 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.

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, fish, invertebrates, and plants with known occurrence in North Dakota are described below.

Mammals

Noise associated with the installation of cables could affect mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

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 has been found to fly up to 9,300 miles from their breeding and wintering sites and often return to the same stopover sites year and after year in North Dakota. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in adverse effects to federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the pallid sturgeon. Further, increased human disturbance, noise, and vessel traffic could cause stress to the pallid sturgeon causing them to abandon spawning locations or alter migration patterns. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Invertebrates

Disturbances to food sources including harebell, wood lily, smooth camas, and purple coneflower, especially during the breeding season, in areas known to have Dakota skipper butterflies could impact survival. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

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 North Dakota do not have critical habitat in the state.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in North Dakota. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

No designated critical habitat occurs for birds in North Dakota. 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

No designated critical habitat occurs for fish in North Dakota. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

The Dakota skipper was granted designated critical habitat in 2015 (*80 FR 59247 59384, October 1, 2015*) within Brookings, Day, Deuel, Grant, Marshall, and Roberts Counties, North Dakota (USFWS, 2015e). Habitat for the butterfly includes bluestem prairies and dry upland prairies. The Poweshiek skipperling was granted designated critical habitat in 2015 (*80 FR 59247 59384, October 1, 2015*). Critical habitat in North Dakota includes Richland County in the southeastern corner of the state (USFWS, 2015e). Habitat for the butterfly includes tallgrass dry to wet prairies, moist meadows, grassy lake and stream beds, and sedge meadows. Land clearing, excavation activities, and other ground disturbing activities in these regions of North Dakota could lead to habitat loss or degradation, which could lead to adverse effects to the two federally listed butterflies depending on the duration, location, and spatial scale of the associated activities. BMPs and mitigation measures as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures provides 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.

Plants

No designated critical habitat occurs for plants in North Dakota. 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 effects 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 effect to may affect, but not likely to adversely affect depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on 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 effect on 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 have no effect on threatened or endangered species 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 affect protected species, it is anticipated that this activity would have no effect on protected species.

Activities that May Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of effects 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 – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 12.2.4, 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.

- 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 effects 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.
- 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 effects 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 the shore to accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 13.2.4, 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 affect 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, blimps, or piloted aircraft could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely adversely affect protected species as FirstNet activities are generally expected to be small-scale in nature. These impacts may affect, but are anticipated to not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect, threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures, provides 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.

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. Chapter 19, BMPs and Mitigation Measures, provides 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 effects 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 effects 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. Chapter 19, BMPs and Mitigation Measures, provides 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 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. Chapter 19, BMPs and Mitigation Measures, provides 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 effects on 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 13.1.6.6, Threatened and Endangered Species and Species of Concern.

13.2.7. Land Use, Recreation, and Airspace

13.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.7.2. 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 13.2.7-1. As described in Section 13.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 13.2.7-1: 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

13.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 13.2.7-1, 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 13.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scale; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

Access to public or private recreation land or activities could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 13.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Enjoyment of recreation land could be temporarily impacted by crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 13.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on tower locations. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 13.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage as drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period of time, FirstNet would not impact airspace resources.

13.2.7.4. 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 rights-of-way.
    - <u>Land Use:</u> See *Activities Likely to Have Impacts* below.
    - <u>Recreation:</u> See *Activities Likely to Have Impacts* below.
    - <u>Airspace:</u> 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*.
  - 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.
    - <u>Land Use:</u> 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.
    - <u>Recreation:</u> See *Activities Likely to Have Impacts* below.
    - <u>Airspace:</u> 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*.
  - 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.
    - <u>Land Use:</u> See *Activities Likely to Have Impacts* below.

- Recreation: See *Activities Likely to Have Impacts* below.
- Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.

- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 13.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities Likely to Have Impacts* below.

        - Recreation: See *Activities Likely to Have Impacts* below.
        - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*.

- Wireless Projects
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building
        - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
        - Recreation: See *Activities Likely to Have Impacts* below.
        - Airspace: See *Activities Likely to Have Impacts* below.
- Deployable Technologies
    - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
        - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
        - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
        - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet AGL or do not trigger any of the other FAA obstruction to airspace criteria.
- 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 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) ROWs or easements and the potential construction of access roads.
        - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
        - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment

phase. Small reductions to visitation during the deployment phase may be anticipated.

- Airspace: No impacts are anticipated – see previous section.

- New Build – Submarine Fiber Optic Plant: Installing cables in bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: Deployment 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 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 other criteria. 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 North Dakota'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 North Dakota airports. 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. Chapter 19, BMPs and Mitigation Measures provides 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 because there would be no ground disturbance, no airspace activity, and no access restrictions to recreational lands. 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 13.2.8, 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.7.5. 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 if deployment occurs in areas with compatible land uses. While a single deployable technology may have an insignificant 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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.7, Land Use, Recreation, and Airspace.

13.2.8. Visual Resources

13.2.8.1. Introduction

This section describes potential impacts to visual resources in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 13.2.8-1. As described in Section 13.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 13.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character.	Effect that is potentially significant, but with mitigation is less than significant.	Intermittently noticeable change in aesthetic character that is marginally negative.	No visible effects.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase.	Transient or no visible effects.
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Effect that is potentially significant, but with mitigation is less than significant.	Lighting alters night-sky conditions to a degree that is only intermittently noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase.	Transient or no visible effects.

NA = Not Applicable

13.2.8.3. 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 North Dakota, residents and visitors travel to visit the Theodore Roosevelt National Park and other areas around the state for scenic vistas and recreational activities. 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. 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 13.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects could be considered potentially significant.

Based on the impact significance criteria presented in Table 3.2.8 1, lighting that illuminates the night sky, 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, although potentially minimized to less than significant with implementation of BMPs and mitigation measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, BMPs and Mitigation Measures, provides 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. Potential

Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of 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 bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a NPS unit or other sensitive area. If new

towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lighting.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a list 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 BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.8.4. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 19, BMPs and Mitigation Measures provides 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.

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 13.1.8, Visual Resources.

13.2.9. Socioeconomics

13.2.9.1. Introduction

This section describes potential impacts to socioeconomics in North Dakota associated with deployment and operation of the Proposed Action and alternatives. Chapter 19, BMPs and Mitigation Measures, provides 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.

13.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 13.2.9-1. As described in Section 13.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 13.2.9-1: 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	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

13.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts Related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values 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 across North Dakota. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $170,000 in the greater Dickinson area, to below $90,000 in the Devils Lake and Valley City areas. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to Changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and partners 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 user to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's 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 gains 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 North Dakota. The average unemployment rate in 2014 was 2.8 percent, considerably lower than the national rate of 6.2 percent. Most counties in the state had unemployment rates below the national average (that is, better employment performance). Only two counties in the north-central part of North Dakota had unemployment rates above 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 13.2.9-1 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.

13.2.9.4. 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 13.2.9-1.

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 summarizes how 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; and
- 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., parked vehicles in new parking lots), 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. Chapter 19, BMPs and Mitigation Measures provides 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 (the literature is not clear on this subject), 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 District. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.9.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant as described above. Chapter 19, BMPs and Mitigation Measures provides 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 District. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.9, Socioeconomics.

13.2.10. Environmental Justice

13.2.10.1. Introduction

This section describes potential impacts to environmental justice in North Dakota associated with deployment and operation of the Proposed Action and alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 13.2.10-1. As described in Section 13.2, 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.

Table 13.2.10-1: 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

13.2.10.3. Description of Environmental Concerns

Effects associated with other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). See Socioeconomics Environmental Consequences for additional discussion. The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 13.2.9).

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 13.1.10.4) as having moderate or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 13.1.10.3, Environmental Setting: Minority and Low-Income Populations, North Dakota's population has considerably lower percentages of minorities than the region or the nation, and considerably lower rates of poverty than the region or nation. The relatively few areas with high potential for environmental justice populations are fairly evenly distributed across the state. They occur within the largest population concentrations and in the sparsely populated regions of the state. Areas with moderate potential for environmental justice populations are larger in number and are also fairly evenly distributed across North Dakota. Further analysis using the data developed for the screening analysis in Section 13.1.10.4, Environmental Justice Screening Results, may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015e) (USEPA, 2016e).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts could 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.

13.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any

surrounding communities. Therefore, they would not affect environmental justice communities.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice communities, it is anticipated that this activity would have no impact on environmental justice issues.

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 onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise, and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. Chapter 19 BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.10.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.10, Environmental Justice.

13.2.11. Cultural Resources

13.2.11.1. Introduction

This section describes potential impacts to cultural resources in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 13.2.11-1. As described in Section 13.2, 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 13.2.11-1: 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 Area of Potential Effects (APE) are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

13.2.11.3. 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 13.2.11-1, 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, since archaeological sites and historic properties are present throughout North Dakota, some deployment activities may occur in deployment areas, in which case BMPs would help avoid or minimize the potential impacts. Chapter 19, BMPs and Mitigation Measures, provides 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.

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 could be avoided or minimized through BMPs. Chapter 19, BMPs and Mitigation Measures, provides 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.

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

American Indians. It is anticipated that FirstNet would identify potential impacts to such areas through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

13.2.11.4. 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 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 cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources where there potential to contain archaeological sites. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits tend to be associated with bodies of water and have high probabilities for archaeological deposits), and the associated structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas, such as Fargo, that have larger numbers of historic public buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment 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 Chapter 19, BMPs and Mitigation Measures provides 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 effect but would not likely adversely effect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.11.5. 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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 13.1.11, Cultural Resources.

13.2.12. Air Quality

13.2.12.1. Introduction

This section describes potential impacts to North Dakota's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on North Dakota's air quality were evaluated using the significance criteria presented in Table 13.2.12-1. As described in Section 13.2, 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.

Table 13.2.12-1: Impact Significance Rating Criteria for North Dakota

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

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 North Dakota's air quality addressed in this section are presented as a range of possible impacts.

13.2.12.3. 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 unpredictable 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. No areas exist in North Dakota that are in maintenance or nonattainment for one or more criteria pollutants (see Section 13.1.12, Air Quality and Figure 13.1.12-2).

13.2.12.4. 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-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 Potential Impacts to 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 bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If 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. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.12.5. 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 on ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

13.2.13. Noise

13.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in North Dakota. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 13.2.13-1. As described in Section 13.2, 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 North Dakota addressed in this section are presented as a range of possible impacts.

Table 13.2.13-1: 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.

13.2.13.3. 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 13.2.13-1, 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.

13.2.13.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment 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 increase 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 bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.13.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 19, BMPs and Mitigation Measures provides 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. Chapter 19, BMPs and Mitigation Measures provides 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 on ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

13.2.14. Climate Change

13.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in North Dakota associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.14.2. 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 13.2.14-1. As described in Section 9.2, 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 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, 2015g), 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 13.2.14-1: 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 greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA= Not Applicable

13.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. For an average of seven days per year, maximum temperatures reach more than about 95 °F in the Northern Plains. These high temperatures are projected to occur much more frequently with days over 100 °F projected to double in number in the Northern Plains even in a low emissions scenario. Increases are also expected in the number of nights with minimum temperatures higher than 60 °F in the north part of the plains. These increases in extreme heat will have many negative consequences, including increases in surface water losses, heat stress, and demand for air conditioning. (USGCRP, 2014a)

Air Temperature

Figure 13.2.14-1 and Figure 13.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for North Dakota from a 1969 to 1971 baseline.

Dfb – Figure 13.2.14-1 shows that by mid-century (2040 to 2059), temperatures under a low emissions scenario would increase by approximately 4 °F for the majority of the Dfb region of North Dakota and by 5 °F in the eastern portion of the state. By the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of North Dakota would increase by approximately 6 °F. (USGCRP, 2009)

Figure 13.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F for the entire state of North Dakota. Under a high emissions scenario for the period (2080 to 2099) in the Dfb region, temperatures would increase by approximately 9 °F in certain portions of the region and by 10 °F in other portions of the region. (USGCRP, 2009)

Dwb – Temperatures in this region are expected to increase by mid-century (2040 to 2059) under a low emissions scenario by approximately 4 °F, and by the end of the century (2080 to 2099) temperatures under a low emissions scenario will increase at the same rate as the Dfb region. (USGCRP, 2009)

Under a high emissions scenario by mid-century temperatures are projected to increase at the same rate as the Dfb region of North Dakota, and by the end of the century temperatures are expected to increase by approximately 9 °F. (USGCRP, 2009)

Bsk – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Dwb region under both low and high emissions scenarios. (USGCRP, 2009)

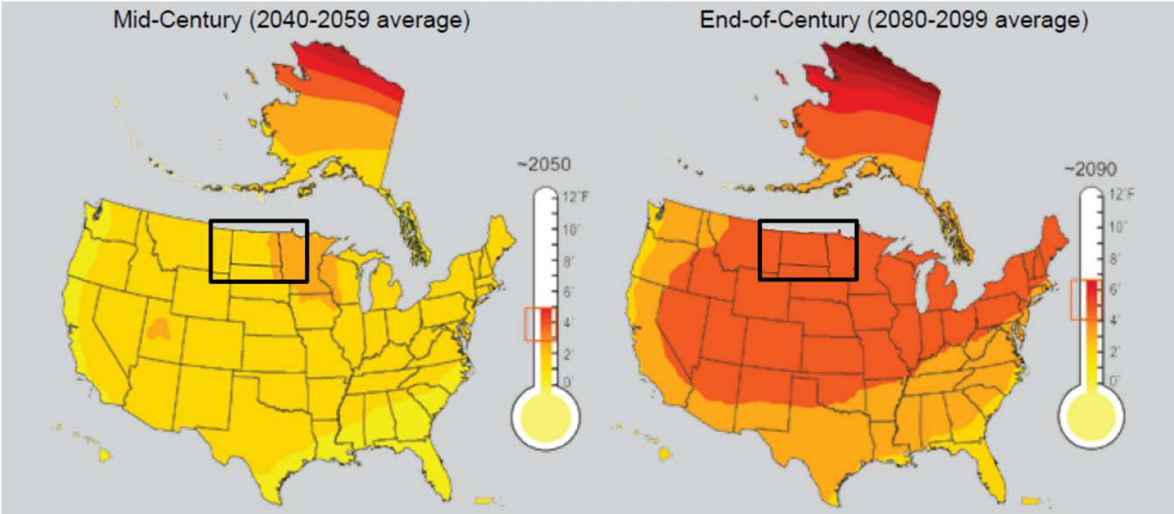

Figure 13.2.14-1: North Dakota Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

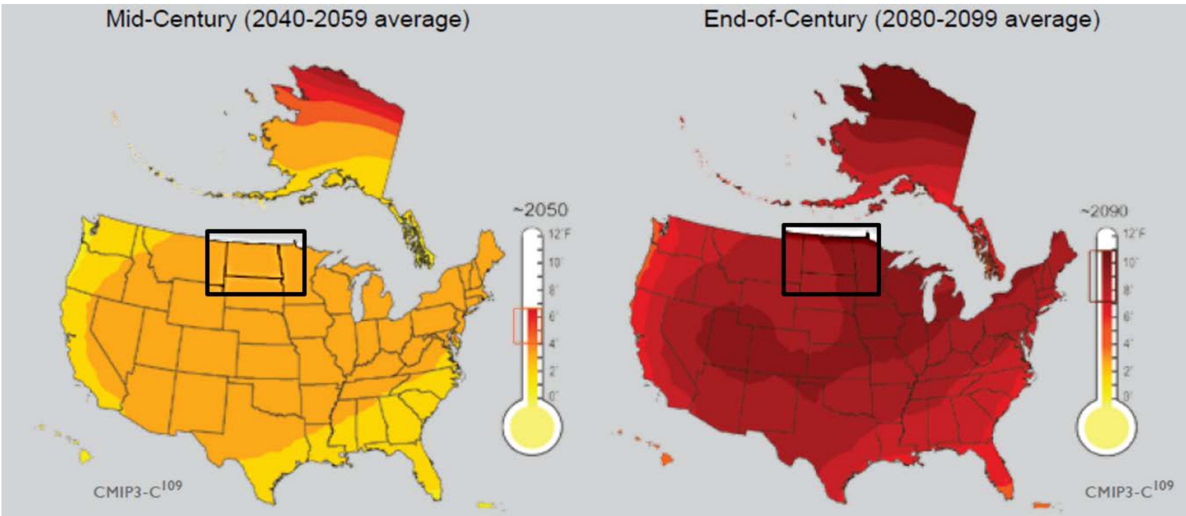

Figure 13.2.14-2: North Dakota High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

Winter and spring precipitation is projected to increase in the northern states of the Great Plains region relative to a 1971-2000 average. In central areas, changes are projected to be small relative to natural variations. Projected changes in summer and fall precipitation are also small except for summer drying in the central Great Plains. The number of days with heavy precipitation is expected to increase by mid-century, especially in the Northern Plains. (USGCRP, 2014a)

Total seasonal snowfall has generally increased in the northern Great Plains although snow is melting earlier in the year and more precipitation is falling as rain versus snow. Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow spends on the ground. (USGCRP, 2014c)

In the eastern portion of North Dakota there is an expected decrease in the number of consecutive dry days while the rest of the state will have an increase in these numbers under a low emissions scenarios by mid-century (2041 to 2070) as compared to the period (1971 – 2000). Under a high emissions scenario, the majority of the state is projected to have an increase in the number of consecutive dry days. An increase in consecutive dry days can lead to drought. (USGCRP, 2014a)

Figure 13.2.14-3 and Figure 13.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 13.2.14-3 show seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 13.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014b)

Dfb **–** Figure 13.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and spring for the entire state of North Dakota. However, there are no expected increases in precipitation in summer or fall other than fluctuations due to natural variability in the entire state of North Dakota. (USGCRP, 2014b)

Figure 13.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 30 percent over the period 2071 to 2099. In summer, precipitation in this scenario could decrease as much as 10 percent in the entire state. No significant change to fall precipitation is anticipated over the same period depending on the portion of the region while some other portions of the region can expect a 10 percent increase in fall precipitation. (USGCRP, 2014b)

Dwb **–** Precipitation changes for the Dwb region are consistent with projected changes for the Dfb region of North Dakota in both low and high GHG emissions scenarios, with the exception of fall under a high emissions scenario in which there are no anticipated changes in precipitation. (USGCRP, 2014b)

Bsk **–** Precipitation changes for the Bsk region are consistent with projected changes for the Dfb region of North Dakota in both low and high emissions scenarios. (USGCRP, 2014b)

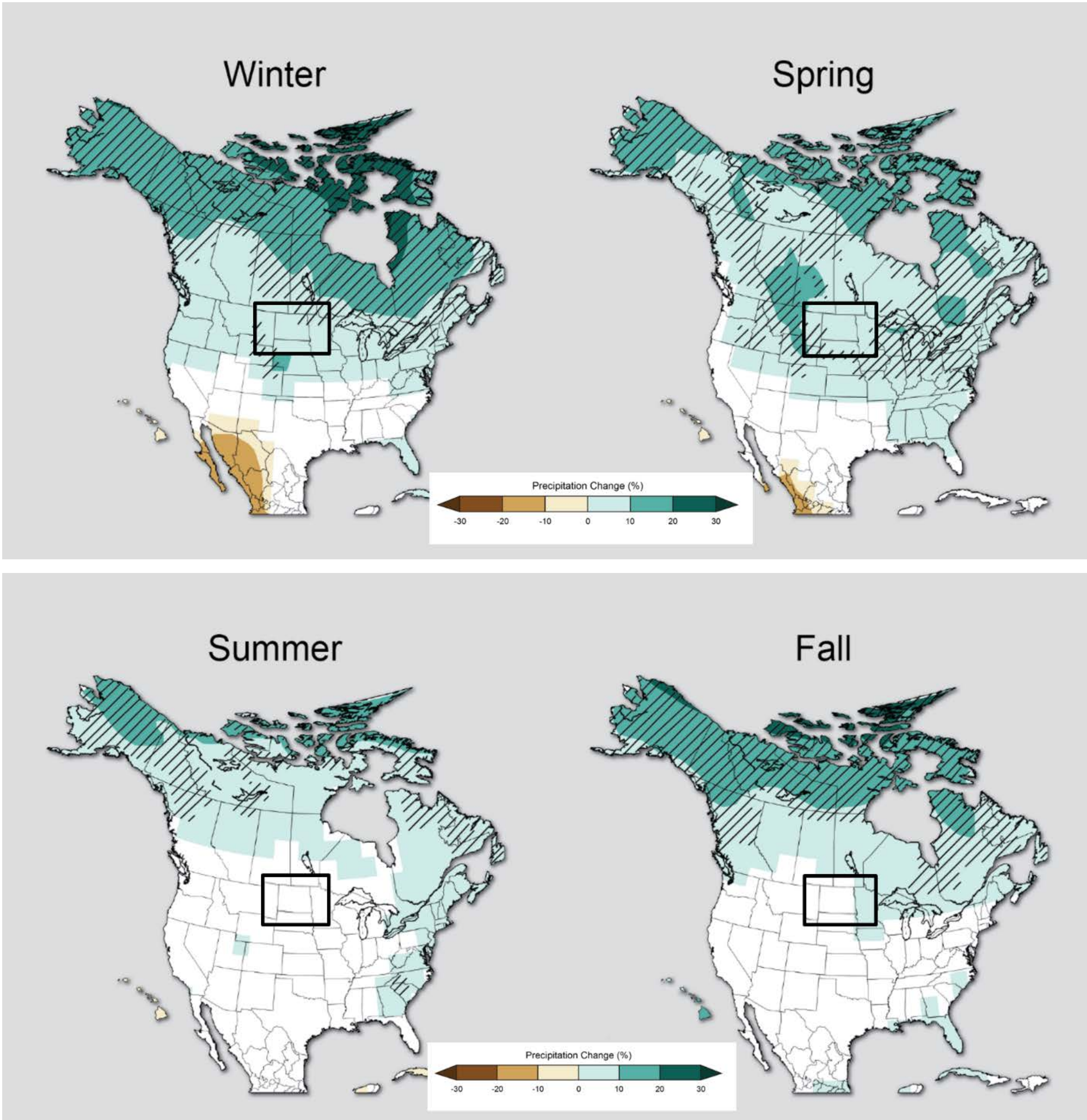

Figure 13.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

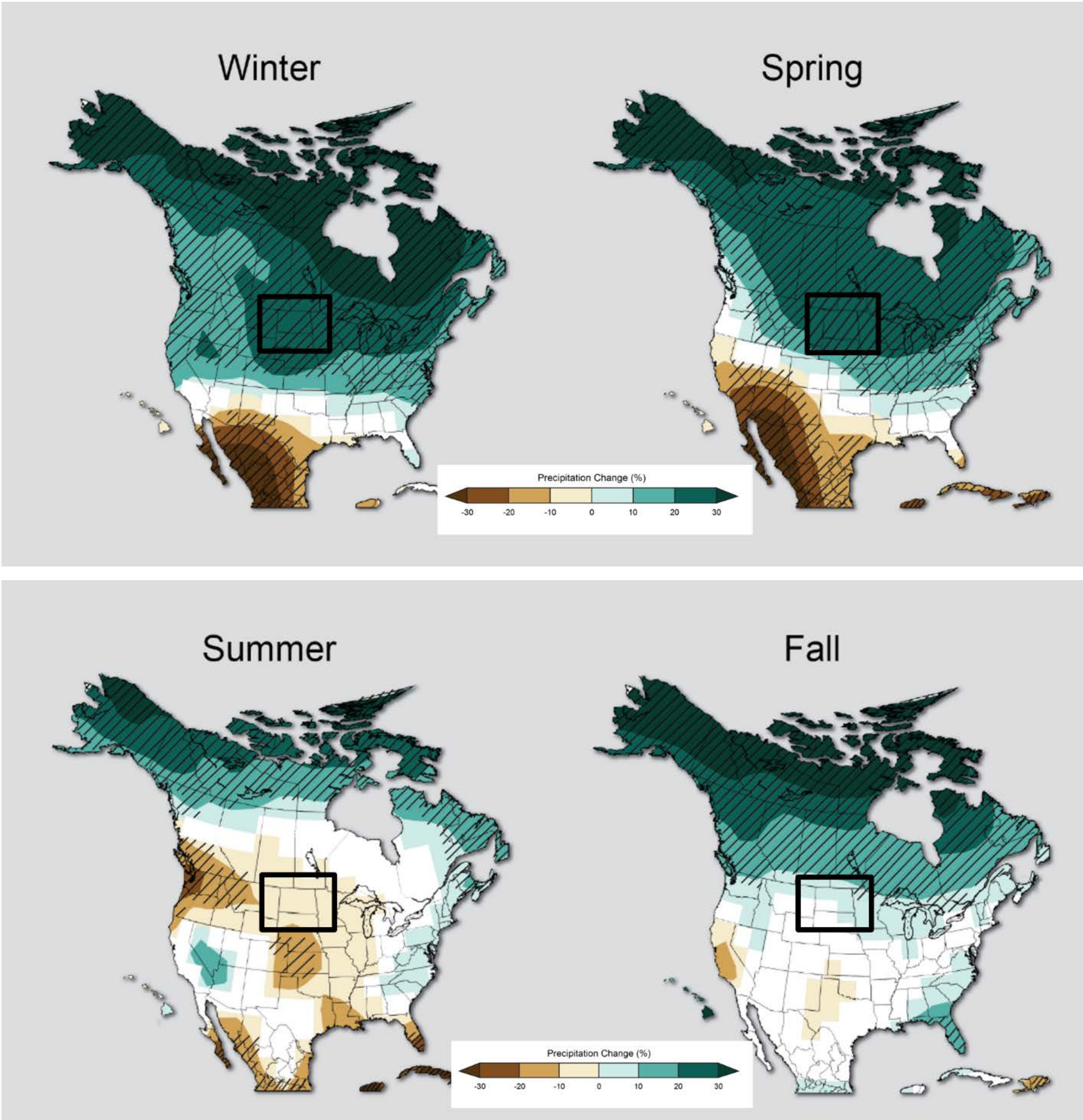

Figure 13.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as winter storms and thunderstorms. Trends in thunderstorms are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change. (USGCRP, 2014c)

13.2.14.4. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 13.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Diesel Service & Supply, 2016). Diesel fuel combustion emits 22.38 lbs. of CO_2 per gallon (EIA, 2015e). A 60kW transmitter running on a generator would therefore be responsible for 1.35 tons of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than onsite provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs/MWh (USEPA, 2015n), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters

(Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

The frequency of flooding events throughout the Great Plains is projected to increase, negatively impacting soil quality, and productivity through erosion. Longer and more intense droughts are also projected to occur. Both flooding and droughts, together with temperature changes, will negatively affect agriculture in and the overall economy of North Dakota and require adaptive cultivation and livestock management practices (USGCRP, 2014a). Climate change may also negatively impact the habitat of threatened species such as the Sage Grouse (USGCRP, 2014a).

Impact of Climate Change on FirstNet Installations and Infrastructure

Areas of North Dakota already at risk for flooding are vulnerable as climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash floods (USGCRP, 2014d). Climate change may expose areas of North Dakota to increased intensity and duration of heat waves (USGCRP, 2014d), particularly in areas around population centers such as Fargo that may experience enhanced effects due to the urban heat island effect. North Dakota’s increase in annual temperature over the last 130 years has been the fastest in the U.S. continent, although these increases have taken place mostly in the winter months (USGCRP, 2014a). Extended periods of extreme heat may increase general demand on regional electrical distribution systems in the Great Plains states, and impede the operation of the grid (DOE, 2015), and overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool.

13.2.14.5. 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 North Dakota, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action 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 these activities.

Activities with the 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 engine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However this would be highly dependent on their size, number, and the frequency and duration of their use. Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e., months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. Chapter 19, BMPs and Mitigation Measures provides 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 BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

13.2.14.6. 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.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. These activities are expected to be less than significant due to the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

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. 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. If there are no permanent structures, particularly near coastal areas, there would be little to no impacts as a result of sea-level rise. 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 13.1.14 Climate Change.

13.2.15. Human Health and Safety

13.2.15.1. Introduction

This section describes potential impacts to human health and safety in North Dakota associated with deployment of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation

Measures provides 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.

13.2.15.2. 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 13.2.15-1. As described in Section 13.2, 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 13.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed (“regional” assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Man-Made Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

13.2.15.3. 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 13.2.15-1, 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 general public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015b).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[151] 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

[151] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents buildings. (OSHA, 2016b)

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 partners would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partners for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015b). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices e.g., earplugs, muffs, hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure (OSHA, 2015b).

The North Dakota Department of Labor and Human Rights (NDDLHR) is not authorized by OSHA to administer a state program to oversee employee safety in public or private sector workplaces. Therefore, the NDDLHR defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of U.S. 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 13.2.15-1, 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 Cleanups in My Community database and U.S. Department of Interior's (USDOI) Abandoned Mine Lands inventory, the North Dakota Public Service Commission, Abandoned Mine Lands Division, through the NDDH Environmental Health Section, or through an equivalent commercial resource.

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. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and applicable North Dakota state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great, NDDH 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 13.2.15-1, 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 partners would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

13.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure 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 or near bodies of water requires workers to operate over aquatic environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road

traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure, and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, BMPs and Mitigation Measures provides 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 less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, BMPs and Mitigation Measures provides 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.

13.2.15.5. 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 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. Chapter 19, BMPs and Mitigation Measures provides 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 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. Chapter 19, BMPs and Mitigation Measures, provides 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 13.2.15, Human Health and Safety.

ND Appendix A – Water Resources

Table A-1: Characteristics of North Dakota's Watersheds, as Defined by NDDH

Watershed / Size Land Area within MT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Devils Lake Basin (3,842)	Big Coulee Calio Coulee Devils Lake Dry Lake Edmore Coulee Lake Alice Mauvais Coulee Morrison Lake Starkeweather Coulee Stump Lake	• NPS pollution, • Flow alteration and oxygen depletion, • Agricultural operations contaminants, • Discharges from aboveground and underground storage tanks, • Discharges from surface impoundments, • Discharges from large industrial facilities, and • Spills and releases.
James River Basin (6,493)	Bear Creek Beaver Creek Bone Hill Creek Cottonwood Creek James River Jamestown Reservoir Maple River Pipestem Creek Pipestem Reservoir	• NPS pollution, • Flow alteration and oxygen depletion, • Agricultural operations contaminants, • Discharges from aboveground and underground storage tanks, • Discharges from surface impoundments, • Discharges from large industrial facilities, and • Spills and releases.
Missouri River Basin (34,544)	Beaver Creek Cannonball River Cedar Creek Green River Heart River Knife River Lake Oahe Lake Sakakawea Lake Tschida Little Missouri River Little Muddy River Missouri River Painted Woods Creek Square Butte Creek White Earth River	• NPS pollution, • Flow alteration and oxygen depletion, • Agricultural operations contaminants, • Discharges from aboveground and underground storage tanks, • Discharges from surface impoundments, • Discharges from large industrial facilities, and • Spills and releases.
Mouse (Souris) River Basin (8,734)	Cutbank Creek Deep River Des Lacs River Lake Darling Reservoir Long Creek Moose Creek Mouse River Willow Creek Wintering River	• NPS pollution, • Flow alteration and oxygen depletion, • Agricultural operations contaminants, • Discharges from aboveground and underground storage tanks, • Discharges from surface impoundments, • Discharges from large industrial facilities, and • Spills and releases.

Watershed / Size Land Area within MT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Red River Basin (17,100)	Elm River Forest River Goose River Lake Ashatabula Maple River Park River Pembina River Red River Rush River Sheyenne River Tongue River Turtle River Wild Rice River	• NPS pollution, • Flow alteration and oxygen depletion, • Agricultural operations contaminants, • Discharges from aboveground and underground storage tanks, • Discharges from surface impoundments, • Discharges from large industrial facilities, and • Spills and releases

Source: (NDSWC, 2015a), (NRCS, 2007a), (NRCS, 2007b), (State of North Dakota, 2014), (NDSWC, 2014a), (NDDH, 2015r)

ND Appendix B – North Dakota S1 Ranked Terrestrial Communities of Concern in North Dakota

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Bog Birch Willow Prairie Fen	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A shrubland community found on shallow, peat with mineral, alkaline soils. This community often found in tallgrass prairies and adjacent to prairie-forest edge habitat. The shrub layer is dominated by bog birch (*Betula pumila*), shrubby cinquefoil (*Dasiphora fruticosa ssp. floribunda*), meadow willow (*Salix petiolaris*), and sageleaf willow (*Salix candida*). Graminoids and forbs are also present, and may include bluejoint (*Calamagrostis canadensis*), slimstem reedgrass (*Calamagrostis stricta*), woollyfruit sedge (*Carex lasiocarpa*), flat-top goldentop (*Euthamia graminifolia*), Ontario lobelia (*Lobelia kalmii*), and Fraser's marsh St. Johnswort (*Triadenum fraseri*) (Dirk, 2015)(Drake & Faber-Langendoen 2013a).	Found throughout North Dakota.
Bulrush Wet Meadow	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A wet meadow community found on the periphery of slow-moving, meandering, perennial streams and springs and ponds and marshes. The dense herbaceous vegetation layer is dominated by common threesquare (*Schoenoplectus pungens*). Other herbaceous vegetation that may be present includes cosmopolitan bulrush (*Schoenoplectus maritimus*), alkali cordgrass (*Spartina gracilis*), western wheatgrass, Baltic rush (*Juncus balticus*), and common spikerush (*Eleocharis palustris*). Scattered trees and shrubs may be present and include eastern cottonwood (*Populus deltoides*), Fremont's cottonwood (*Populus fremontii*), and willow (Dirk, 2015) (Jones, Schulz, Coles, & Allen, 2006).	Found throughout North Dakota.
Bur Oak Mixedgrass Loam Savanna	Northern Glaciated Plains	A grassland community found on upper slopes of moraine hills, ravines, and river valley slopes on level to hilly glacial till uplands. The tree strata is typically open, with bur oak (*Quercus macrocarpa*) dominating. Scattered shrubs are often present and include western snowberry (*Symphoricarpos occidentalis*), chokecherry (*Prunus virginiana*), Wood's rose (*Rosa woodsii*), and Saskatoon serviceberry (*Amelanchier alnifolia*). The herbaceous layer is dominated by graminoids and often includes Canada wildrye (*Elymus canadensis*), western wheatgrass, bearded wheatgrass (*Elymus caninus*), and marsh muhly (*Muhlenbergia racemosa*). Forbs may also be present in the herbaceous layer and include species such as Canadian anemone (*Anemone canadensis*) and American vetch (*Vicia americana*) (Faber-Langendoen 2001).	Found along the edge of the Turtle Mountains in the north central part of North Dakota.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Great Plains Marl Fen	Lake Agassiz Plain, Northern Glaciated Plains, Northwestern Glaciated Plains	A wetland fen community found in areas with mineral-rich groundwater emerging from glacial till. This community is often found on the peripheral slopes of wetlands and along river valley slopes both of which are saturated throughout the growing season. A defining characteristic of this community is the presence or marl[152]. Common short herbaceous species include fewflower spikerush (*Eleocharis quinqueflora*), needle beaksedge (*Rhynchospora capillacea*), Ontario lobelia (*Lobelia kalmii*), and fen grass of Parnassus (*Parnassia glauca*). Algae species such as *Chara* spp. and taller vegetation such as prairie sedge (*Carex prairea)* may also be present (Dirk, 2015) (Faber-Langendoen 2001).	Found in the western half of North Dakota.
Little Bluestem – Porcupine Grass Dry-Mesic Prairie	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A prairie community found on rocky, south facing slopes, with grasses and forbs on average 9.8 to 19.6 in tall. Dominant grasses include little bluestem, big bluestem, sideoats grama, western wheatgrass, porcupine grass (*Hesperostipa spartea*). Forbs include sensitive brier (*Mimosa nuttallii*), prairie coneflower (*Ratibida columnifera*), groundplum milkvetch (*Astragalus crassicarpus*), and white prairie clover (*Dalea candida var. oligophylla*) among many others. A scattered shrub layer may include western snowberry, soapweed yucca (*Yucca glauca*), and rose (*Rosa* spp.) (Dirk, 2015).	Found throughout North Dakota.
Northern Mesic Big Bluestem Prairie	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A dense grassland community found in the northern tallgrass prairies of the U.S. that provide rich, black soils. Dominant species include grasses such as big bluestem, prairie dropseed (*Sporobolus heterolepis*), porcupine grass, and occasionally Indiangrass. Forbs may also be present, although not dominant, and include leadplant (*Amorpha canescens*), white heath aster (*Symphyotrichum ericoides*), and Canada goldenrod (*Solidago canadensis*) (Dirk, 2015) (Drake et al. 1994).	Found throughout North Dakota.
Northern Plains Big Bluestem Prairie	Northwestern Great Plains	A tallgrass prairie often found on loam to sandy loam soils on lower slopes of landscapes, where rain and snow runoff accumulates on drifts. Tall to medium grasses 2.3 to 4.9 ft (0.7 to 1.5 m) dominate, and include big bluestem, sideoats grama, little bluestem, prairie dropseed, and porcupine grass. Forbs may be present, and include white sagebrush (*Artemisia ludoviciana*), purple coneflower (*Echinacea angustifolia*), and spikeoat (*Helictotrichon hookeri*) may be present, among many others. Also, western snowberry is also present in the shrub layer, but never dominant (Dirk, 2015) (Drake, J., 1996).	Found in northwestern North Dakota.

[152] Marl: "A mix of calcium carbonate, organic matter, and other materials."

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Northern Plains Transition Bluestem Prairie	Northern Glaciated Plains, Northwestern Glaciated Plains	A tallgrass prairie community found on upper slopes of knolls on gently sloping hillsides with deep, well-drained, loamy soils. Dominant species in the community include big bluestem, Kentucky bluegrass (*Poa pratensis*), needleleaf sedge (*Carex duriuscula*), blue lettuce (*Lactuca tatarica var. pulchella*), sideoats grama, and little bluestem (Dirk, 2015) (Faber-Langendoen 1995b).	Found in the northern part North Dakota.
Northern Water Sedge Wet Meadow	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A wet meadow community usually found in depressional areas near ponds, lakes, streams, or rivers, with mineral soils and marginally saline water. Graminoids dominate this community, including water sedge (*Carex aquatilis*), beaked sedge (*Carex rostrata*), hairy sedge (*Carex lacustris*), and upright sedge (*Carex stricta*). Other species that may be present include common spikerush, bulrush (*Schoenoplectus* spp.), and cattails (*Typha* spp.) (Dirk, 2015).	Found throughout North Dakota.
Northern Sedge Poor Fen	Lake Agassiz Plains	A saturated fen community found in peatlands, including basic fens, wet areas at higher elevations but adjacent to flooded areas, and larger peatlands. Graminoids dominate this community and include creeping sedge (*Carex chordorrhiza*), mud sedge (*Carex limosa*), few-seeded sedge (*Carex oligosperma*), white beaksedge (*Rhynchospora alba*), tufted bulrush (*Trichophorum caespitosum*), and rannoch-rush (*Scheuchzeria palustris*). Forbs may also be present and include dragon's mouth (*Arethusa bulbosa*) and northern bog aster (*Symphyotrichum boreale*) among many others. The shrub layer includes bog birch and pussy willow (*Salix discolor*) among many others. The moss layer is present throughout this community and dominant species include northern peatmoss (*Sphagnum capillifolium*), brown peatmoss (*Sphagnum fuscum*), and midway peatmoss (*Sphagnum magellanicum*) (Dirk, 2015) (Drake, J.; Faber-Langendoen, D., 2013).	Found in the Great Lakes Region in eastern North Dakota.
Northern Wet-Mesic Tallgrass Prairie	Northern Glaciated Plains, Northwestern Glaciated Plains, Northwestern Great Plains, Lake Agassiz Plains	A grassland, prairie community with wet loamy to silty-loam soils. Tall grasses dominate this association, with big bluestem and switchgrass frequently present. Other species associated include bluejoint, slimstem reedgrass, prairie cordgrass, and mat muhly (*Muhlenbergia richarsonis*) (Dirk, 2015)(Faber-Langendoen 1995c).	Found throughout North Dakota.

Vegetative Community Type	USEPA Ecoregion(s)	Description	Distribution
Rough Fescue-Bluebunch Wheatgrass Mixedgrass Prairie	Northwestern Glaciated Plains, Northwestern Great Plains	A prairie community found in the Great Plains on loamy soils of areas of steep slopes but with level topography at elevations of 2,700 to 6,200 ft. Rough fescue (*Festuca campestris*) is the dominant species with bluebunch wheatgrass (*Pseudoroegneria spicata*) being second-most abundant and an characteristic species that differentiates this communities. Idaho fescue (*Festuca idahoensis*) is also common in this community. Forbs may also be present and include hairy false goldenaster (*Heterotheca villosa*), dotted blazing star (*Liatris punctata*), and silky lupine (*Lupinus sericeus*). Shrub layer species may include prairie sagewort (*Artemisia frigida*) and broom snakeweed (*Gutierrezia sarothrae*) (Dirk, 2015) (Drake, Schulz, & Kittel, 2013).	Found in northwestern North Dakota.

% = percent, in. = inches, ft. = feet

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AML	Abandoned Mine Lands
ANS	Aquatic Nuisance Species
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CCD	Common Core of Data
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH^4	Methane
CIMC	Cleanups in My Community
CIO	Chief Information Officer
CO	Carbon Monoxide
CO^2	Carbon Dioxide
COLT	Cell On Light Trucks
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
CWS	Community Water Systems
DAQ	Division of Air Quality
DOE	Department of Energy
DWSRF	Drinking Water State Revolving Fund
EDACS	Enhanced Digital Access System
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency

Acronym	Definition
FGDC	Federal Geographic Data Committee
FHWA	Federal Highways Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FRA	Federal Railroad Administration
FTA	Federal Transit Authority
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GAO	Government Accountability Office
GAP	Gap Analysis Program
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	International Birding Area
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
ITD	Information Technology Department
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LID	Low Impact Development
LMR	Land Mobile Radio
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MDI	Methylene Diphenyl Diisocyanate
MHI	Median Household Income
MLRA	Major Land Resource Areas
MOA	Memorandum of Agreement
MMT	Million Metric Tons
MSFCMA	Magnuson-Stevens Fisheries Conservation Management Act
MSL	Mean Sea Level
MT	Million Tons
MYA	Million Years Ago
N_2O	Nitrous Oxide
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
ND	North Dakota
NDAAQS	North Dakota Ambient Air Quality Standards
NDAC	North Dakota Administrative Code / North Dakota Aeronautics Commission
NDCC	North Dakota Century Code
NDDA	North Dakota Department of Agriculture
NDDES	North Dakota Department of Emergency Services
NDDLHR	North Dakota Department of Labor and Human Rights
NDDOT	North Dakota Department of Transportation
NDGFD	North Dakota Game and Fish Department
NDPDES	North Dakota Pollutant Discharge Elimination System

Acronym	Definition
NDPRD	North Dakota Parks and Recreation Department
NDSWC	North Dakota State Water Commission
NEPA	National Environmental Policy Act
NESCA	Nongame and Endangered Species Conservation Act
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NIH	National Institute of Health
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NNL	National Natural Landmarks
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices To Airmen
NOX	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTIA	National Telecommunications and Information Administration
NTFI	National Task Force On Interoperability
NTNC	Non-Transient Non-Community
NWI	National Wetlands Inventory
NWR	National Wildlife Refuges
NWS	National Weather Service
OCIO	Office of the Chief Information Officer
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
ORION	Omaha Regional Interop Network
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
PGA	Peak Ground Acceleration
PM	Particulate Matter
POP	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetland
PTC	Permit to Construct
PTO	Permit to Operate
PUB	Palustrine Unconsolidated Bottom
R&D	Research and Development
RACOM	Radio Communications

Acronym	Definition
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROW	Right-of-Way
SAA	Sense and Avoid
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF^6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO^2	Sulfur Dioxide
SO^3	Sulfur Trioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SOX	Oxides of Sulfur
SPL	Sound Pressure Level
SRS	Statewide Radio System
SUA	Special Use Airspace
SWPPP	Storm Water Pollution Prevention Plan
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TNC	Transient Non-Community Systems
TPY	Tons Per Year
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
USNVC	U.S. National Vegetation Classification System
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
WCS	Wetlands Classification Standard
WMA	Wildlife Management Areas
WMD	Wetland Management District
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WPA	Works Progress Administration
WWI	World War I
WWII	World War II

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