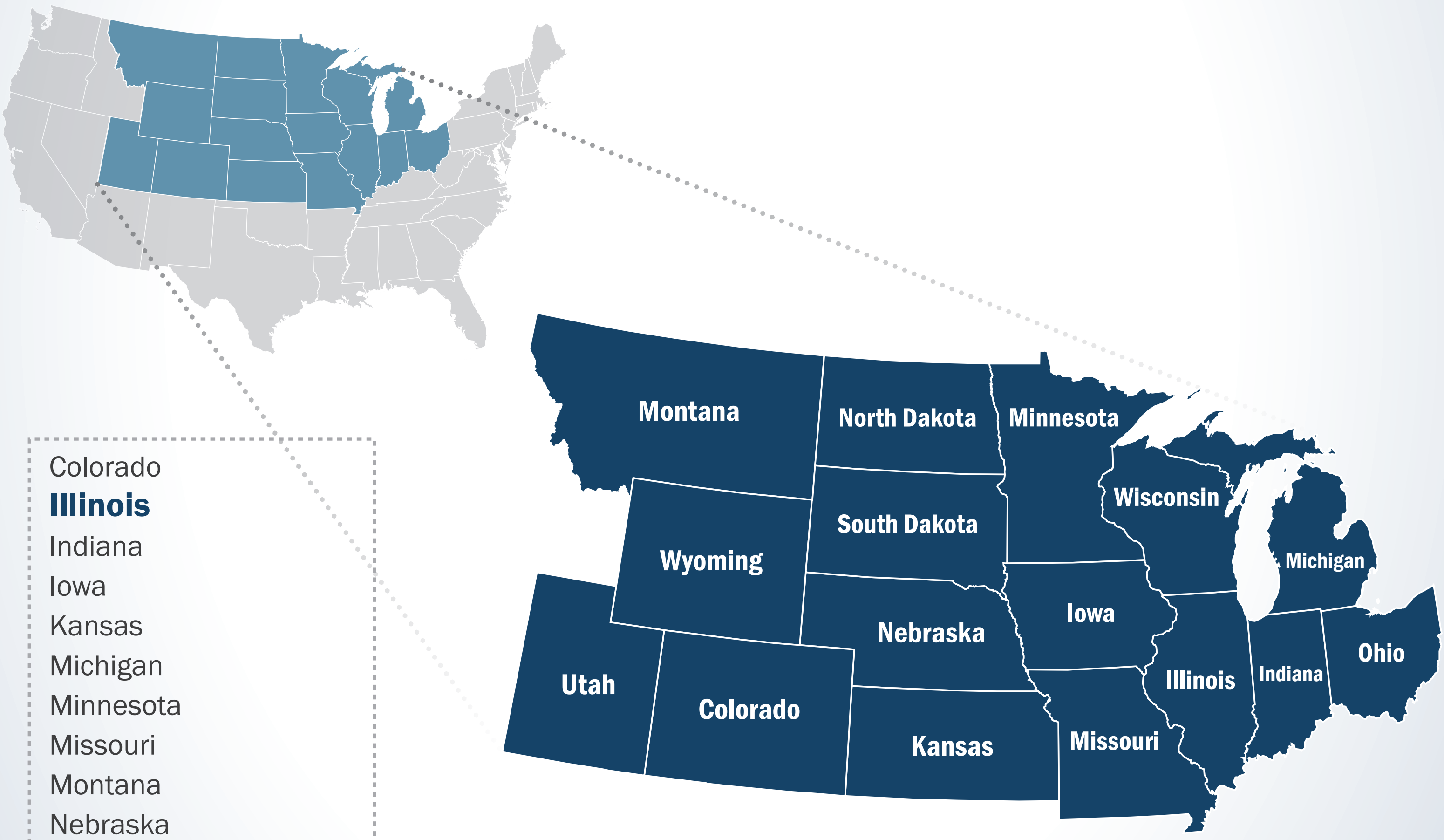
Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 2 - CHAPTER 4



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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 2 - CHAPTER 4

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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

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4 ILLINOIS

American Indian tribes with a rich cultural history lived in what is now the state of Illinois for centuries before the 1600s. The first European settlers to come to Illinois were Jesuit priests and missionaries who hoped to spread Christianity to the New World. Illinois became a U.S. territory in 1787 and the 21st state in 1818 (State of Illinois, 2014a). Located in the central region of the United States, Illinois is bordered by Wisconsin to the north, Indiana and Lake Michigan to the east, Iowa and Missouri to the west, and Kentucky to the south. This chapter provides details about the existing environment of Illinois as it relates to the Proposed Action.

General facts about Illinois are provided below:

- **State Nickname**: Land of Lincoln
- **Land Area:** 55,519 square miles; **U.S. Rank**: 25 (U.S. Census Bureau, 2010)
- **Capital:** Springfield
- **Counties:** 102 (U.S. Census Bureau, 2015a)
- **2015 Estimated Population:** 12,859,995 million people; **U.S. Rank (2009):** 5 (U.S. Census Bureau, 2015a)
- **Most Populated Cities:** Chicago, Aurora, and Rockford (U.S. Census Bureau, 2015a)
- **Main Rivers:** Big Muddy River, Des Plaines River, Edwards River, Embarras River, Fox River, Green River, Illinois River, Kaskaskia River, Little Wabash River, Mississippi River, Ohio River, Rock River, Sangamon River, Spoon River, and Wabash River (Geology.com, 2016)
- **Bordering Waterbodies:** Mississippi River, Ohio River, Wabash River, and Lake Michigan (Illinois State Water Survey, 2016a)
- **Mountain Ranges:** None
- **Highest Point:** Charles Mound (1,235 ft.) (USGS, 2016a)

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4.1 AFFECTED ENVIRONMENT

4.1.1 Infrastructure

4.1.1.1 Definition of the Resource

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

Section 4.1.1.3 provides an overview of the traffic and transportation infrastructure in Illinois, including road and rail networks and airport facilities. Illinois 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 20121 (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 Illinois are presented in more detail in Section 4.1.1.4. Section 4.1.1.5 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Illinois. An overview of utilities in Illinois, such as power, water, and sewer, are presented in Section 4.1.1.6.

4.1.1.2 Specific Regulatory Considerations

Table 4.1.1-1 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. Code [U.S.C.] § 1401(26)).

Table 4.1.1-1: Relevant Illinois Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Illinois Compiled Statutes (ICS): Chapter 20 Executive Branch; Chapter 420 Nuclear Safety; Chapter 430 Public Safety: Illinois Accessibility Code (IAC): Title 29 Emergency Services, Disasters, and Civil Defense	Illinois Emergency Management Agency (IEMA)	Coordinates the state's emergency management functions and programs. (Illinois General Assembly, 2015a)
ICS: Chapter 220 Utilities: IAC: Title 83 Public Utilities	Illinois Commerce Commission (ICC)	Regulates electric, gas, sewage, water, or pipeline companies (Illinois General Assembly, 2015a).
ICS: Chapter 605 Roads and Bridges; Chapter 615 Waterways; Chapter 630 General Transportation: IAC: Title 92 Transportation	Illinois Department of Transportation (IDOT)	Oversees the development and operation of the state's transportation systems (Illinois General Assembly, 2015a).

4.1.1.3 Transportation

This section describes the traffic and transportation infrastructure in Illinois, including specific information related to the road networks, airport facilities, rail networks, harbors, and ports. 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 Illinois are based on a review of maps, aerial photography, and federal and state data sources.

IDOT has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for smaller streets and roads. The IDOT is responsible for "sustaining, strengthening, expanding, and maintaining the system," which includes "roads, railways, airways, waterways, canals, and terminals such as airports, railway stations, bus stations, warehouses, and intermodal facilities" (IDOT, 2015a).

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

- 145,708 miles of public roads (FHWA, 2014) and 26,588 bridges (FHWA, 2015a);
- approximately 9,982 miles of rail network that includes passenger rail and freight (IDOT, 2015b);
- 731 aviation facilities, including airstrips and heliports (FAA, 2015a); and
- 2 major ports that includes both public and private facilities (IDOT, 2016).

Road Networks

As identified in Figure 4.1.1-1, the major urban centers from north to south and west to east in the state are Rockford, Chicago, Aurora, Peoria, Bloomington, Champaign, Springfield, and Belleville (U.S. Census Bureau, 2013a). Illinois has 12 major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel outside the major metropolitan areas is conducted on interstates, state and county roads. Table 4.1.1-2 lists the interstates and their start/end points in Illinois. 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 4.1.1-2: Illinois Interstates

Interstate	Southern or western terminus in IL	Northern or eastern terminus in IL
I-24	I-57 near Pulleys Mill	KY line near Metropolis
I-39	I-55 in Normal	WI line in South Beloit
I-55	I-270 near Troy	U.S.-41 in Chicago
I-57	MO line near Future City	I-94 in Chicago
I-64	MO line in East St. Louis	IN line in Grayville
I-70	MO line in East St. Louis	IN line in Dennison
I-72	U.S.-36 near Seehorn	I-57 in Champaign
I-74	IA line at Moline	IN line in Danville
I-80	IA line in East Moline	IN line in Lansing
I-88	IL-92 in East Moline	I-290 in Hillside
I-90	WI line in South Beloit	IN line in Chicago
I-94	WI line near Russell	I-80 in South Holland

In addition to the Interstate System, Illinois has National Scenic Byways. National Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA 2013). Figure 4.1.1-1 illustrates the major transportation networks, including roadways, in Illinois. Section 4.1.8, Visual Resources, describes the National Scenic Byways found in Illinois from an aesthetic perspective.

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

- Great River Road (550 miles in Illinois, 2,069 miles total);
- Historic National Road (164 miles in Illinois, 842.2 miles total);
- Historic Route 66 (301 miles in Illinois, 2,451 miles total);
- Illinois River Road (219 miles);

- Illinois Lincoln Highway (178.8 miles);
- Meeting of the Great Rivers Scenic Route (33 miles); and
- Ohio River Scenic Byway (943 miles) (Illinois Byways, 2016).

Airports

Air service to the state and to Chicago is provided by two major international airports. The Chicago Department of Aviation (CDA) owns and operates both Chicago O'Hare International Airport (ORD) and Chicago Midway International Airport (MDW) (CDA, 2015a). O'Hare Airport facilitated 881,933 aircraft operations in 2014, served 70,075,204 passengers, and handled 1,578,330.8 tons of cargo (CDA, 2015b). According to the CDA, O'Hare was the busiest airport in the world in 2014, by the number of aircraft operations. Midway Airport facilitated 249,252 aircraft operations in 2014, served 21,179,833 passengers, and handled 25,372.1 tons of cargo (CDA, 2015c). According to the CDA, Midway was the 24th busiest airport in the U.S. in 2010, by the number of passengers served.

Figure 4.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 4.1.7, Land Use, Recreation, and Airspace, provides more detail on airports and airspace in Illinois.

Rail Networks

Illinois is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Given its central location, a significant amount of the nation's rail traffic passes through Illinois: "approximately 25 percent of all U.S. rail traffic…touches Chicago" (IDOT, 2012). With approximately 500 freight trains and 700 passenger trains passing through Chicago every day (IDOT, 2015c), Chicago is the largest rail hub in North America (IDOT, 2015d) and Illinois' rail system is the second largest in the nation (IDOT, 2015c). Passenger rail serves over 87 million passengers per year within Illinois (IDOT, 2012). Figure 4.1.1-1 illustrates the major transportation networks, including rail lines, in Illinois.

Amtrak runs numerous lines throughout Illinois because Chicago is Amtrak's regional hub. Chicago's Union Station is ranked the fourth busiest Amtrak station in the nation (IDOT, 2012). Table 4.1.1-3 provides a complete list of Amtrak lines that run through Illinois.

Table 4.1.1-3: Amtrak Train Routes Serving Illinois

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Illinois
California Zephyr	Chicago, IL	Emeryville, CA	51 hours 20 minutes	Chicago
Capitol Limited	Washington, DC	Chicago, IL	18 hours	Chicago
Cardinal	New York, NY	Chicago, IL	26 hours 30 minutes	Chicago
City of New Orleans	Chicago, IL	New Orleans, LA	19 hours	Chicago, Champaign-Urbana
Empire Builder	Chicago, IL	Seattle, WA	46 hours	Chicago
Hiawatha	Chicago, IL	Milwaukee, WI	1 hour 29 minutes	Chicago
Hoosier State	Indianapolis, IN	Chicago, IL	5 hours	Chicago

Illinois Service	Chicago, IL	St. Louis, MO	5 hours 30 minutes	Chicago, Champaign-Urbana, Springfield
Lake Shore Limited	Chicago, IL	New York, NY or Boston, MA	19 hours	Chicago
Michigan Services	Chicago, IL	Pontiac, MI	6 hours 30 minutes	Chicago
Southwest Chief	Chicago, IL	Los Angeles, CA	40+ hours	Chicago
Texas Eagle	Chicago, IL	Los Angeles, CA	65 hours 20 minutes	Chicago, Springfield

Source: (Amtrak, 2015)

In the Chicago metropolitan area, Metra operates a commuter rail service comprised of 11 lines, all of which radiate out from Chicago's downtown into the Chicago suburbs (IDOT, 2012). Metra stops at 241 train stations in over 100 communities (IDOT, 2012). Metra operates on over 1,200 miles of track, which makes it the largest commuter railroad in the nation based on the miles of track; it is the fourth largest commuter railroad based on ridership (Metra, 2015). In 2013, Metra facilitated 82.3 million passenger trips (Metra, 2014); the average ride on Metra is 22 miles long (Metra, 2015).

The Northern Indiana Commuter Transportation District (NICTD) operates the South Shore Line (SSL), which runs from Chicago to South Bend, in northwest Indiana. The SSL makes seven stops in Illinois before crossing into Indiana and served over 3,980,000 passengers across the entire line in 2011 (IDOT, 2012).

The Chicago Transit Authority (CTA) operates the mass transit system in Chicago, which is the second largest public transportation system in the nation (CTA, 2015). This includes Chicago's rapid transit rail system, known as the "L." The "L" operates on 224.1 miles of track, stops at 145 stations on eight routes, and makes approximately 2,276 trips every day (CTA, 2016). In 2015, the "L" served 241 million passengers (CTA, 2016).

Forty-five freight railroad companies operate in Illinois, which includes seven Class I railroads (IDOT, 2012). The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA, 2015a). Of Illinois' 9,982 miles of tracks, Class I railroads operate on 7,792 miles of track and regional railroads operate on the other 2,190 miles of track (IDOT, 2015b). Due to its central location, Illinois serves as the crossroads for the nation's freight rail traffic. For example, in 2011, 490.4 million tons of freight traveled through Illinois, making it number one in the nation for the volume of freight rail (IDOT, 2015b).

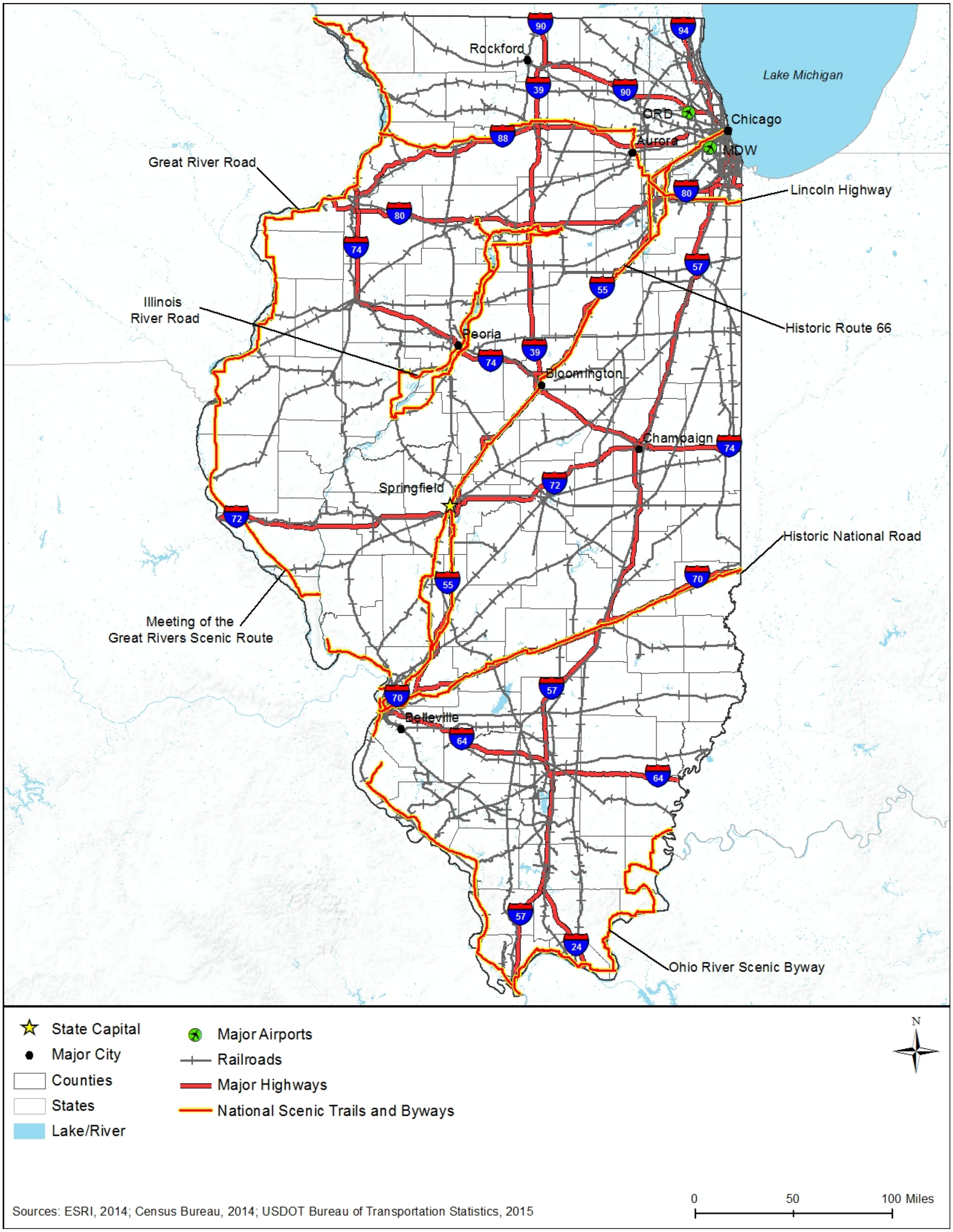


Figure 4.1.1-1: Illinois Transportation Networks

"In 2010, the Illinois rail system was ranked as follows:

- Illinois ranked first in carloads carried with nearly 11 million;
- Illinois ranked first in carloads terminated with 3.7 million, and second in carloads originated with 3.4 million;
- Illinois ranked second in tons originated with 109.5 million and second in tons terminated with 157.8 million;
- Illinois ranked second in miles of railroad track with 7,044 miles (not including trackage rights); and
- Illinois ranked third in tons carried with 481.6 million tons." (IDOT, 2012).

Harbors and Ports

Much of the state of Illinois is landlocked with the exception of the state's northeast corner, which borders Lake Michigan. Though much of Lake Michigan's western border belongs to Wisconsin, the 14 miles of lakeshore along Lake Michigan that exists in Illinois is home to 10 relatively small harbors operated by the Chicago Park District (Chicago Port District, 2015a). This area is home to the harbors of Montrose, Belmont, Diversey, DuSable, Monroe, Burnham, 31st Street, 59th Street, and the Inner and Outer Jackson Park Harbors. Combined they offer space for the mooring of more than 6000 boats, though over 95 percent of this space is currently occupied. These harbors offers individual attractions in both the heart of Chicago and more family oriented areas of the city. Burnham Harbor is the largest of the group, though the 31st Street Harbor is the newest and is offers nearly the same amount of space for mooring (Chicago Port District, 2015b).

In addition to the public harbors along the shore of Lake Michigan, the area is also home to the Port of Chicago. While the two Jackson Park Harbors are the most southern of the ten facilities operated by the Chicago Park District, the Port of Chicago has facilities further south along the lakeshore. Located at the mouth of the Calumet River is the Iroquois Landing Lakefront Terminus; the 100-acre facility is the closest point of the port to Lake Michigan. The Senator Dan Dougherty Harbor is further up the Calumet River, where it meets the Little Calumet River (IIPD, 2015a). The Port of Chicago, also known as the Illinois International Port District (IIPD), "moves more general cargo than any other port on the Great Lakes" (IIPD, 2015b). Though easily reached via I-90, the port also offers rail services. There are a total of 12 "main line railroads" that feed into terminals on port property. This makes the Port of Chicago one of the most well rail-connected ports in the Great Lakes region (IIPD, 2015c). According to data from the U.S. Census Bureau, in 2013 the Port of Chicago imported $1.14 billion worth of cargo, which weighed 2.6 million tons. Also in 2013, $359.5 million weighing 732,045 tons was exported through the port (U.S. Census Bureau, 2015b).

Though small, the Port of Peoria was also noted by the U.S. Census Bureau as doing international trade in 2013. Located on the Illinois River, the Port of Peoria exported $3.7 million worth of cargo in 2013, weighing 15,543 tons. Imports through the facility were minimal (U.S. Census Bureau, 2015b).

4.1.1.4 Public Safety Services

Illinois public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 4.1.1-4 presents Illinois's key demographics including estimated population; households; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 4.1.9, Socioeconomics; however, these demographics are key to understanding the breadth of public safety services throughout the state.

Table 4.1.1-4: Key Illinois Indicators

Illinois Indicators	
Estimated Population (2015)	12,859,995
Land Area (square miles) (2010)	55,519
Population Density (persons per sq. mile) (2010)	231.1
Municipal Governments (2013)	1,298

Sources: (U.S. Census Bureau, 2015a) (U.S. Census Bureau, 2015c) (U.S. Census Bureau, 2013b)

Table 4.1.1-5 presents Illinois' public safety infrastructure, including fire and police stations. Table 4.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 4.1.1-5: Public Safety Infrastructure in Illinois by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	1,837
Law Enforcement Agencies [b]	877
Fire Departments [c]	1,104

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

[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.

Table 4.1.1-6: First Responder Personnel in Illinois by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	3,970
Fire and Rescue Personnel [b]	38,061
Law Enforcement Personnel [c]	52,838
Emergency Medical Technicians and Paramedics [d e]	12,060

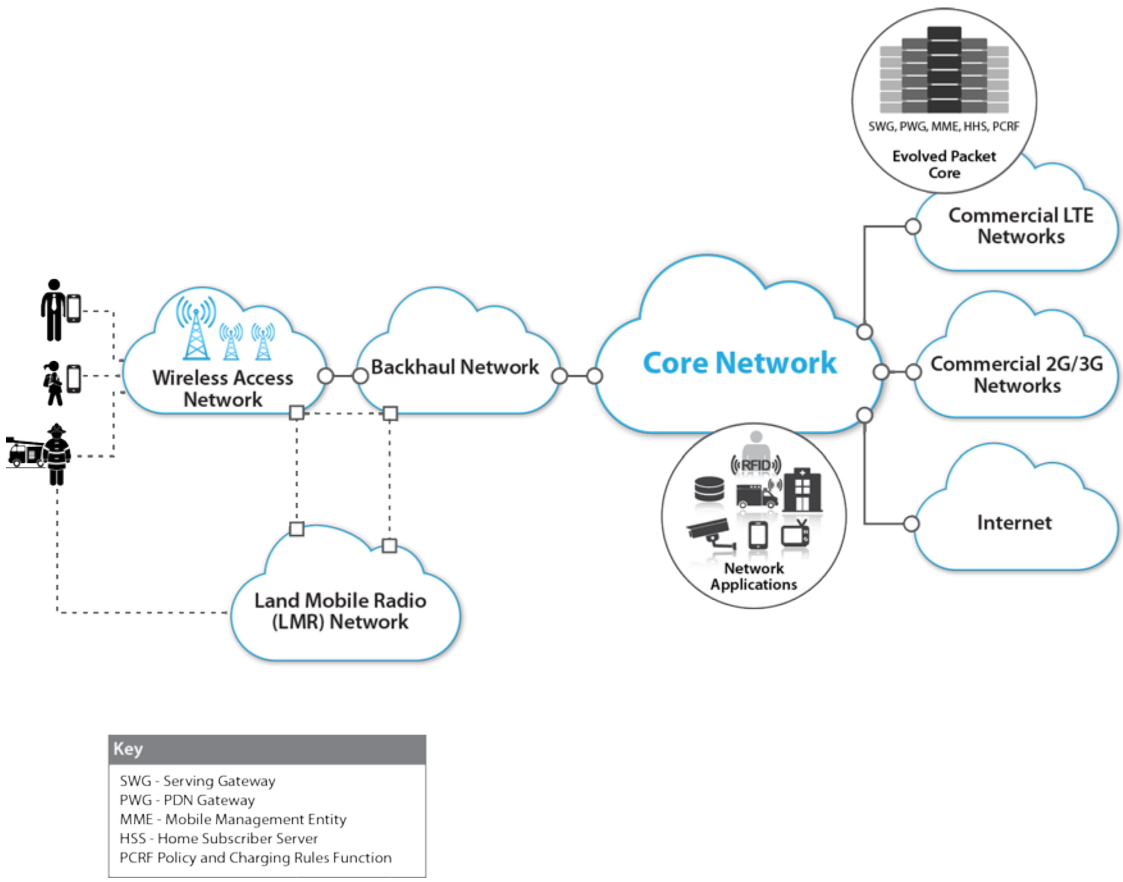
Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011) (BLS, 2015a)
[a] BLS Occupation Code: 43-5031.
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 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.

4.1.1.5 Telecommunications Resources

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

Department of Commerce Public Safety Communications Research Program (PSCR) throughout the state are based on a variety of publicly- and commercially-owned technologies.

Figure 4.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications.



Prepared by: Booz Allen Hamilton

Figure 4.1.1-2: 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. Chief among these factors affecting information sharing are network coverage gaps, land mobile radio system infrastructure diversity, insufficient budgets, and diverse radio frequencies. Communication interoperability also has been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and specifically in Illinois.

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 inform better investment decisions (PSCR, 2015).

Public safety network communications in Illinois reflect a combination of legacy analog Very High Frequency (VHF)[2], Ultra High Frequency (UHF)[3] radios operating across multiple frequencies bands as well as a statewide digital Project 25 (P 25) 700 MHz/800 MHz network called State Radio Communications for the 21st century (STARCOM21) (State of Illinois, 2014b).

Illinois has outsourced the ownership and operational management of the STARCOM21 statewide network to Motorola Solutions. Motorola Solutions manages the statewide network and provides fee-based structure service per user to Public Safety users. The Illinois Bureau of Communications Services catalog describes the background, purpose, and targeted users as follows, "The Illinois Department of Central Management Services' (CMS) Bureau of Communication and Computer Services (BCCS) makes two-way radio communication services available via the STARCOM21 master contract. STARCOM21 is a groundbreaking

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

public/private partnership with Motorola Solutions envisioned and commissioned by the state to enable seamless, interoperable communications among state, local and federal government users. The network primarily focuses on the daily, two-way radio communication needs of its subscribers, enables enhanced response to disaster and emergency situations, and allows the state to address effectively homeland security concerns.

The STARCOM21 network is owned and operated by Motorola Solutions and currently serves nearly 30,000 subscribers from various state, local and federal government and non-governmental entities" (Illinois CMS Bureau of Communication Services, 2015).

In 2010, the Illinois Department of CMS was awarded a National Telecommunications Information Administration (NTIA) Broadband Technologies Opportunity Program (BTOP) infrastructure grant. This infrastructure middle mile fiber[4] optic grant resulted in the deployment of 1,512 fiber miles and enabled connectivity to 32 Public Safety Community Anchor Institutions (CAIs) in Illinois (Illinois CMS, 2015).

Statewide/Regional Networks

The STARCOM21 network is a digital Phase 2 P-25[5] network, which provides statewide coverage in Illinois; it is the cornerstone of the state of Illinois' interoperability approach. This 700 MHz/800Mhz network is used by a wide array of Public Safety and Illinois State Agencies as well as counties and local municipalities, as Illinois' 2012 Statewide Communications Interoperability Plan (SCIP) explains, "The Statewide Interoperability Platform is the infrastructure network that supports a number of radio systems in Illinois and is known as STARCOM21. Through a public private partnership with Motorola, Illinois has developed a 700/800 MHz voice communication system of systems, STARCOM21 as a platform. On this platform of physical infrastructure and software, we have a number of systems for various agencies and organizations within the state. For example, the Illinois State Police STARCOM21 system, Illinois Emergency Management Agency **(**IEMA**)** STARCOM21, IDOT STARCOM21, and Illinois Department of Natural Resources (IDNR) STARCOM21 along with non-state entities like; Champaign County, St Clair County, McLean County and McHenry County to name a few. All of these 'systems' coexist and to a greater or lesser extent can interoperate on the STARCOM21 platform simultaneously" (State of Illinois, 2014b)**.**

Figure 4.1.1-3 below depicts the presence of the STARCOM21 sites and associated numbers throughout Illinois' 102 counties as well as those 800 MHz only, and 700 MHz assigned sites (RadioReference.com, 2015a).

[4] Middle mile fiber is fiber that connects to last mile terrestrial or wireless network points of presence.
[5] Phase 2 P-25 networks use the digital Time Division Multiple Access (TDMA) channel management regime.

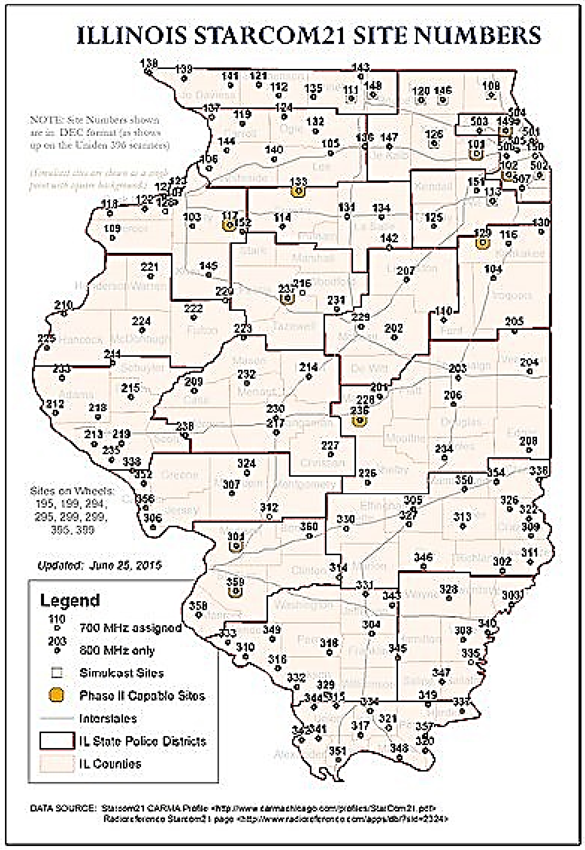


Figure 4.1.1-3: Illinois STARCOM21 Network Radio Site County Locations

For the Illinois State Police (ISP) the main communications system used is the 700MHz/800MHz STARCOM21 Phase 2 P-25 system with VHF frequencies. STARCOM21 is the primary means of wireless voice communication for the ISP. It also employs VHF radio systems for targeted uses such as, supplemental interoperability and mutual aid communications, aircraft communications, and Emergency Medical Services (EMS) coordination (RadioReference.com, 2015b).

In Illinois, there are two common statewide Fire channels on the Interagency Fire Emergency Radio Network (IFERN): IFERN and IFERN2 (RadioReference.com, 2016). Within the state, the Illinois State Police Emergency Radio Network (ISPERN), which operates in the VHF 155.475 band, is found in most police vehicles (RadioReference.com, 2016).

The IEMA uses a wide variety of frequencies, including Lo VHF[6], UHF, and 700 MHz/800MHz with the majority of its communications occurring now on the STARCOM21 network. (RadioReference.com, 2015c).

[6] Lo VHF is 32 MHz-50MHz.

Statewide EMS and Hospital communications occur on both VHF (155.34 MHz) and UHF (463.175 MHz) frequencies in Illinois via the Illinois Department of Public health EMS System; 11 regional EMS networks also operate in Illinois (RadioReference.com, 2015d).

In addition to its core statewide Public Safety communications network for daily operational needs, Illinois has also implemented a statewide 11 region, Transportable Emergency Communications System (ITECS) and Unified Command Post (UCP) vehicles for emergency response incidents, natural disasters, and potential terrorist threat response. These regional communications assets are deployed across the state for the Illinois Emergency Management (IEM) and complemented by UCP vehicles are depicted in Figure 4.1.1-4. The ITECS transportable system's purpose is to provide mutual aid interoperability through use of local mutual frequencies and selection of core interoperable channels including 700 MHz/800MHz, VHF, and UHF channels (ITTF, 2016).

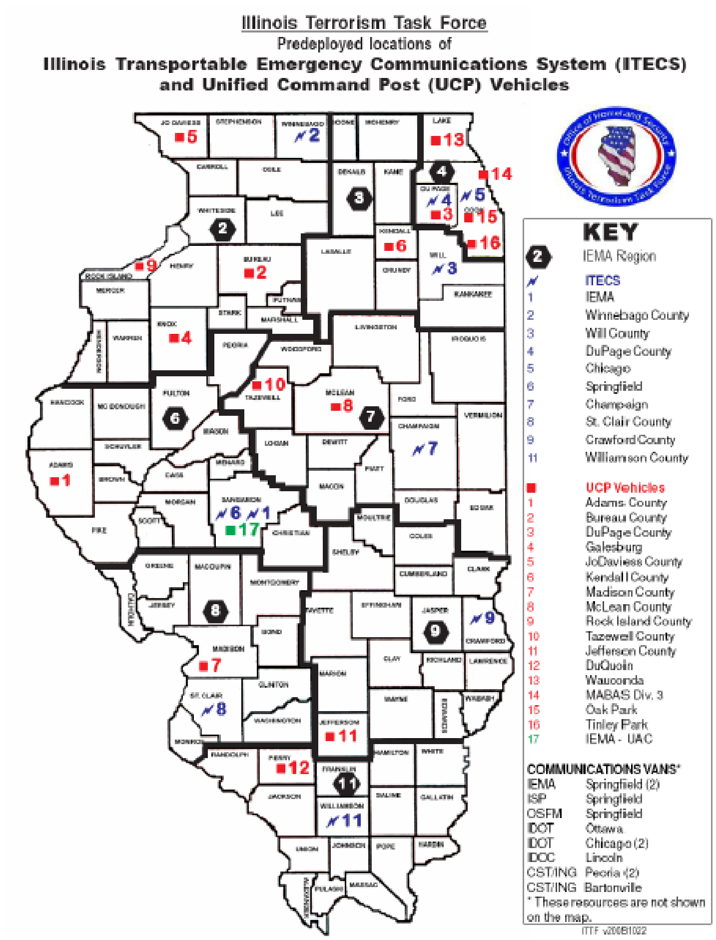


Figure 4.1.1-4: Illinois Transportable Emergency Communications System and Command Post Vehicles Locations

City and County Public Safety Networks

Similar to most states, local city, and county communications systems in Illinois are highly diverse including a wide range of analog VHF, UHF systems, and digital P-25 systems (RadioReference.com, 2015e). For example, in Cook County, the Chicago Police use UHF frequencies for dispatch and tactical communications as does the Chicago Fire Department and EMS in Chicago (RadioReference.com, 2015e). In southern Illinois's Pope County, Sheriff and EMS communications for dispatch and tactical communications are done over VHF frequencies (RadioReference.com, 2015e).

As of mid-2015 there were also three County Phase 1 P-25 digital networks operating in Illinois: Will County Public Safety (800 MHz), Champlain County Metropolitan Computer Aided Dispatch (METCAD) METCAD Digital Interoperable Communications Environment (MDIC) (800 MHz), and Peoria County Illinois (800 MHz) (Project 25.org, 2015).

Public Safety Answering Points (PSAPs)

According to the Federal Communication Commission's (FCC) Master PSAP[7] registry, there are 376 PSAPs in Illinois serving the state's 102 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

Illinois' 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 Illinois' 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

Illinois'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 for connectivity. Table 4.1.1-7 presents the number of providers of switched access[8] lines, Internet access,[9] and mobile wireless services including coverage.

[7] The FCC defines a PSAP as follows: "A primary PSAP is defined as a PSAP to which 9-1-1 calls are routed directly from the 9-1-1 Control Office, such as, a selective router or 9-1-1 tandem. A secondary PSAP is defined as a PSAP to which 9-1-1 calls are transferred from a primary PSAP." (USFCC, 2016)
[8] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)." (FCC, 2014b).
[9] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

Table 4.1.1-7: Telecommunications Access Providers and Coverage (2013)

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access line	236	97% of households
Internet access	160	57% of households
Mobile wireless	10	100% of population

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

[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 4.1.1.5, Last Mile Fiber Assets.

Table 4.1.1-8 shows the wireless providers in Illinois along with their geographic coverage. The following six maps: Figure 4.1.1-5, Figure 4.1.1-6, Figure 4.1.1-7, Figure 4.1.1-8, Figure 4.1.1-9, and Figure 4.1.1-10 show: i) the combined coverage for the top two providers (each of which covers the entire state), ii) Cellular One, Wisper ISP Inc., Cricket Wireless, Computerese-CIN.net, and Royell Comm Inc.'s coverage, iii) Sprint and U.S. Cellular's coverage, iv) T-Mobile and T6 Broadband's coverage, v) Pwr-Net, Maxwire, Rural Comm, DerbyNet LLC, E-vergent.com LLC, Illinois Rural Electric Co Op, and Network Business Systems Inc., and vi) the coverage of all other providers with less than 5 percent coverage area, respectively.[10]

Table 4.1.1-8: Wireless Telecommunications Coverage by Providers in Illinois

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	95.43%
Verizon Wireless	92.17%
Sprint	63.26%
U.S. Cellular	34.54%
T6 Broadband	34.50%
T-Mobile	17.04%
Cricket Wireless	12.67%

[10] 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 were 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 "Illinois Other Fiber Providers." All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "Illinois Other Wireless Providers." Providers under 5% were denoted in their respective tables.

Wireless Telecommunications Providers	Coverage
Illinois Valley Cellular	12.61%
Wisper ISP, Inc.	11.71%
Cellular One	10.56%
Computerese-CIN.net	9.07%
Royell Communications, Inc.	8.46%
Pwr-Net	7.63%
DerbyNet, LLC	7.35%
Maxwire	6.77%
Illinois Rural Electric Co Op	6.73%
Rural Comm	6.44%
E-Vergent.com, LLC	5.96%
Network Business Systems, Inc.	5.44%
Other [a]	65.99%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Next-Level Technology Partners; CASSCOMM; Air-Wans Wireless Broadband; Cyber Broadcasting, LLC; Urban Communications, Inc.; SandPrairie Wireless; ClearSKY Systems; New Wave Net Corp; MR Systems Wireless; Rocket Communications; Prairie Wind LLC; JCWIFI; Springnet1; Bspeedy Wireless Inc.; Heartland Cable, Inc.; Hofnet Communications, Inc.; Wireless Data Net, LLC; Midwest First, Inc.; DLS Internet Services; NOW Wireless, LLC; Foresite Wireless, LLC; One-Eleven Internet Services, Inc.; Cox Wireless; Park TV and Electronics, Inc.; CCAonline, Inc.; Hihart; Hamilton County Communications, Inc.; KWISP Wireless Internet Services; Intelligent Computing Solutions; Wigi Wireless; Netwitz Internet Services; Noize Communications LLC; Ag Prospects, LLC; IVNet, LLP; Blast Communications; IndianValley.com LLC; 4SIWI, LLC; Hy-Rail Communications; HTC Technologies Co.; Future Link of Illinois, Inc.; Convergence Technologies; XL Internet; Illini Wireless; Satnet, Inc.; S&B Technology Consultants; Geneseo Communications Services, Inc.; Fox Valley Internet, Inc.; Tincans Wireless Internet; Adams Networks, Inc.; Surf Air Wireless; BLIP Networks; Everywhere Wireless, LLC; NewarkNet Wireless; WOWaccess, Inc.; theWISP.net, Inc.; Monster Wireless Internet, LLC; Reynolds Cable, Inc.; PeoplesNet Wireless; McHenryCom Co.; Maximum Broadband; DJK Link, Inc.; MediaNet Wireless; BroadTech Inc.; Wonderwave.net Internet, Inc.; Joink LLC; LR Communications; Logonix; Norcom 2000; Rochelle Municipal Utilities; Lazernet, Inc.; Cumberland Internet, Inc.; Montrose Mutual Telephone Company; SonicPCS; MidwayNet, LLC; Viola Communications, Inc.; Node1 Internet; Tri-Lutions Computer and Internet Center; Egyptian Internet Service; Full Choice Communications, Inc.; MachLink; LiteWire; Volo Broadband; Infobahn Outfitters, Inc.; Clearwave Communications, LLC; Jimmy Wireless; Stelle Telephone Company.

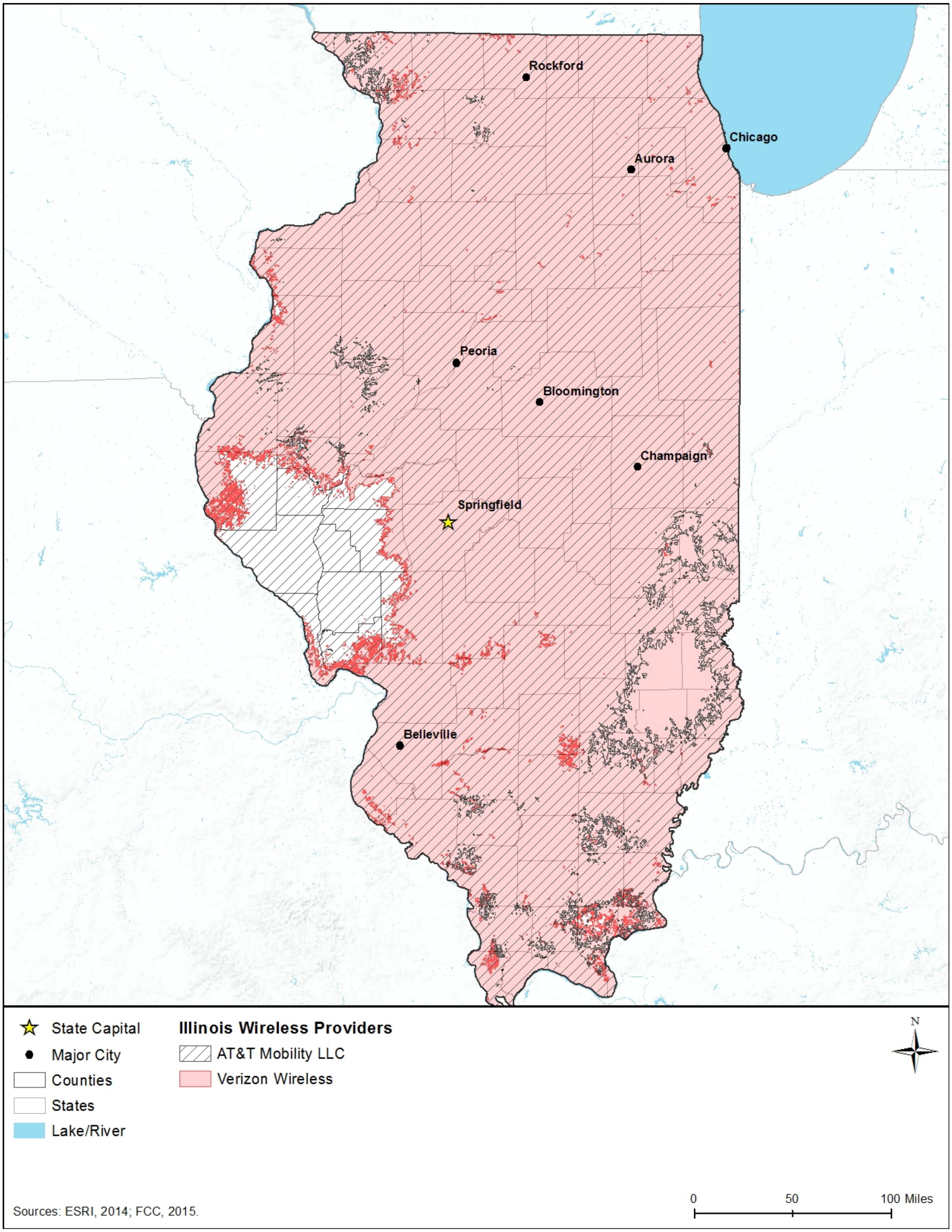


Figure 4.1.1-5: AT&T and Verizon Wireless Availability in Illinois

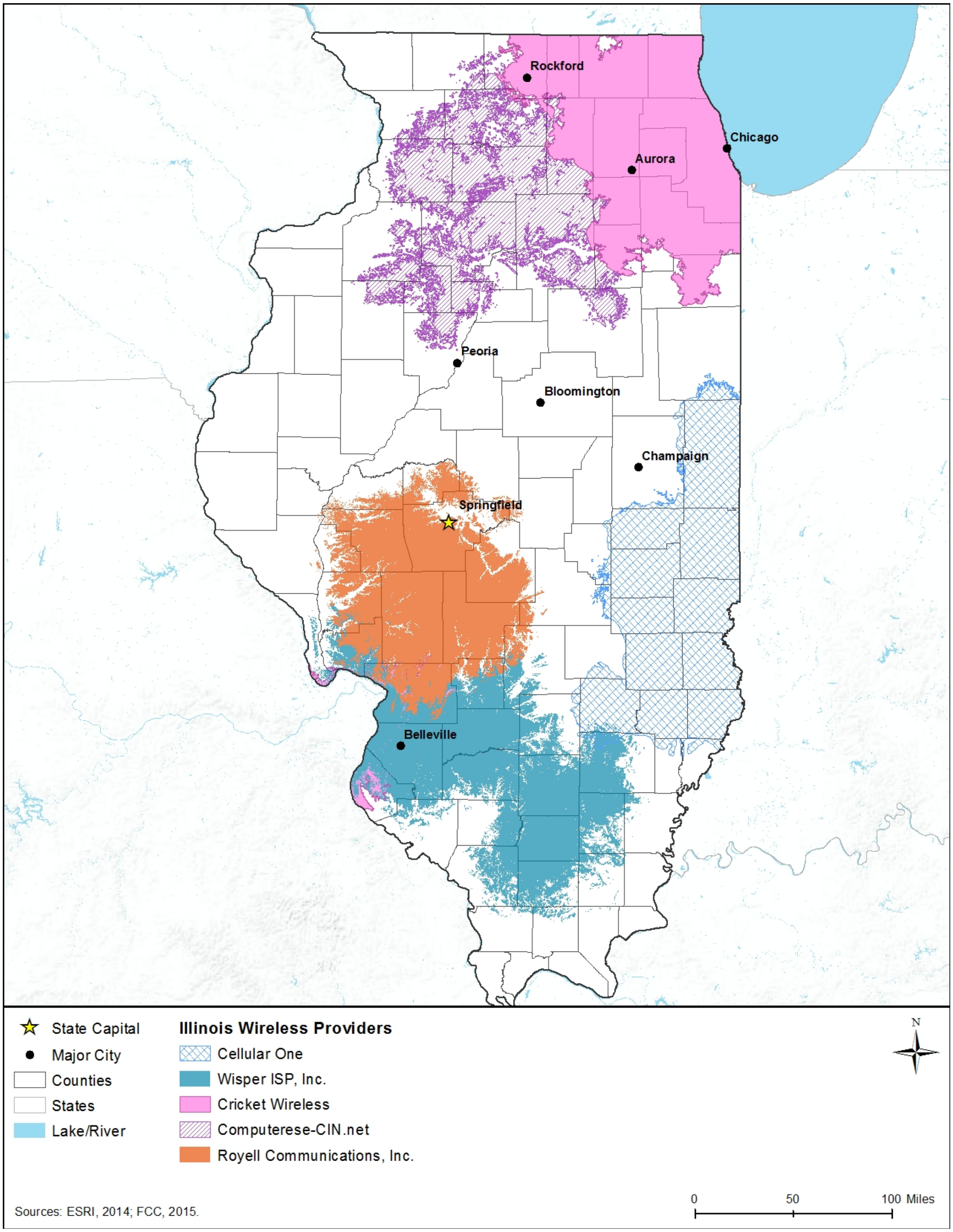


Figure 4.1.1-6: Cellular One, Wisper ISP, Inc., Cricket Wireless, Computerese-CIN.net, and Royell Communications, Inc. Wireless Availability in Illinois

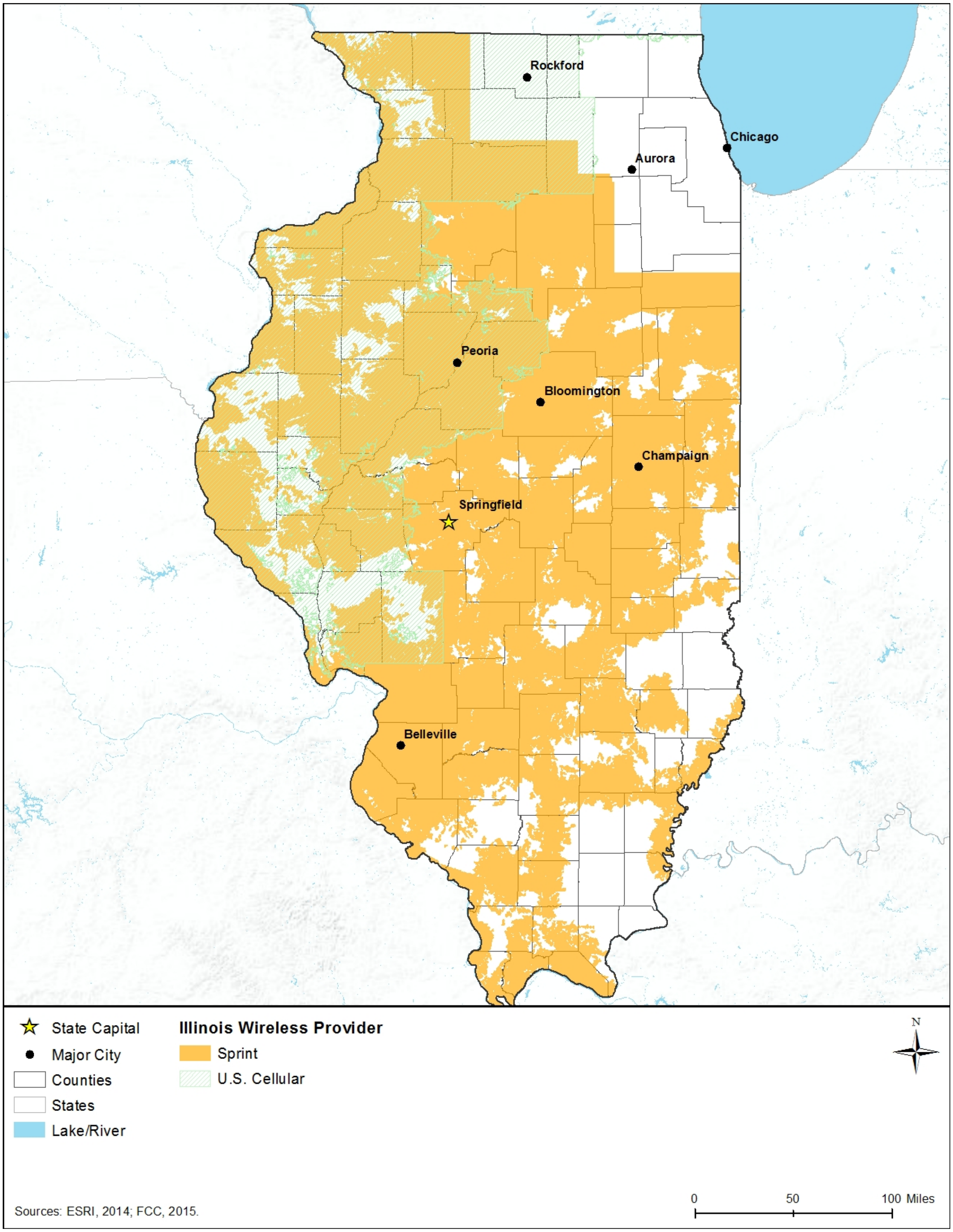


Figure 4.1.1-7: Sprint and U.S. Cellular Wireless Availability in Illinois

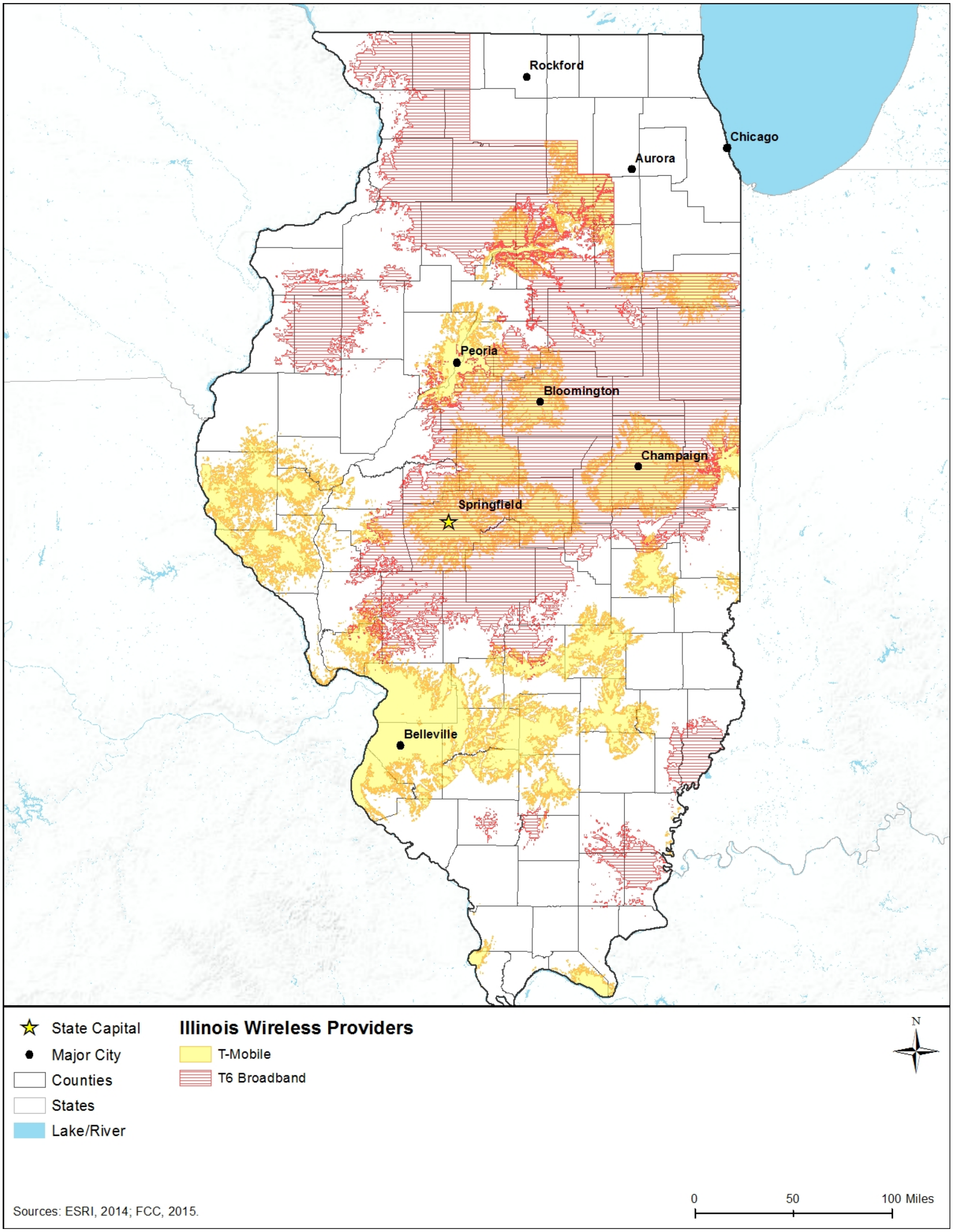


Figure 4.1.1-8: T-Mobile and T6 Broadband Wireless Availability in Illinois

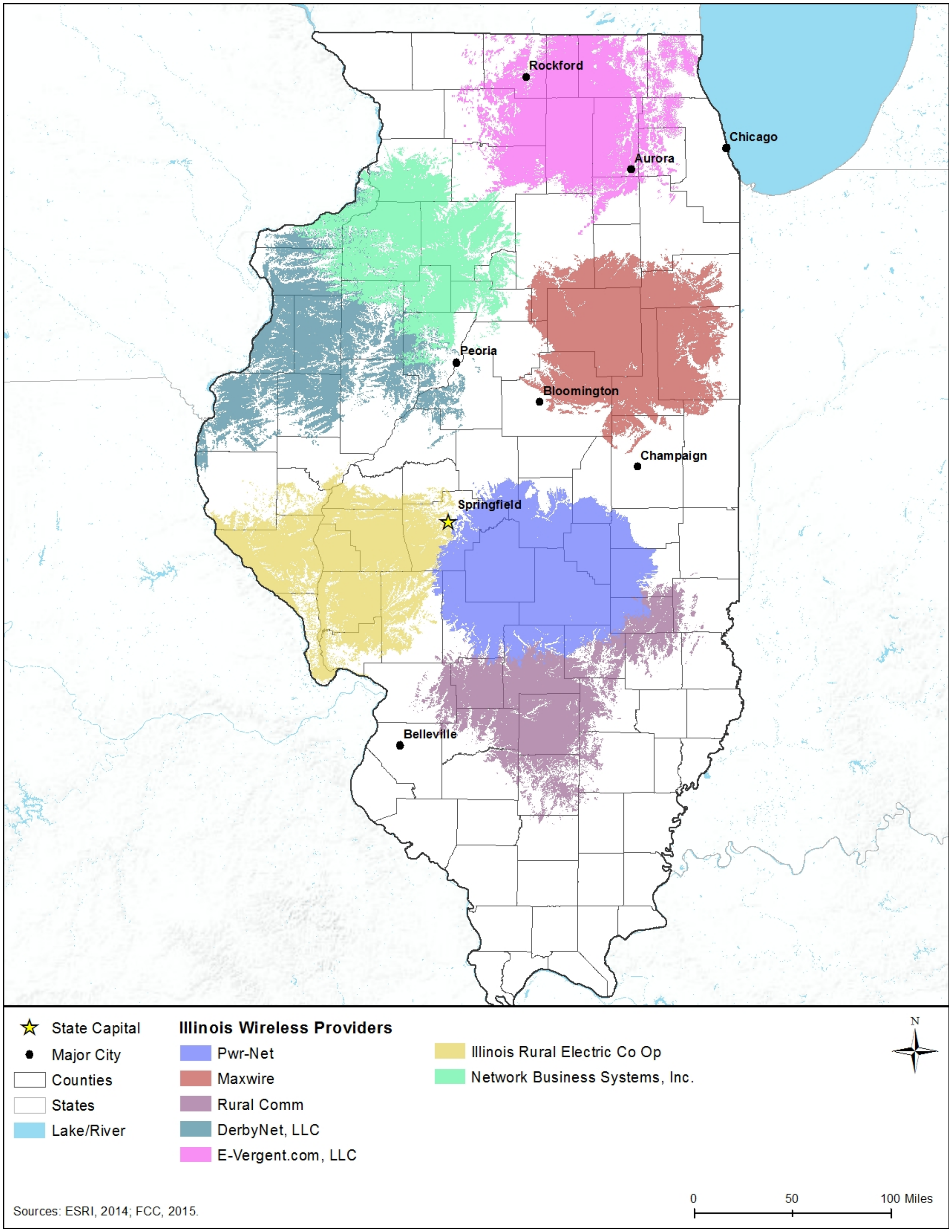


Figure 4.1.1-9: Pwr-Net, Maxwire, Rural Comm, DerbyNet, LLC, E-Vergent.com LLC, Illinois Rural Electric Co Op, and Network Business Systems Inc. Wireless Availability in Illinois

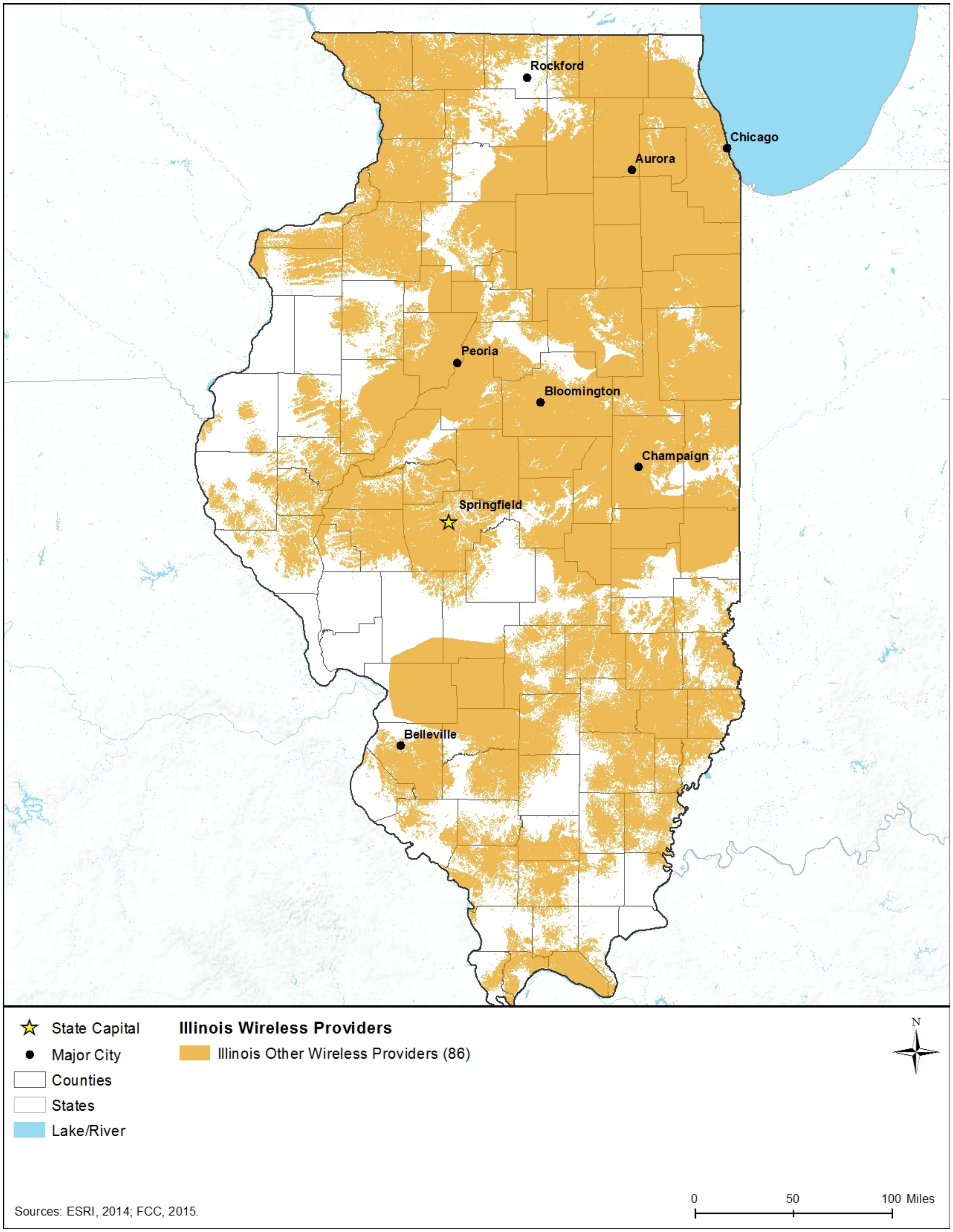


Figure 4.1.1-10: Other Wireless Providers Availability in Illinois

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 4.1.1-11 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 4.1.1-11: Types of Towers

Telecommunications tower infrastructure proliferates throughout Illinois, although tower infrastructure is concentrated in the higher and more densely populated areas of Illinois: Rockford, Chicago, Aurora, Peoria, Bloomington, Champaign, Springfield, and Belleville. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC[11] (FCC, 2016a). Table 4.1.1-9 presents the number of towers (including broadcast towers) registered with the FCC in Illinois by tower type, and Figure 4.1.1-12 presents the location of those structures, as of June 2016.

[11] 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, 2016a).

Table 4.1.1-9: Number of Commercial Towers in Illinois by Type

Constructed [a] Towers [b]		Constructed Monopole Towers	
100ft and over	494	100ft and over	0
75ft – 100ft	1,026	75ft – 100ft	1
50ft – 75ft	825	50ft – 75ft	50
25ft – 50ft	652	25ft – 50ft	114
25ft and below	80	25ft and below	22
Subtotal	**3,077**	**Subtotal**	**187**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	64	100ft and over	4
75ft – 100ft	83	75ft – 100ft	4
50ft – 75ft	35	50ft – 75ft	6
25ft – 50ft	6	25ft – 50ft	4
25ft and below	0	25ft and below	0
Subtotal	**188**	**Subtotal**	**18**
Constructed Lattice Towers		**Multiple Constructed Structures** [c]	
100ft and over	11	100ft and over	5
75ft – 100ft	198	75ft – 100ft	4
50ft – 75ft	84	50ft – 75ft	3
25ft – 50ft	37	25ft – 50ft	0
25ft and below	5	25ft and below	0
Subtotal	**335**	**Subtotal**	**12**
Constructed Tanks[d]			
Tanks	18		
Subtotal	**18**		
Total All Tower Structures		**3,835**	

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, 2016b).
[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016b).

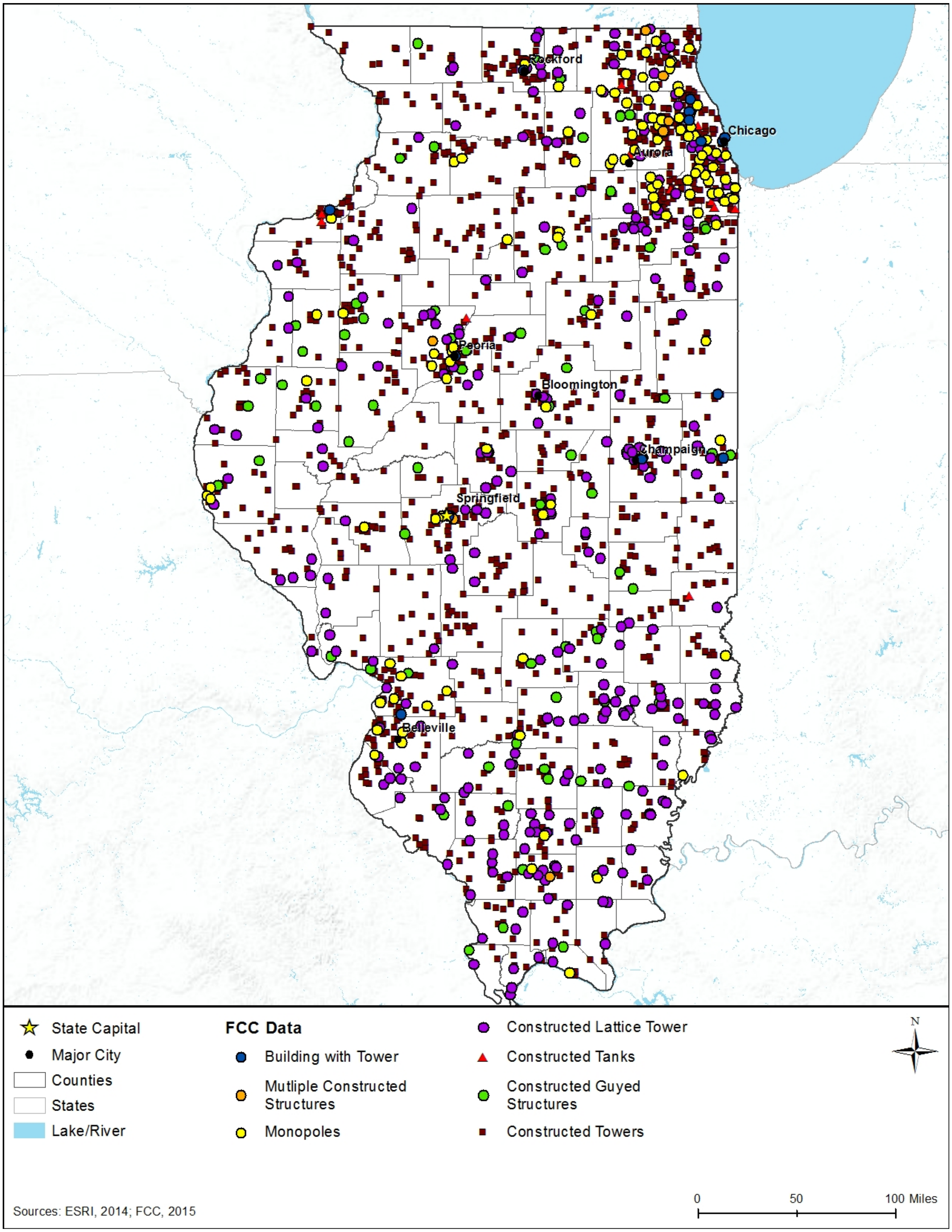


Figure 4.1.1-12: FCC Tower Structure Locations in Illinois

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 4.1.1-13. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

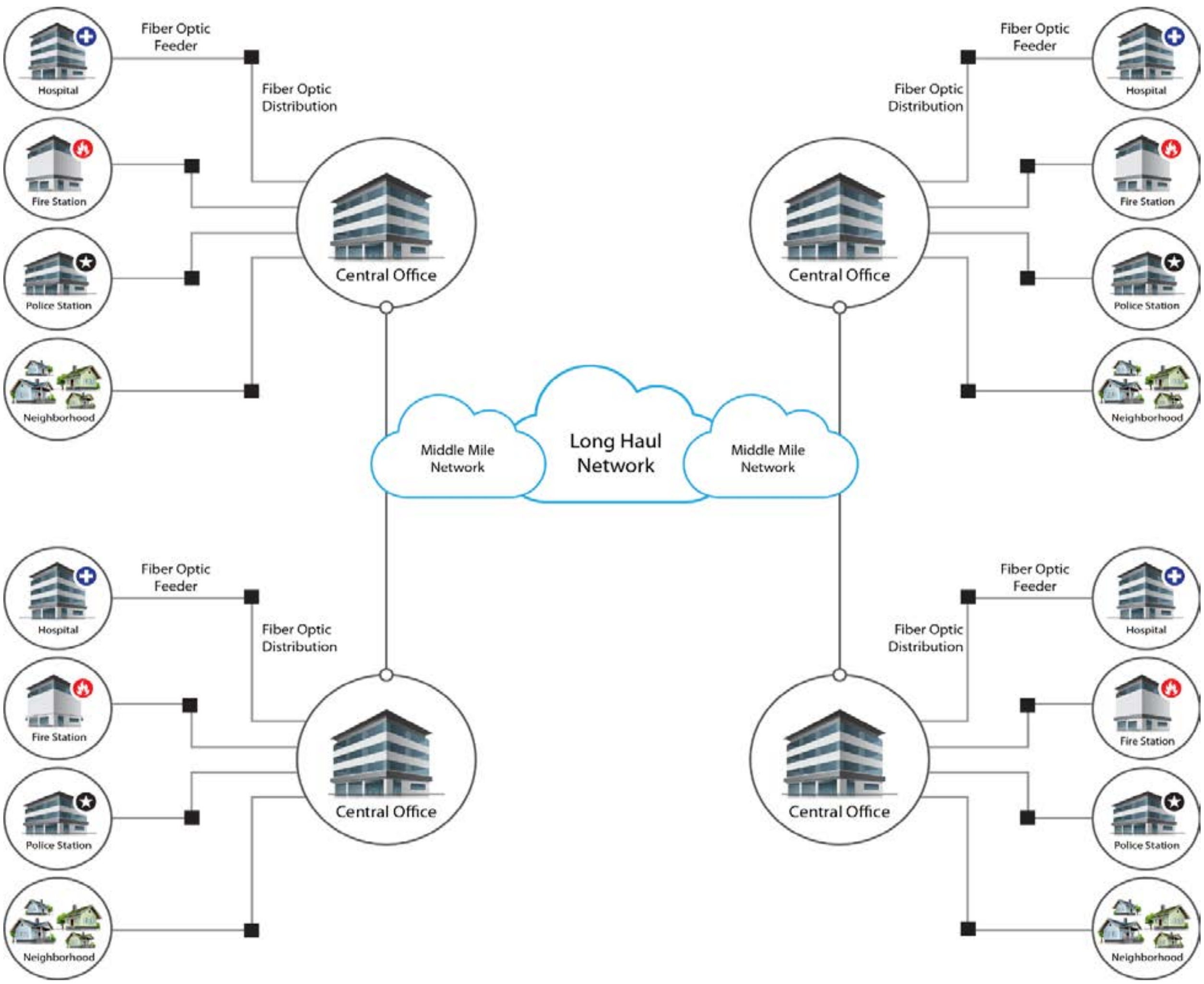


Figure 4.1.1-13: Typical Fiber Optic Network in Illinois

Source: (ITU-T, 2012)

Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In Illinois, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Illinois, there are 82 fiber providers that offer service in the state, as listed in Table 4.1.1-10. Figure 4.1.1-14 shows coverage for AT&T, with Comcast's, Mediacom's, and Frontier Communications' availability and other providers with less than 5 percent coverage area respectively, whose coverage areas are depicted in Figure 4.1.1-15 and Figure 4.1.1-16, respectively.

Table 4.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Frontier Communications of Illinois	27.07%
AT&T Illinois	9.75%
Comcast	6.73%
Mediacom	5.46%
Other [a]	29.73%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5% coverage area. Providers include: MegaPath Corporation; Consolidated Communications; Charter Communications Inc.; Newwave Communications; MDTC Communications, Inc.; Wabash Independent Networks, Inc.; Zayo Broadband; Adams Telephone Co-Operative; Mid Century Telephone Cooperative; CenturyLink; Clearwave; Communications, LLC; Shawnee Telephone Company; Hamilton County Telephone Coop; Harrisonville Telephone Company; Egyptian Telephone Cooperative; MTCO; CASSCOMM; WideOpenWest; Montrose Mutual Telephone Company; FairPoint Communications; Geneseo Telephone Company; Madison Telephone Company, Inc.; iTV-3; La Harpe Video and Data Services Company, Inc.; GTI; Henry County Telephone Company; Park TV and Electronics, Inc.; Tel-Star Cablevision, Inc.; Flat Rock Telephone Co-Op, Inc.; Diverse Communications, Inc.; A-G Long Distance; Gridley Telephone Co.; Oneida Telephone Exchange; Adams Networks, Inc.; City of Springfield, City Water Light and Power; Crossville Communications; McNabb Internet Leaf River Telephone Company; Reynolds Telephone Company; New Windsor Telephone Company; Heartland Cable, Inc.; Glasford Telephone Company; Home Telephone Co.; Moultrie Independent Telephone Company; Zito Media; Tonica Telephone Company; Level 3 Communications, LLC; Nova Cablevision Inc.; 4SIWI, LLC; RCN and RCN Business Solutions; Sharon Telephone Company; Viola Home Telephone Co.; Leonore Mutual Telephone Company; Joink LLC; Bergen Telephone Company; Elwood Cable; U.S. SONET; Princeton, City Of; Manhattan Cable; Time Warner Cable Inc.; Seneca Cable; Volo Broadband; Highland Communication Services-HCS; IVNet, LLP; Gardner Cable; Rochelle Municipal Utilities; DJK Link, Inc.; TW Telecom Inc.; Cox Broadband; Full Choice Communications, Inc.; Conxxus, LLC; UC2B; WOWaccess, Inc; HIHART; Cogent Communications; Cambridge TelCom Services, Inc.; CTI Fiber; Sidera Networks, LLC.

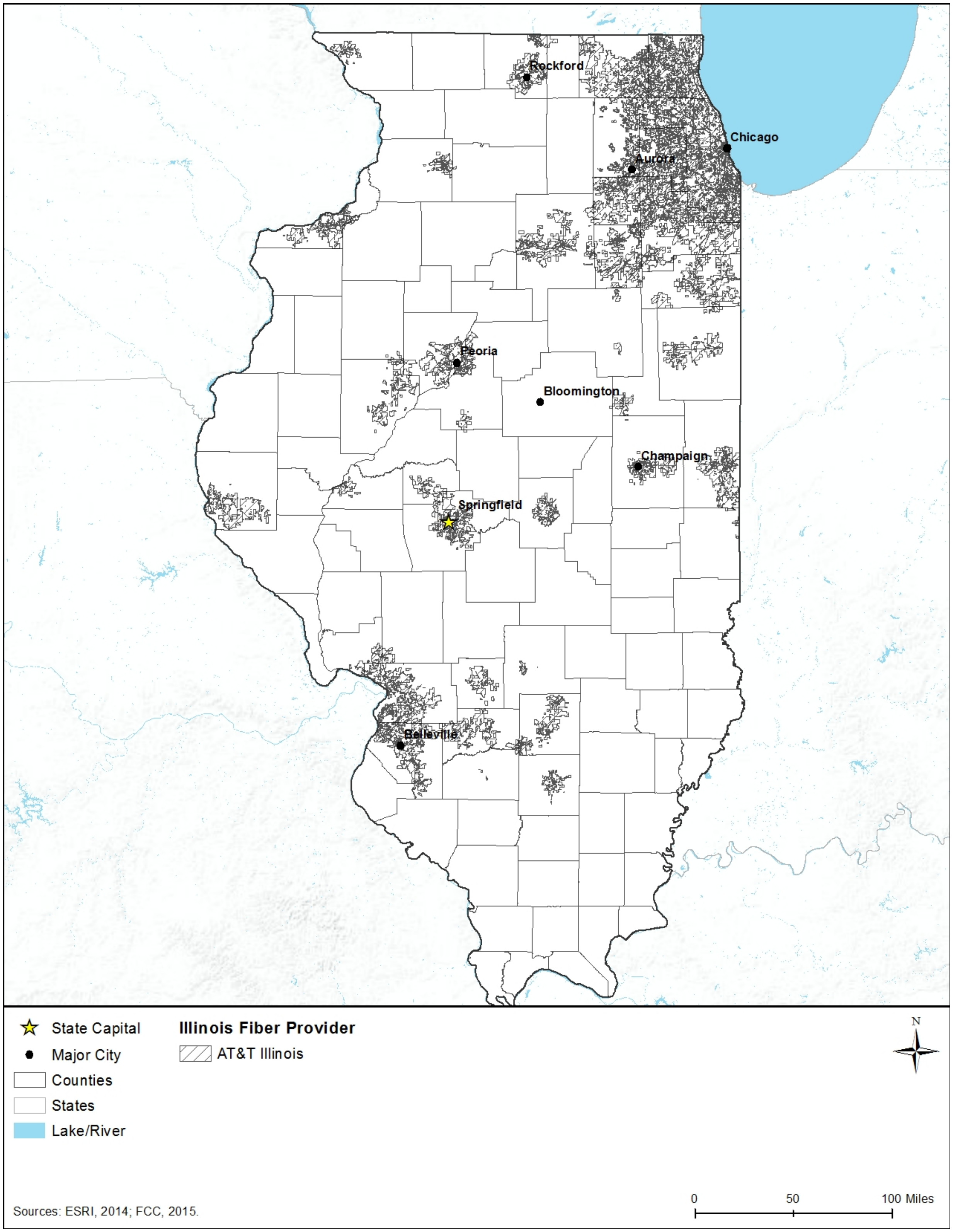


Figure 4.1.1-14: Fiber Availability in Illinois for AT&T

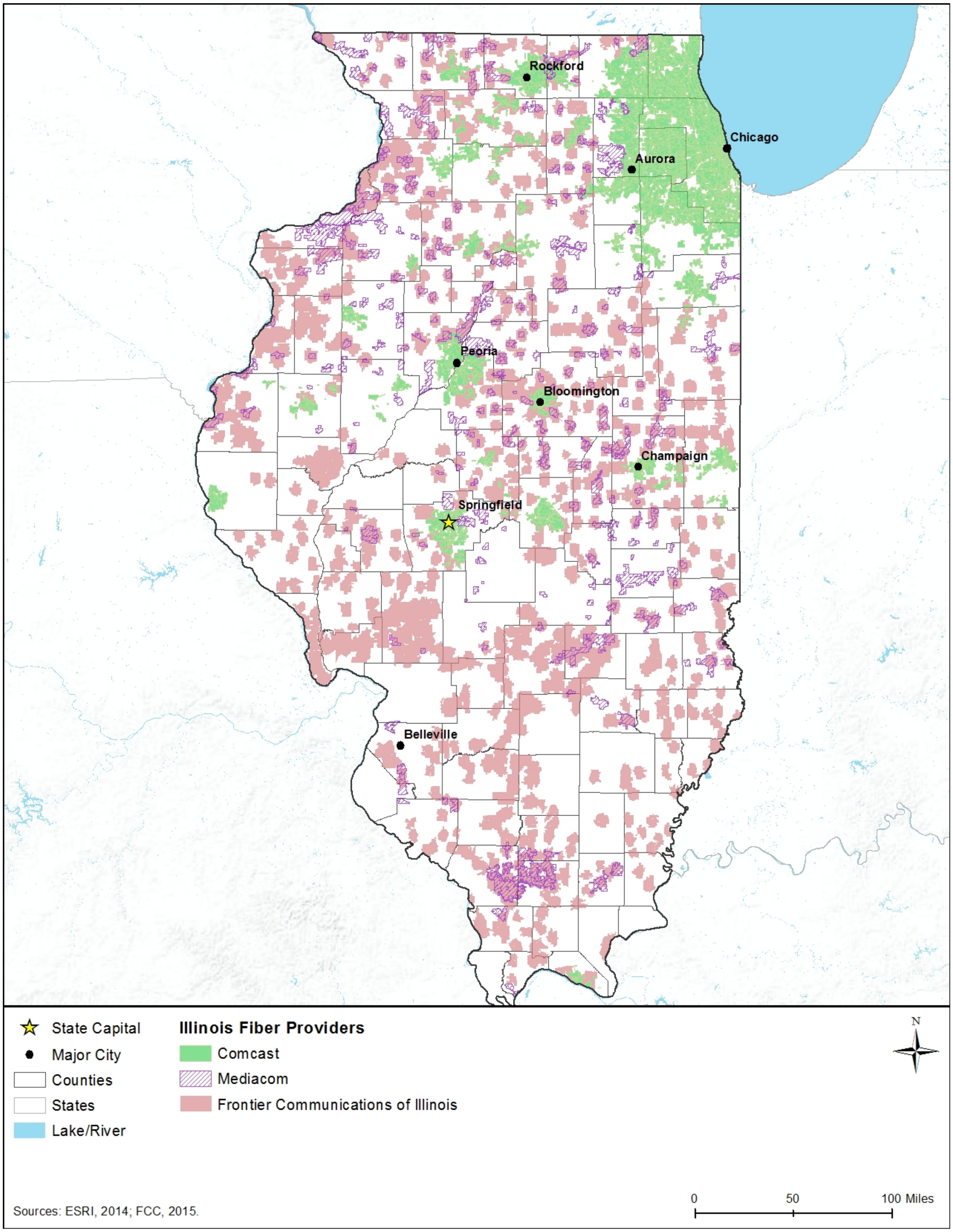


Figure 4.1.1-15: Comcast's, Mediacom's, and Frontier Communications' Fiber Availability in Illinois

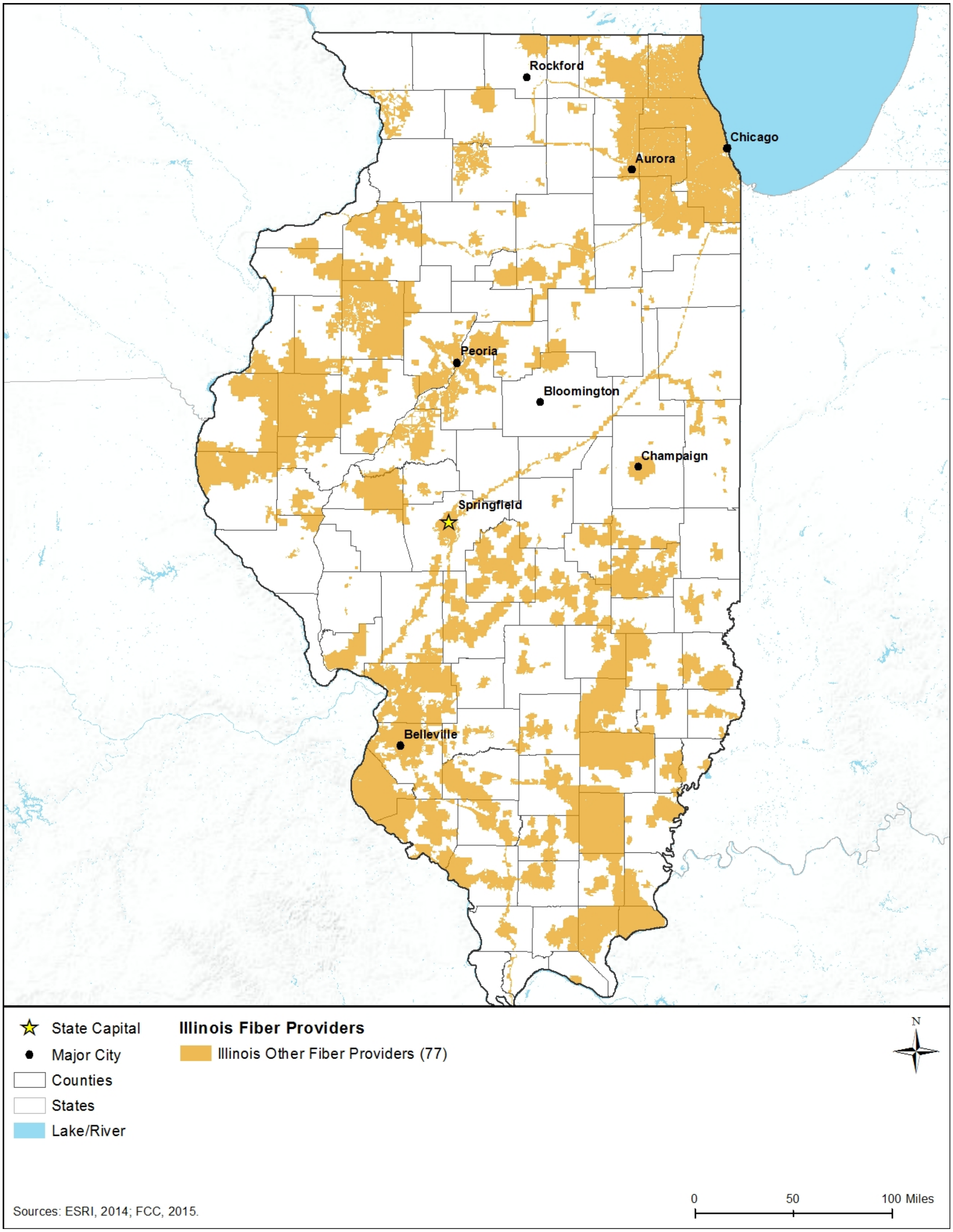


Figure 4.1.1-16: Other Fiber Providers in Illinois

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.

4.1.1.6 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 4.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Public electric utilities in Illinois are regulated by the Illinois Commerce Commission. In this case, the term public utility does not refer to utilities owned or operated by municipal governments, institutions of higher learning or political subdivision (ICC, 2015a). It is the responsibility of the ICC to regulate public utilities to “balance the interests of consumers and utilities to ensure adequate, efficient, reliable, safe and least-cost public utility services” (ICC, 2015b). There are seven investor-owned public utilities in the state the fall under the jurisdiction of the ICC. Two of these are located in northern Illinois, while the remaining five are based in either southern or central parts of the state (ICC, 2014). Much of the electricity generated by the state of Illinois comes from nuclear power plants. In 2014, it was the largest generator of electricity from nuclear power, with the state accounting for 12 percent of the nuclear power generated in the United States. Illinois also was ranked first in capacity for electricity generation from nuclear facilities that year (EIA, 2015a). Historically, nuclear power has been one the largest sources of electricity generation in the state, with coal being a close second (EIA, 2015b). In 2015, 202,143,878 megawatt hours[12] of electricity was generated in Illinois, of which 97,857,900 megawatt hours was generated in a nuclear facility. This accounted for about 48.4 percent of the total. The same year, coal was responsible for the production of 87,282,390 megawatt hours, or 43.2 percent of the total. Much of the remaining 8.4 percent of electricity generated came from wind power or the use of natural gas. These accounted for 10,082,894 megawatt hours (5.0 percent) and 5,465,425 megawatt hours (2.7 percent), respectively (EIA, 2015j).

[12] One megawatthour is defined as “one thousand kilowatt-hours or one million watt-hours.” One watt-hour 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, 2016).

Water

Public utilities that provide water services are governed by the Illinois Commerce Commission (ICC). They define public utilities as those that are investor owned as opposed to those utilities owned or operated by municipal governments, institutions of higher learning or political subdivision (ICC, 2015a). The ICC regulates public utilities in order to "balance the interests of consumers and utilities to ensure adequate, efficient, reliable, safe and least-cost public utility services" (ICC, 2015b). Under its jurisdiction are 15 utility companies, many of which operate in multiple regions of the state. For example, Utility Services of Illinois, Inc., serves customers in 22 divisions. Some utilities provide different services in different regions; Utility Services of Illinois, Inc. provides only water services in 13 divisions, only sewer services in 2 divisions, and both services in 7 divisions (ICC, 2015c). The quality of drinking water produced by public water systems is monitored by the Illinois Environmental Protection Agency (IEPA) (IEPA, 2015a). The IEPA uses its Source Water Assessment and Protection Program to determine the quality and condition of the source waters used by utilities and public water systems. This assessment includes delineating the source water protection area, identifying potential sources or causes of pollution and the water's susceptibility to contamination and ensuring that the public is aware of the assessment's results. This process has been performed for all of the roughly 1,800 community water systems in the state, as well as over 4,100 non-community systems. The Source Water Assessment and Protection Program helps to ensure that the more than 11 million people relying on public water are able to obtain safe and reliably contaminant-free water (IEPA, 2015b).

Wastewater

Like other public utilities, the rates and services of wastewater utilities are overseen by the Illinois Commerce Commission (ICC). The ICC regulates investor-owned utilities, though their reach does not extend to municipal governments, political subdivisions or institutions of higher learning (ICC, 2015a). The ICC compares the rates of its regulated utilities to ensure that rates are fair to both the consumer and the company (ICC, 2015d). There are seven public wastewater companies regulated by the ICC, six of which also provide clean drinking water services to customers. These utilities divide their service areas by division, with some serving customers in as many as 17 districts (ICC, 2015c). Wastewater treatment facilities in Illinois that discharge into streams or lakes must obtain a permit from the IEPA. These permits function both as an approval of new facility design and as a way to monitor and limit discharges, as well as ensure that treatment facilities make timely reports back to the IEPA (IEPA, 2015c). Once treated at a facility, wastewater is then discharged into a body of water. The state has organized these bodies of water in larger overall groups by watershed. There are 33 separate watersheds in the state, housing hundreds of treatment facilities (IEPA, 2015d). It is also the responsibility of the IEPA to issue certifications for the "technical competency of operators of municipal and industrial wastewater treatment/ pretreatment facilities." Someone wishing to become a wastewater treatment facility operator would need to meet "specific experience, education, and examination requirements in order to qualify for certification" (IEPA, 2015e).

Solid Waste Management

Solid Waste Management in Illinois is handled by the IEPA. The IEPA's Division of Land Pollution Control oversees the "proper management of solid and hazardous wastes (generation, transportation, and storage/treatment/disposal)" (IEPA, 2015f). Much of Illinois' solid waste eventually makes its way to one of the state's 39 active landfills. In 2014, these landfill facilities took in over 44 million gate cubic yards of solid waste. This left an unused capacity of 962.6 million gate cubic yards of space as of January 2015. At the current rate, this would allow for continued use of these landfills for another 21 years (IEPA, 2015g). Between 2013 and 2014, the state saw an increase in the amount of material landfilled and a correlating decrease in landfill capacity. In 2013, the state had an approximate 1,040 million gate cubic yards of space, an estimate that had held for the previous two years. Plans for new landfills and the expansion of existing landfills should help to ease this burden (IEPA, 2015h). In addition to the 39 landfills, there are seven facilities permitted in Illinois to handle solid waste treatment or recycling. These facilities range from those that handle the recovery of zinc, cadmium, or lead, to those dedicated to the crushing of aerosol cans (IEPA, 2015i). The state of Illinois also is home to incinerator facilities, Potentially Infectious Medical Waste facilities, precious metal facilities and other that are dedicated to the management of specific and possibly harmful wastes (IEPA, 2015j). Electronic products that have reached the end of their lifespan can no longer be placed in landfills. Regulations that took effect in July 2015 now require that manufacturers offer recycling programs to their consumers, as well as imposing recycling goals on the manufacturer. For example, the makers of television and computer monitors will seek to meet an 80 percent recycling rate goal. Cell phones, PDAs, computer cables and zip drives are still eligible for landfilling (IEPA, 2015k).

4.1.2 Soils

4.1.2.1 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; and
- Time: Soil properties are dependent on the period over which other processes act on them.

4.1.2.2 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 4.1.2-1 below.

Table 4.1.2-1: Relevant Illinois Soils Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State National Pollution Discharge Elimination System (NPDES) Permit (Illinois Pollution Control Board Rules and Regulations 35 Illinois Administrative code, Subtitle C, Chapter 1)	IEPA	Requires construction activities disturbing one acre or more to have an Erosion and Sediment Control Plan. (IEPA, 2013a)

4.1.2.3 Environmental Setting

Illinois is composed of six Land Resource Region (LRR),[13] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Central Feed Grains and Livestock Region;
- East and Central Farming and Forest Region;
- Lake State Fruit, Truck Crop, and Dairy Region;
- Mississippi Delta Cotton and Feed Grains Region;
- Northern Lake States Forest and Forage Region; and
- South Atlantic and Gulf Slope Cash Crops, Forest, and Livestock Region.

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

Within and among Illinois's 6 LRRs are 15 Major Land Resource Areas (MLRA),[14] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of Illinois's MLRAs are presented in Figure 4.1.2-1 and Table 4.1.2-2, respectively.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, and position on the landscape, biota[15] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[16] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[17] (discussed further in the subsections below).

[14] 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).
[15] The flora and fauna of a region.
[16] 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, Olshansky, & Rogers, 2004).
[17] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

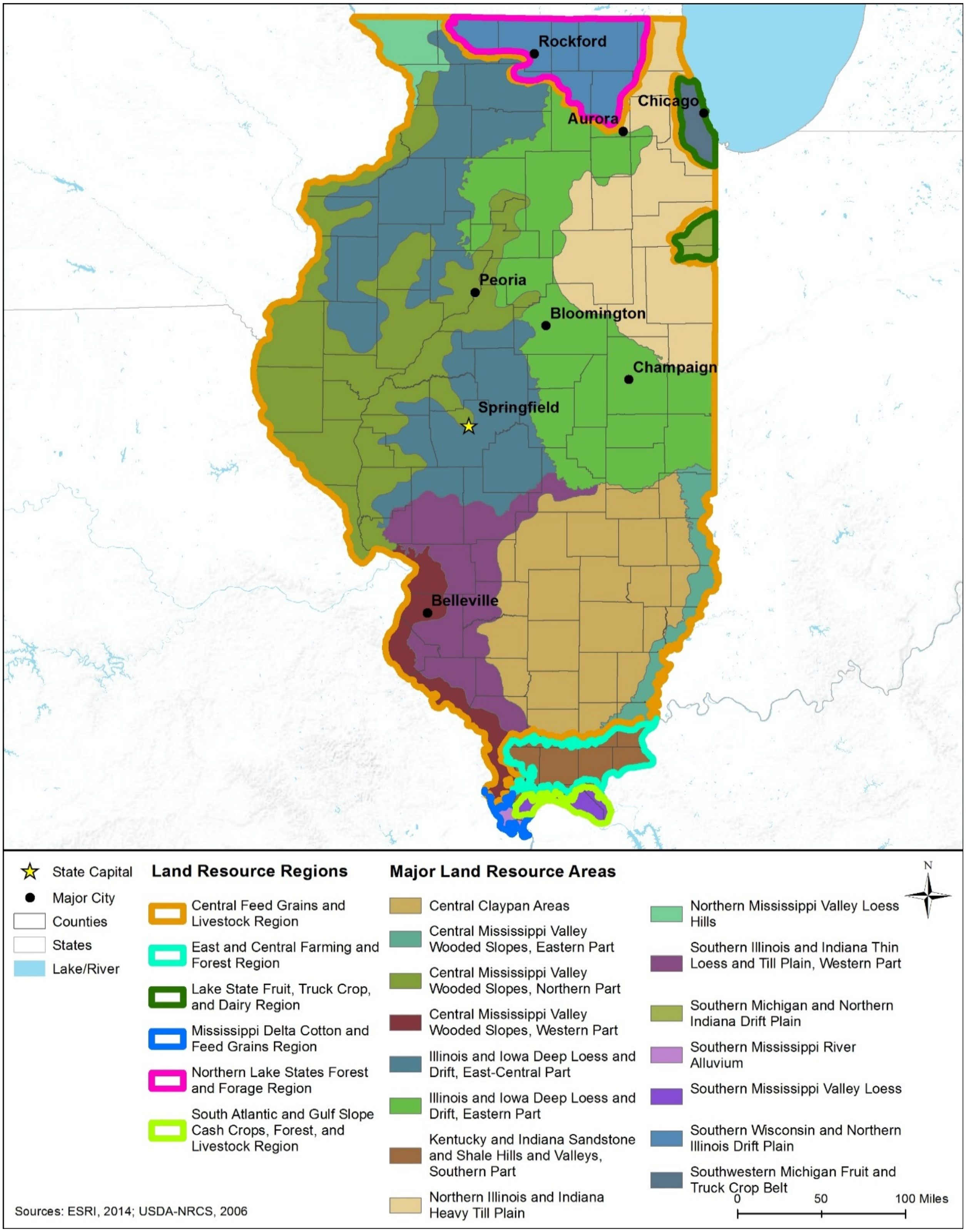


Figure 4.1.2-1: Locations of Major Land Resource Areas in Illinois

Table 4.1.2-2: Characteristics of Major Land Resource Areas in Illinois

MLRA Name	Region of State	Soil Characteristics
Central Claypan Areas	Southern Illinois	Alfisols[a] is the dominant soil order. These loamy[b] or clayey soils range from well drained to poorly drained and are typically very deep.
Central Mississippi Valley Wooded Slopes, Eastern Part	Southeastern Illinois	Alfisols, Entisols[c], Inceptisols[d], and Mollisols[e] are the dominant soil orders. These very deep soils are loamy, silty, and clayey, and range from excessively drained to poorly drained.
Central Mississippi Valley Wooden Slopes, Northern Part	Western Illinois	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from excessively drained to poorly drained, and from very deep to very shallow. They are loamy, clayey, or silty.
Central Mississippi Valley Wooded Slopes, Western Part	Southwestern Illinois	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from excessively drained to poorly drained, and from very deep to very shallow. They are loamy, clayey, or silty.
Illinois and Iowa Deep Loess and Drift, East-Central Part	Northwestern Illinois	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from somewhat poorly drained to well drained. They are silty or clayey, and are typically moderately deep to very deep.
Illinois and Iowa Deep Loess and Drift, Eastern Part	Northeastern Illinois	Alfisols and Mollisols are the dominant soil orders. These soils range from poorly drained to moderately well drained, and are typically moderately deep to very deep. They are silty or clayey.
Kentucky and Indiana Sandstone and Shale Hills and Valleys, Southern Part	Southern Illinois	These soils are generally Alfisols, and specifically Udalfs. They are loamy or clayey.
Northern Illinois and Indiana Heavy Till Plain	Northeastern Illinois	Alfisols, Histosols[f], Inceptisols, and Mollisols are the dominant soil orders. These soils typically range from moderately well drained to poorly drained, and are moderately deep to very deep. They are "silty or clayey in the subsoil."
Northern Mississippi Valley Loess Hills	Northwestern Illinois	Alfisols and Entisols are the dominant soil orders, with Mollisols less so. These loamy soils are typically well drained or moderately well drained, and are moderately deep to very deep.
Southern Illinois and Indiana Thin Loess and Till Plain, Western Part	Southern Illinois	Alfisols and Inceptisols are the dominant soil orders, with Entisols, Mollisols, and Ultisols[g] less so. These soils typically range from somewhat poorly drained to well drained.
Southern Michigan and Northern Indiana Drift Plain	Northeastern Illinois	Alfisols, Histosols, and Mollisols are the dominant soil orders. These loamy or sandy soils range from very poorly drained to well drained and are very deep.
Southern Mississippi River Alluvium	Southern Illinois	Alfisols, Entisols, Inceptisols, and Vertisols[h] are the dominant soil orders. These generally clayey or loamy soils range from poorly drained to somewhat poorly drained, and are very deep.
Southern Mississippi Valley Loess	Southern Illinois	Alfisols, Entisols, Inceptisols, and Ultisols are the dominant soil orders. These deep or very deep soils range from well drained to poorly drained and are loamy or silty.

MLRA Name	Region of State	Soil Characteristics
Southern Wisconsin and Northern Illinois Drift Plain	Northern Illinois	Alfisols, Histosols, and Mollisols are the dominant soil orders. These loamy and very deep soils typically range from poorly drained to well drained.
Southwestern Michigan Fruit and Truck Crop Belt	Northeastern Illinois	Alfisols, Entisols, Histosols, and Spodosols[i] are the dominant soil orders. These soils typically range from very poorly drained to excessively drained. They are loamy or sandy, and are very deep.

Source: (NRCS, 2006)

[a]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)
[b] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts" (Purdue University Consumer Horticulture, 2006).
[c] 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)
[d] 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)
[e] 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)
[f] Histosols: "Histosols have a high content of organic matter and no permafrost. Most are saturated year round, but a few are freely drained. They form in decomposed plan remains that accumulate in water, forest litter, or moss faster than they decay. Histosols make up about 1% of the world's ice-free land surface." (NRCS, 2015b)
[g] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8% of the world's ice-free land surface." (NRCS, 2015b)
[h] 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)
[i] Spodosols: "Spodosols formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in the subsoil. They commonly occur in areas of course-textured deposits under coniferous forests of humid regions, tend to be acid and infertile, and make up about 4% of the world's ice-free land surface." (NRCS, 2015b)

4.1.2.4 Soil Suborders

Soil suborders are part of the soil taxonomy.[18] Soil orders are the highest level in the taxonomy;[19] there are 12 soil orders in the world and they are characterized by both observed and inferred[20] 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[21] soil database identifies 10 different soil suborders in Illinois (NRCS, 2015d). Figure 4.1.2-2 depicts the distribution of the soil suborders, and Table 4.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[18] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA 2013).
[19] Science of naming and classifying organisms or specimens.
[20] "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).
[21] 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.

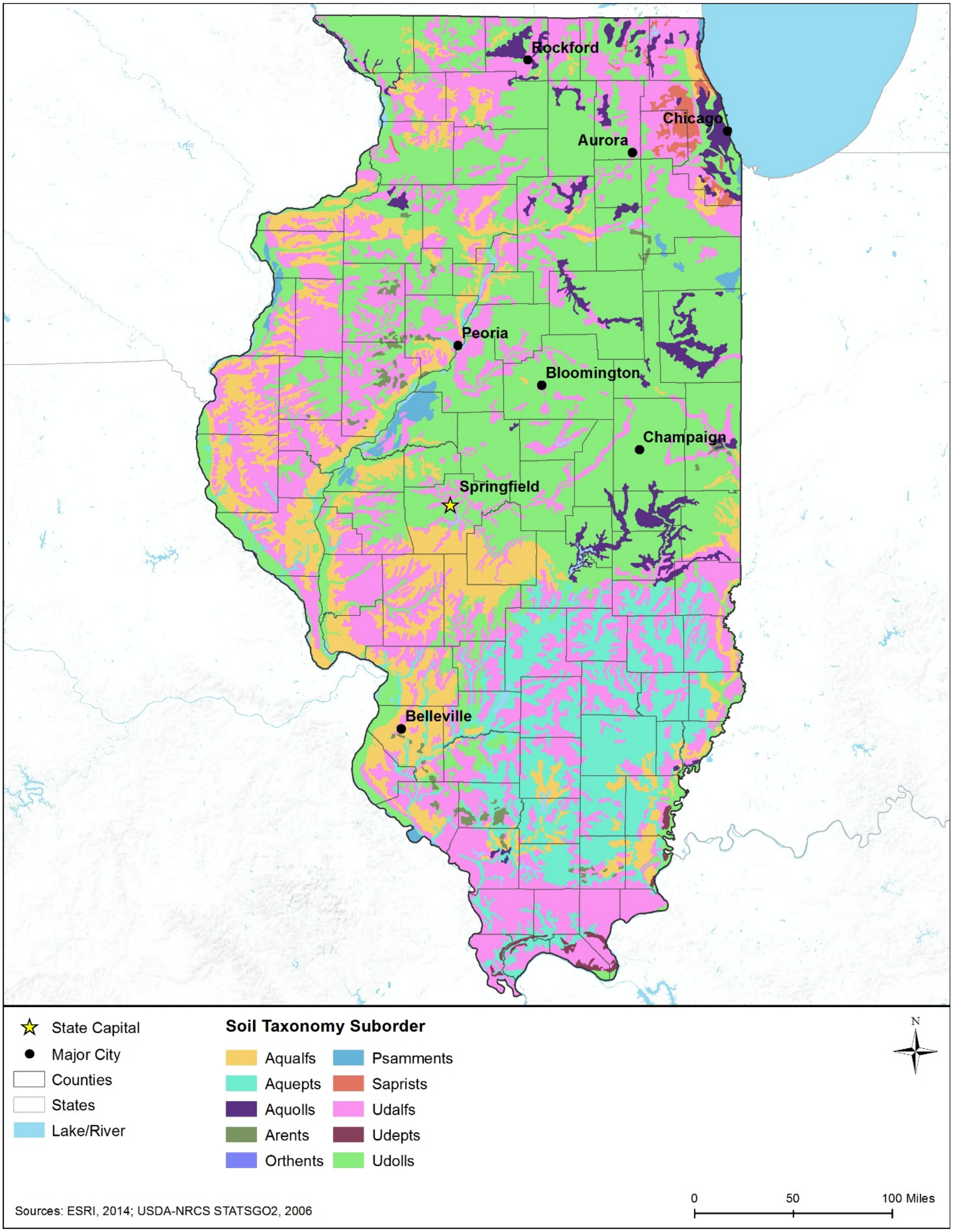


Figure 4.1.2-2: Illinois Soil Taxonomy Suborders

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Table 4.1.2-3: Major Characteristics of Soil Suborders[22] Found in Illinois, as depicted in Figure 4.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil [a]	Hydrologic Group	Runoff Potential [b]	Permeability	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Silt loam, Silty clay, Silty clay loam, Stratified sandy loam to silty clay loam	0-7	Somewhat poorly drained to poorly drained	Yes, No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Loam, Silt loam	0-2	Somewhat poorly drained	No	C	Medium	Low	Medium	Low	Erosion
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, Silt loam, Silty clay, Silty clay loam, Stratified loamy sand to silty clay loam, Stratified silt loam to clay	0-2	Poorly drained to very poorly drained	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	Erosion and Compaction
Entisols	Arents	Arents are predominantly used for pasture, crops, wildlife habitat, and urban land. Since they have been subject to various means of mixing, they lack diagnostic horizons.	Silty clay loam	1-7	Well drained	No	D	High	Very Low	High	Low	Erosion
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Variable	0-15	NA[c]	NA	NA	-	-	-	-	-
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Fine sand, Loamy fine sand, Loamy sand	0-18	Somewhat poorly drained to excessively drained	Yes, No	A, B	Low, Medium	High, Moderate	Low to Medium, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Histosols	Saprists	Saprists have organic materials are well decomposed, and many support natural vegetation and are used as woodland, rangeland, or wildlife habitat. Some Saprists, particularly those with a mesic or warmer temperature regime, have been cleared, drained, and used as cropland.	Muck	0-2	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	Erosion and Compaction
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, Fine sandy loam, Loam, Loamy fine sand, Sand and gravel, Sandy loam, Silt loam, Silty clay loam, Stratified gravelly sand to loam, Very fine sandy loam	0-45	Somewhat poorly drained to somewhat excessively drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low	Erosion

[22] 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 [b]	Permeability	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the northwest and mixed or hardwood forest in the east. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Silt loam, Silty clay loam	0-2	Moderately well drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low	Erosion
Inceptisols	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.	Channery clay, Clay loam Fine sandy loam, Loam, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stratified gravelly loamy sand to silty clay loam	0-15	Somewhat poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion

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

[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 4.1.2.5.
[c] The dataset from NRCS is missing the attributes to populate this information.

4.1.2.5 Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[23] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 4.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in Illinois.

A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[24] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Psamments, Saprists, and Udalfs fall into this category in Illinois.

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

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

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

4.1.2.6 Soil Erosion

"Soil erosion [is] 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, and degrade 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 4.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in Illinois. Soils with the highest erosion potential in Illinois include those in the Aqualfs, Aquepts, Aquolls, Arents, Psamments, Saprists, Udalfs, Udepts, and Udolls suborders, which are found throughout most of the state (Figure 4.1.2-2).

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[23] 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.

[24] 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).

4.1.2.7 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 4.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Illinois. Soils with high potential for compaction and rutting in Illinois include those in the Aqualfs, Aquolls, Psamments, and Saprists suborders (i.e., 17 percent of all Illinois soils), which are found primarily in northeastern Illinois (Figure 4.1.2-2).

4.1.3 Geology

4.1.3.1 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 (USGS, 2016e). Several of these elements are discussed in other sections of this Programmatic Environmental Impact Statement (PEIS), including Water Resources (Section 4.1.4), Human Health and Safety (Section 4.1.15), and Climate Change (Section 4.1.14).

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

- Section 4.1.3.3, Environmental Setting: Physiographic Regions and Provinces;[25,26]
- Section 4.1.3.4, Surface Geology;
- Section 4.1.3.5, Bedrock Geology;[27]
- Section 4.1.3.6, Paleontological Resources;[28]
- Section 4.1.3.7, Fossil Fuel and Mineral Resources; and
- Section 4.1.3.8, Geologic Hazards.[29]

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

4.1.3.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 4.1.3-1 below.

Table 4.1.3-1: Relevant Illinois Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Archaeological and Paleontological Resources Protection Act 20 Illinois Compiled Statutes (ILCS) 3435	Illinois Historic Preservation Society	A permit issued by the Historic Preservation Agency is required for any person, either by himself or through an agent, to explore, excavate or collect any paleontological resources on public lands.
Illinois Building Codes	City and County Agencies	Check county, city, and other local agencies for seismic guidelines in building codes.

Sources: (Illinois General Assembly, 2015b) (Illinois CDB, 2015)

4.1.3.3 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)

Illinois is within three physiographic regions: Atlantic Plain (Coastal Plain Province); Interior Highlands (Ozark Plateaus); and Interior Plains (Interior Low Plateaus and Central Lowlands) (USGS, 2003a) (Figure 4.1.3-1). The general characteristics of these regions and their respective provinces are summarized in the following subsections.

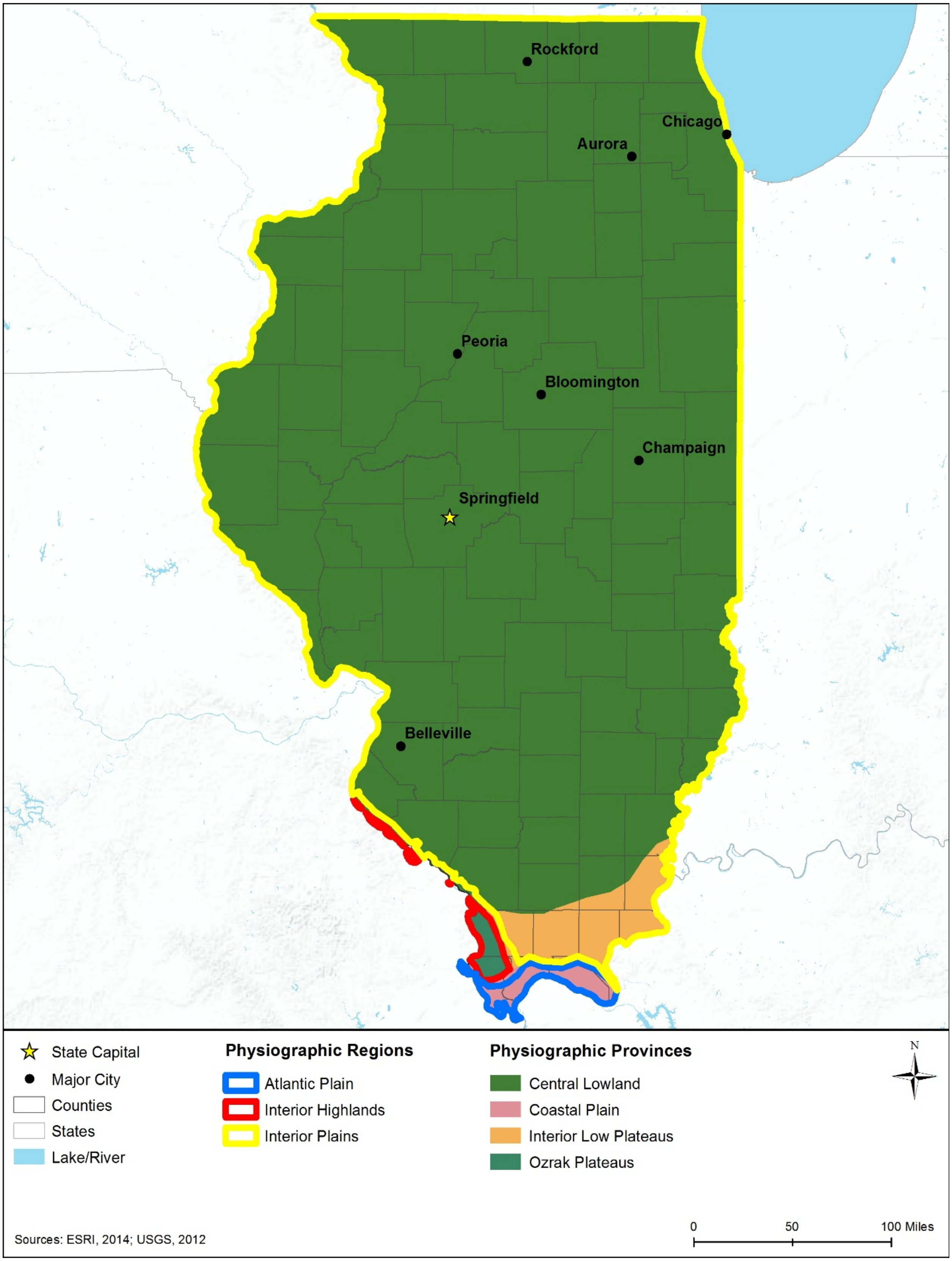


Figure 4.1.3-1: Physiographic Regions and Provinces of Illinois

Atlantic Plain Region

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York south to Florida and west to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. Sedimentary strata become thinner moving westward through the region, and thicken to several thousand feet thick along the coastline. Erosion from the Appalachian Mountains, which began to form 480 to 440 million years ago (MYA), dislodged sediments, which were subsequently deposited by rivers to form the Atlantic Plain.[30] The area is characterized by gentle topography and a transition zone between the land and sea often having marshes, lagoons, swamps, sand bars, and reefs. Deposits of coastal marine life over millions of years form the basis for rich fossil fuel reserves in the region. (NPS, 2015a)

As reported above, the Atlantic Plain Region within Illinois is composed of one physiographic province: the Coastal Plain Province (USGS, 2003a).

<u>Coastal Plain Province</u> – Within Illinois, the Coastal Plain includes the area in the extreme southern portion of the state along the Ohio River (USGS, 1995). “The Coastal Plain in Illinois is underlain by unconsolidated Cretaceous and Tertiary sediments” (Leighton, Ekblaw, & Horberg, 1948). Alluvial[31] deposits and terraces produced by the Mississippi River are common throughout the province (NPS, 2014a) (Leighton, Ekblaw, & Horberg, 1948). At 268 feet above sea level (ASL), the lowest point in Illinois occurs at the confluence of the Mississippi and Ohio Rivers (Leighton, Ekblaw, & Horberg, 1948). These lowlands extend to the Gulf of Mexico (NPS, 2014a).

Interior Highlands Region

The Interior Highlands Region includes the elevated portions of Illinois, Missouri, Arkansas and Oklahoma, and stand in contrast to the flat-lying surrounding areas of the Interior Plains and Atlantic Plains Regions. The Interior Highlands are composed of Paleozoic (542 to 241 MYA) sedimentary[32] rocks. Beginning about 340 MYA, these rocks were uplifted and deformed to form a large mountain range, much of which has subsequently eroded. The remnants of this mountain range are seen today in the Ouachita-Ozark Highlands. (USGS, 2014a)

<u>Ozark Plateaus Province</u> – The Ozark Plateaus Province includes the area along the southwestern margin of Illinois (Leighton, Ekblaw, & Horberg, 1948). The Ozark Plateaus Province is a topographic upland surrounded by lowlands of the Atlantic Plain and Interior Plains (NPS, 2014b). “The plateau surface is rugged and broken by closely spaced valleys and ridges… Most of the minor valleys are narrow, V-shaped, and steeply graded.” Throughout Illinois, much of

[30] 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.
[31] Alluvium: “Sand, gravel, and silt deposited by rivers and streams in a valley bottom” (USGS, 2015c).
[32] Sedimentary Rocks: “Sedimentary rocks are 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, 2015c).

the province is underlain by pre-Pennsylvanian rocks (318 to 299 MYA) with glacial deposits at the surface (Leighton, Ekblaw, & Horberg, 1948).

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[33] and igneous[34] rocks dating to the Precambrian Era (older than 542 MYA) underlie the entire region. 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, 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,[35] mudstone,[36] and clay (USGS, 2014b).

<u>Interior Low Plateaus</u> – The Interior Low Plateaus Province is part of southern Illinois just to the north of the state's Coastal Plain Province and to the south of the Central Lowlands Province. Throughout the Interior Plains, elevations range from 500 to 1000 feet ASL (NPS, 2014b). The geology of this area is composed of Mississippian (359 to 318 MYA) and Pennsylvanian (318 to 299 MYA) rocks. Plateaus are marked by "numerous minor escarpments,[37] structural benches, fault-line scarps, and subsequent valleys which reflect local structure and the varied lithology of the bedrock. Only small patches of flat upland are present" (Leighton, Ekblaw, & Horberg, 1948).

<u>Central Lowlands</u> – As the largest physiographic province in the United States, the Central Lowlands 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, 2014b). Within Illinois, more than 90 percent of the state falls within the Central Lowlands Province (with the exception of areas within extreme southern Illinois); most of the Central Lowlands are covered in glacial deposits, with the exception of a small area in northwestern Illinois referred to as the Wisconsin Driftless section; Illinois' glacial deposits are covered in additional detail in Section 4.1.3.4, Surface Geology. The northeastern section of the state (referred to as the Great Lakes section) is "separated from the Till Plains section to the south because of the bold encircling moraines of Lake Michigan basin" (Leighton, Ekblaw, & Horberg, 1948).

[33] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure or by replacement of elements by hot, chemically active fluids" (USGS, 2015c).
[34] Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)" (USGS, 2015c).
[35] Sandstone: "Sedimentary rock made mostly of sand-sized grains" (USGS, 2015c).
[36] Mudstone: "A very fine-grained sedimentary rock formed from mud" (USGS, 2015c).
[37] Escarpment (Also Scarp): "A cliff formed by faulting, erosion, or landslides" (USGS, 2015c).

4.1.3.4 Surface Geology

Surficial geology is characterized by materials such as till,[38] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures,[39] subsidence,[40] and erosion. (Thompson, 2015)

Glaciers covered the majority of Illinois during much of the last 2M years, with the exception of a few areas in the far northwestern corner of the state, a small area in western Illinois, and the far southern areas in the Coastal Plain Province. Areas that were not impacted by glaciers are noted for their rocky ridges and cliffs; on the other hand, areas that have been affected by glaciers are relatively flat. During the Wisconsinan glaciation (approximately 25,000 years ago), glaciers covered the northeastern quarter of the state, filling river valleys, leveling hills, and depositing till. When the glaciers melted, the water carried the gravel and outwash[41] to the Mississippi River, blocking its old channel and creating a new one similar to its present-day course. The floodwaters also deposited silt in river valleys, which was subsequently transported by large dust storms and deposited across the state as loess.[42] Loess often measures 20 to 30 feet thick near the Mississippi and Illinois rivers, and two to three feet throughout the rest of the state (ISGS, 2015a). Figure 4.1.3-2 depicts a generalized illustration of the surface geology for Illinois.

[38] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013a).
[39] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses (Idaho State University 2000).
[40] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).
[41] Outwash: "Glacial outwash is the deposit of sand, silt, and gravel formed below a glacier by meltwater streams and rivers" (NPS, 2000).
[42] Loess: "A wind-blown deposit of sediment made mostly of silt-sized grains" (USGS, 2015c).

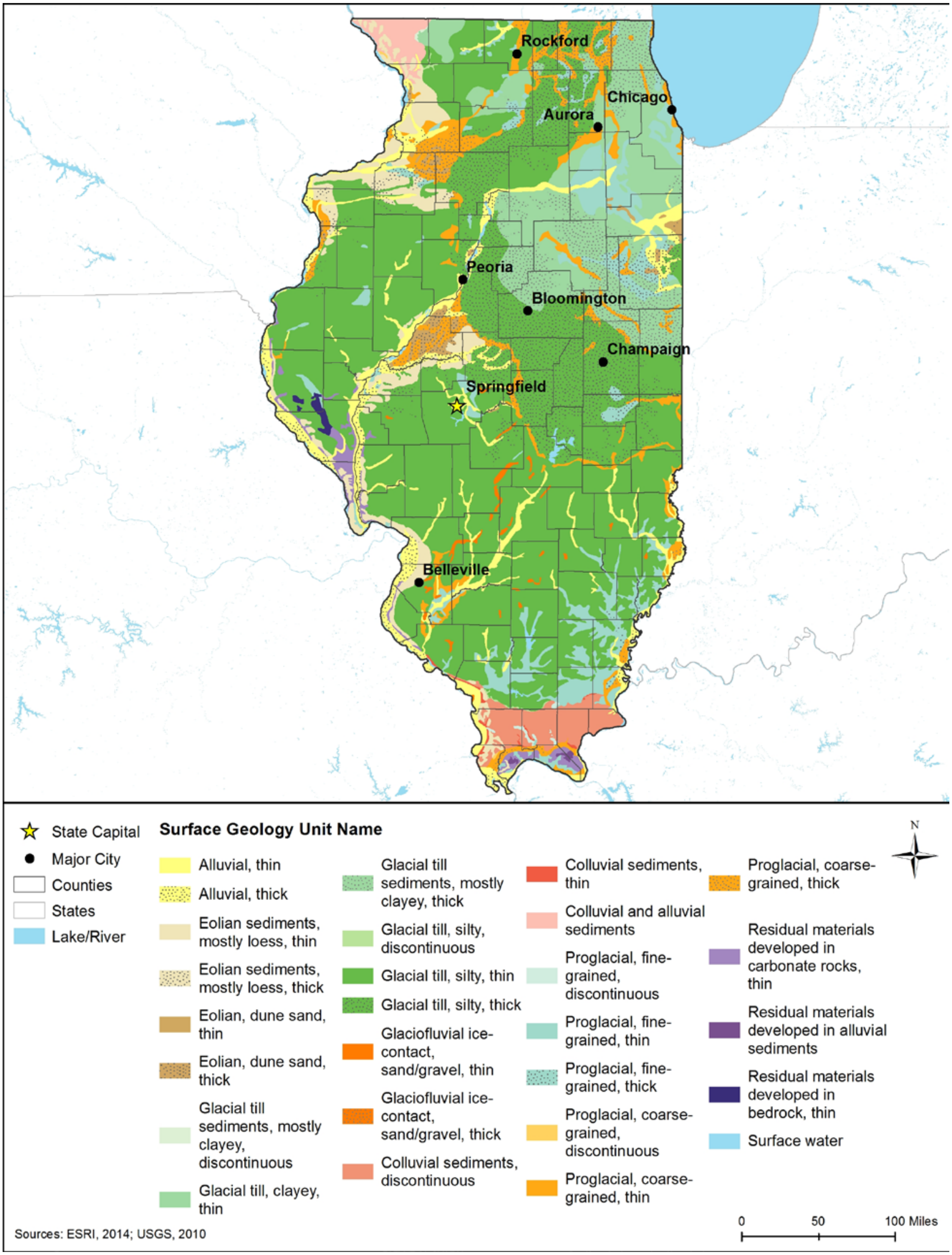


Figure 4.1.3-2: Generalized Surface Geology for Illinois

4.1.3.5 Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015d) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[43] rock composition, and regional tectonism.[44] 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).

Prior to 2M years ago, before glaciers moved into Illinois, a large lowland covered the majority of central Illinois. Surrounding uplands to the north, south, and west, and were composed of more resistant Paleozoic (542 to 251 MYA) limestone and dolomite. When glaciation occurred in the state, the lower area of central Illinois was flattened into a plain topped by thick glacial deposits, while the surrounding uplands impeded glacial movement from proceeding further, as evidenced by the rocky ridges and cliffs found in these areas (Leighton, Ekblaw, & Horberg, 1948), (ISGS, 2015a). Bedrock in Illinois is found under glacial sediment up and is generally comprised of sedimentary rocks. Surface bedrock found in Illinois is found on hilly and steep terrain, and primarily consists of Paleozoic and Mesozoic (251 to 66 MYA) dolomite,[45] limestone,[46] shale,[47] sandstone, and coal (Grimley, Stiff, & Andrew, 2015). Figure 4.1.3-3 displays the general bedrock geology for Illinois. For more site-specific information, other sources from the Illinois State Geological Survey should be consulted.

[43] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure" (NPS, 2000).
[44] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2016b).
[45] Dolomite: "A magnesium-rich carbonate sedimentary rock. Also, a magnesium-rich carbonate mineral ($CaMgCO_3$)" (USGS, 2015c).
[46] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation" (USGS, 2015c).
[47] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks" (USGS, 2015c).

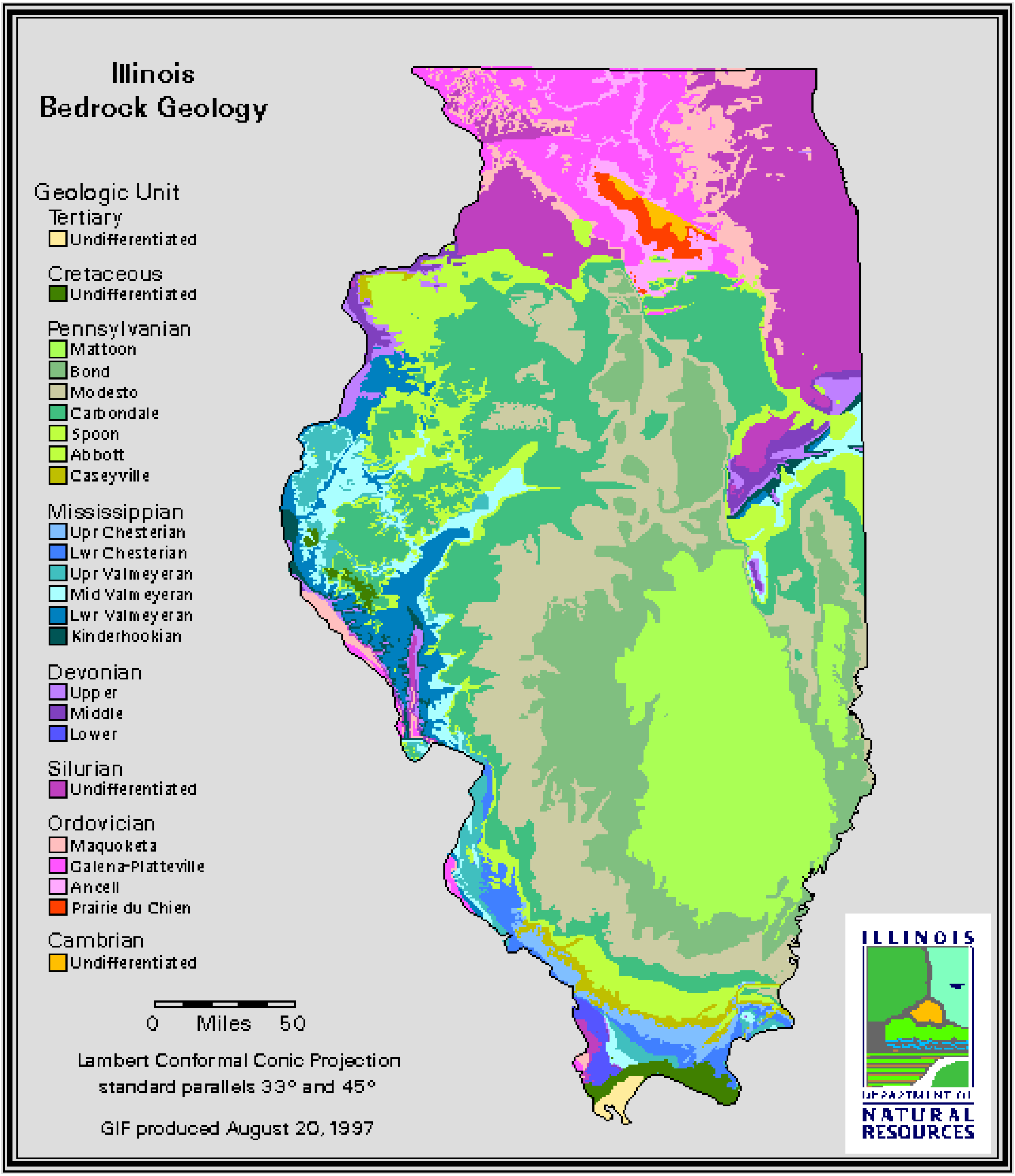


Figure 4.1.3-3: Generalized Bedrock Geology for Illinois

Source: (ISGS, 2005)

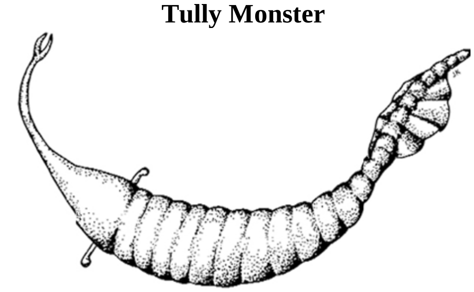
4.1.3.6 Paleontological Resources

Fossils from the Cambrian Period (542 to 488 MYA) through the early Carboniferous Period (359 to 299 MYA) are prevalent throughout Illinois. During the late Carboniferous Period, a large river delta covered much of the state, leaving behind a fossil record referred to as the “Mazon Creek” flora and fauna, which is primarily in Will and Gundy Counties (Figure 4.1.3-4)

(Paleontology Portal, 2015). The Mazon Creek deposits are unique in that they contain the soft parts of both plants and animals (Illinois State Museum, 2015). Mesozoic Era (251 to 66 MYA) fossils are scarce, but there are a few potential fossil-bearing exposures of Cretaceous Period (146 to 66 MYA) rocks in the state. Cenozoic Era (66 MYA to present) fossils are mostly limited to animal fossils from the Quaternary Period (2.6 MYA to present) (Paleontology Portal, 2015).

Marine fossils from the Cambrian through Carboniferous Periods include trilobites,[48] brachiopods,[49] and corals. Snails and nautiloids[50] from the Ordovician Period (488 to 444 MYA), and stromatoporoids[51] and crinoids[52] from the Silurian Period (444 to 416 MYA) also have been recorded, as have shark teeth from the Devonian Period (416 to 359 MYA). Marine fossils from the Carboniferous Period have been found in western and southern Illinois, and include blastoids,[53] brachiopods, bryozoans,[54] corals, crinoids, and sharks. Late Carboniferous Period fossils are common throughout the Mazon Creek area deposits, and include seed ferns, ferns, millipedes, giant dragonflies, and extinct relatives of spiders. Marine fossils recorded include clams, horseshoe crabs, jellyfish, shrimp, brachiopods, bony fishes, sharks, and the Tully monster (Paleontology Portal, 2015). The Tully Monster (*Tullimonstrum gregarium)*, which lived approximately 300 MYA, is the designated state fossil of Illinois. The Tully Monster has been recorded in both the Mazon Creek Deposits and in central Illinois in open-pit coal mines (Illinois State Museum, 2015). Cretaceous Period leaf and foraminifera[55] fossils have been recorded. Fossils from the Quaternary Period include the giant tortoise, mastodon, mammoth, giant beaver, stag moose, and the Jefferson's ground sloth (Paleontology Portal, 2015).

Tully Monster



Source: (ISGS, 2015b)

[48] 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).

[49] 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).

[50] Nautiloid: "Common name for a genus of cephalopods with spiral, chambered shells" (Smithsonian Institution, 2016).

[51] Stramatoporoids: "Any member of a group of extinct sponge or sponge-like organisms that formed vertical pillars of horizontally laminated calcareous fossils (similar in appearance to stromatolites)" (Smithsonian Institution, 2016).

[52] Crionoid: "The common name for any echinoderm of the class Crinoidea, including sea lilies, feather stars, etc. Crinoids are common fossils in the Paleozoic and persist to the present. Many species have stalks and radiating arms and feed on particles in the water column" (Smithsonian Institution, 2016).

[53] Blastoid: "Any member of the extinct echinoderm group Blastoidea. Most blastoids had stalks, were sessile, and fed on particles suspended in the water column. Blastoids went extinct at the end of the Paleozoic" (Smithsonian Institution, 2016).

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

[55] 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).

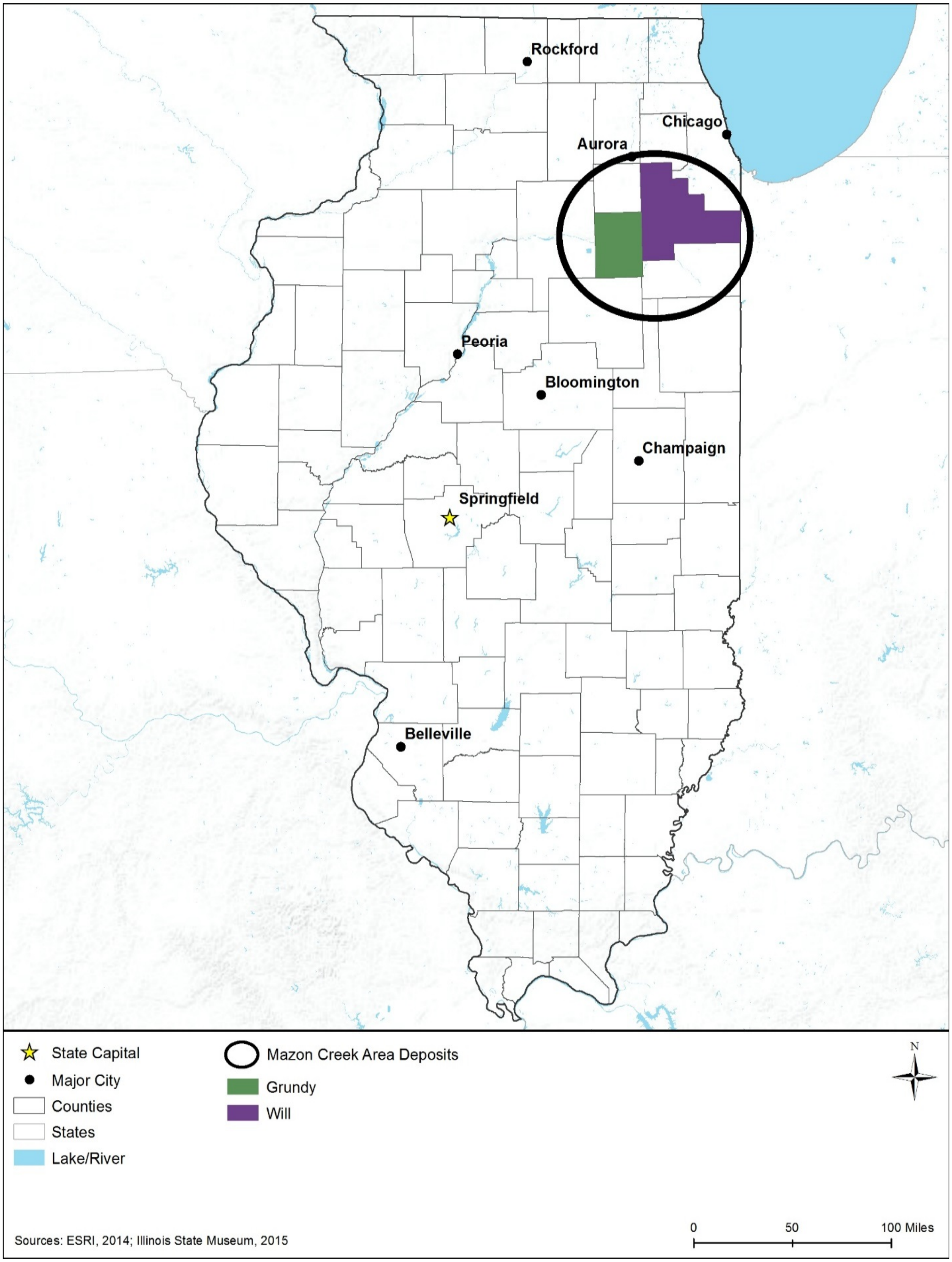


Figure 4.1.3-4: Mazon Creek Area Deposits

4.1.3.7 Fossil Fuel and Mineral Resources

Oil and Gas

Illinois produced just over 9.5M barrels of crude oil in 2015, the majority of which was produced in the southern half of the state. "Oil production peaked in the middle of the 20th century, but now most of the producing oil wells in the state are stripper wells producing less than 2 barrels of crude oil per day." (EIA, 2015c). Illinois has 36 natural gas producing wells and produced 2,626 million cubic feet of natural gas in 2014 (EIA, 2015c).

Minerals

As of 2015, Illinois' total nonfuel mineral production was valued at $2.15M, ranking 14th nationwide (in terms of dollar value), about 2.75 percent of the country's total nonfuel mineral production (USGS, 2016c). Nearly half of Illinois' mineral production is crushed stone, followed by industrial sand and gravel. Illinois ranked third nationwide in production of industrial sand and gravel. Portland cement, construction sand and gravel, common clay and shale, dimension stone (crushed),[56] peat, tripoli, perlite, silica, sulfur, and vermiculite are also mined and produced in the state (USGS, 2015e) (USGS, 2001) (USGS, 2004) (ISGS, 2016a).

In 2013, Illinois produced more than 52M short tons of coal, accounting for about 5.3 percent of total nationwide coal production. Illinois has 24 active bituminous[57] coal mines and the recoverable reserves may amount to 2.5B short tons; Illinois ranks second in the nation in total recoverable coal (nearly 13 percent of the nationwide total) (EIA, 2015c). Coal in Illinois is primarily found in Pennsylvanian (318 to 299 MYA) rocks (ISGS, 2016b).

4.1.3.8 Geologic Hazards

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

Earthquakes

Within Illinois, earthquakes occur, on average, once per year, though damaging earthquakes are far less frequent (ISGS, 1995). 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. Earthquakes can produce secondary flooding impacts as a result of dam failures (USGS, 2012a).

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[56] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape" (USGS, 2016f).
[57] Bituminous Coal: "A dense coal, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke" (EIA, 2015d).

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 type to occur in Illinois, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale.[58] 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." 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 (Oregon Department of Geology, 2015). Illinois is far from any convergence boundaries.

Figure 4.1.3-5 depicts the seismic risk throughout Illinois; 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 (PGA)) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (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% g. (USGS, 2010)

Areas of greatest seismicity in Illinois are concentrated in the southern portions of the state. The largest earthquake ever recorded in Illinois occurred in 1968, and measured 5.4 on the Richter scale. However, Illinois is at risk to damaging earthquakes (greater than magnitude 6.3 on the Richter scale) due to its proximity to the New Madrid Seismic Zone, which includes portions of Illinois, Missouri, Kentucky, Tennessee, and Arkansas, and the Wabash Valley Seismic Zone in southeastern Illinois (IEMA, 2013a). "The likelihood of a damaging earthquake (magnitude 6.3 or greater) occurring somewhere in the central [U.S.] within the next 15 years is 40 to 63 percent and 86 to 97 percent within the next 50 years…The probability of a major earthquake (magnitude 7.5 or greater) is only 5 to 9 percent within the next 15 years, and 19 to 29 percent within the next 50 years" (ISGS, 1995). Three damaging earthquakes occurred along the New Madrid Fault Zone during 1811 and 1812; it is estimated that these earthquakes measured between 7.3 and 7.5 on the Richter scale (USGS, 2012b).

Landslides

The potential for widespread landslides in Illinois is minimal, with the exception of areas along the Illinois and Mississippi Rivers (USGS, 1997) (Figure 4.1.3-6).

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

[58] 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, 2014d).

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

Ample evidence for historic landslide events can be seen in the relic landslides along the Mississippi and Ohio Rivers (USDOE, Office of Scientific and Technical Information, 1992). While most of these landforms are at minimal risk to repeated activity, future failures are highly possible in the event of a major earthquake along the New Madrid Fault (USGS, 1997). The Illinois State Geological Survey recently investigated a landslide in Grafton, IL,[59] which temporarily required the closure of State Route 100 (ISGS, 2015b). Figure 4.1.3-6 shows landslide incidence and susceptibility throughout Illinois.

[59] Grafton is on the Mississippi River about 20 miles north-northwest of St. Louis, MO.

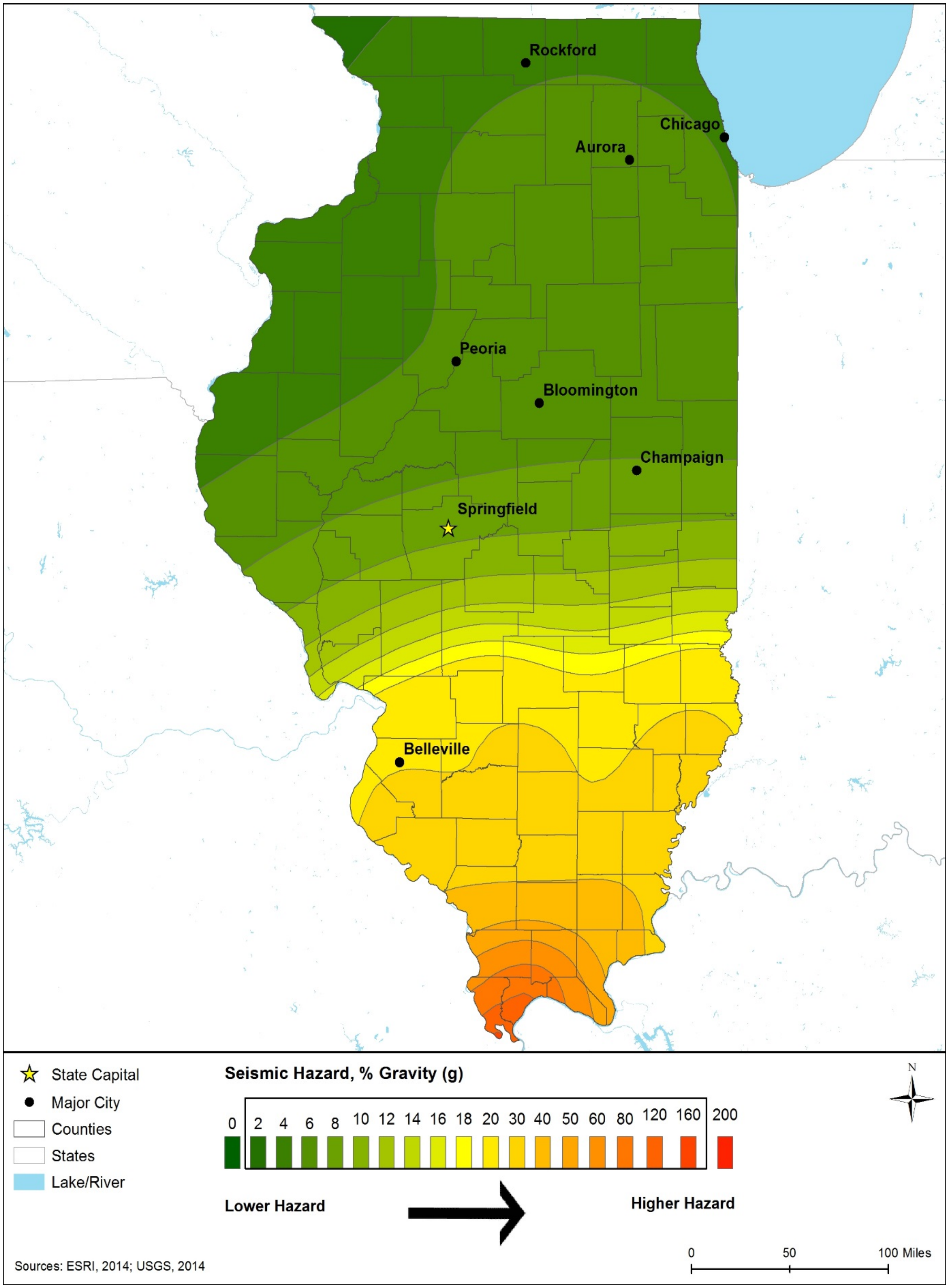


Figure 4.1.3-5: Illinois 2014 Seismic Hazard Map

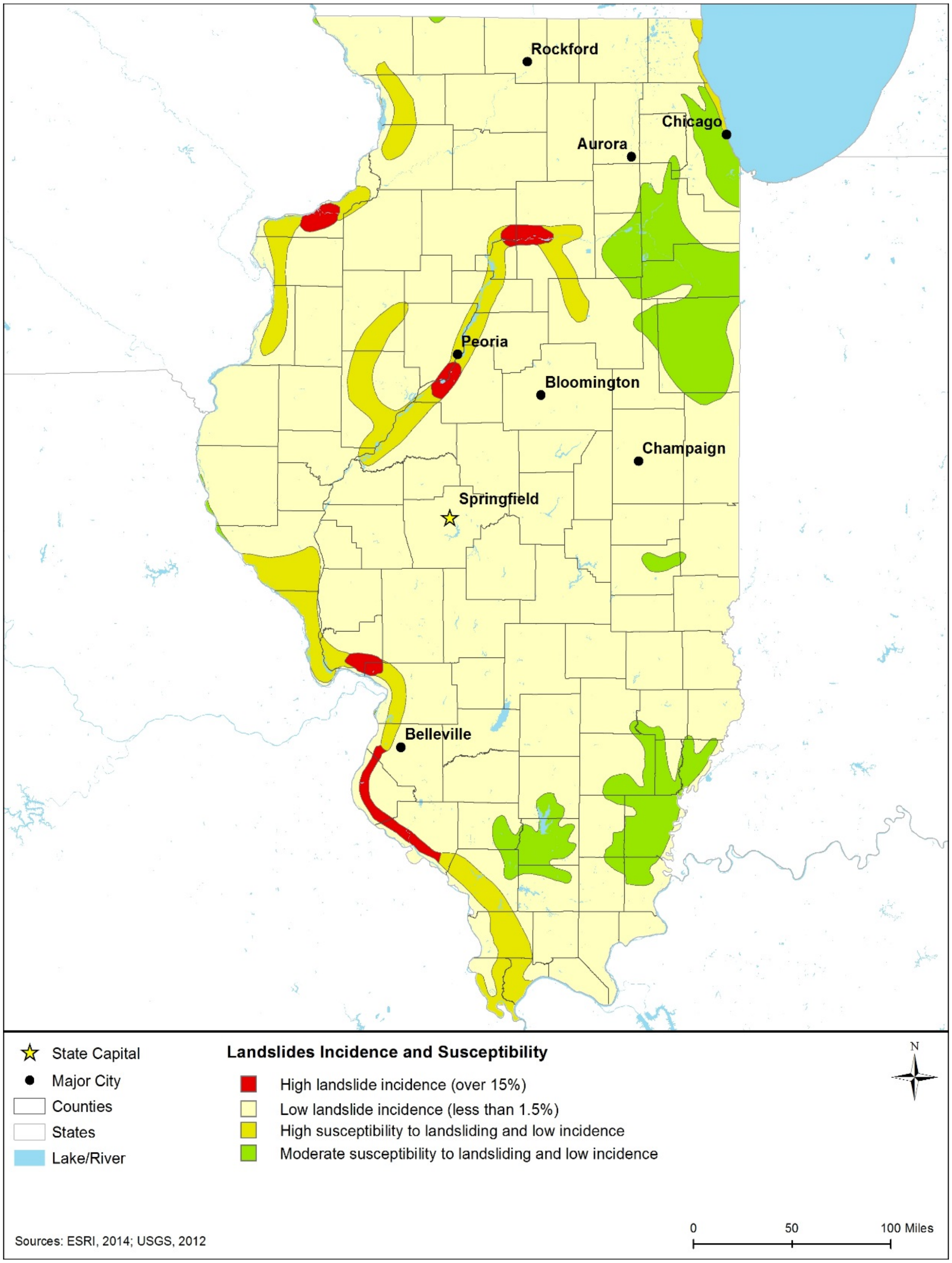


Figure 4.1.3-6: Illinois Landslide Incidence and Susceptibility Hazard Map[60]

[60] Susceptibility hazards not indicated in Figure 4.1.3-6 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014e)

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." Land subsidence has been observed in portions of Illinois due to karst[61] topography and mine subsidence (ISGS, 2015c) (Bauer, 2006). Nationwide, the main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the 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. Lowered terrain is more susceptible to inundation during high tides. Additionally, land subsidence can affect vegetation and land use (USGS, 2013b).

In Illinois, one major cause of land subsidence is karst topography, which is predominantly found in the western portion of the state. Karst is common in portions of western Illinois that are underlain by carbonate rocks, such as dolomite, which are susceptible to dissolution. Sinkholes in areas underlain by dolomite typically measure less than 100 feet. Southwestern portions of the state tend to be underlain by limestone; sinkholes are both larger and more numerous in this area than other portions of the state. "Some sinkholes in St. Clair, Monroe, and Randolph Counties (southeast of St. Louis, Missouri) are more than half a mile in diameter" (ISGS, 2015c). Figure 4.1.3-7 displays areas of Illinois that are susceptible to land subsidence due to karst topography.

Mine collapse poses an additional risk due to land subsidence throughout portions of the state; more than 800,000 acres have been mined in Illinois and can collapse up to 100 years (or more) after operations have ceased (IDNR, 2015a). The Illinois State Geological Survey reports that, as of 1991, more than 178,000 acres of developed land, including 320,000 housing units, were on top of mines at risk of collapse. While most of these areas are near coal mines, "one of the state's largest mine subsidence events (700 × 400 feet and 69- to 70- feet deep) took place over a lead-zinc mine near Galena[62] in 1972" (Bauer, 2006).

[61] Karst Topography: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater." (USGS, 2015c)
[62] Galena is in far northwestern Illinois near the borders with Wisconsin and Iowa.

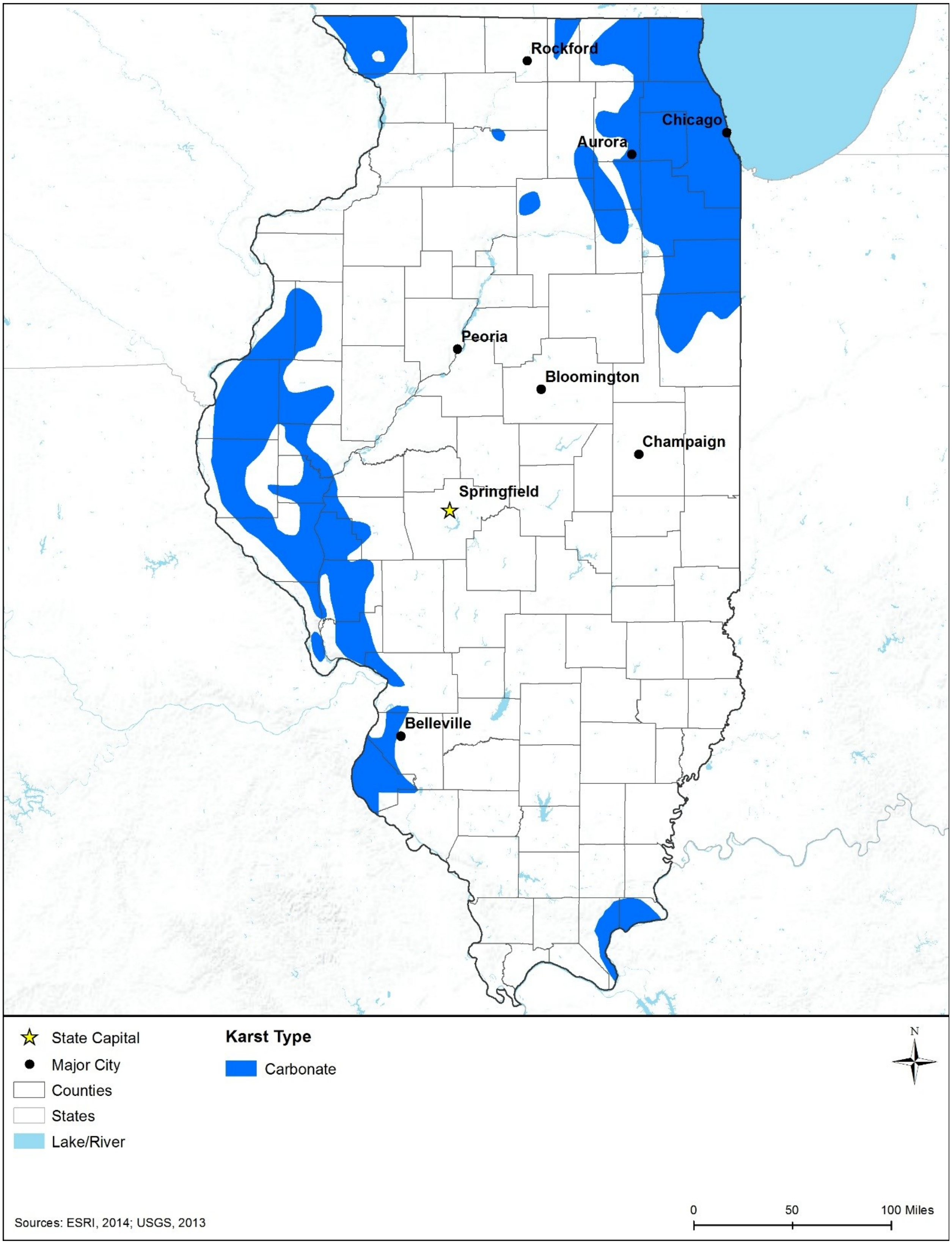


Figure 4.1.3-7: Karst Topography in Illinois

4.1.4 Water Resources

4.1.4.1 Definition of the Resource

Water resources are defined as all surface waterbodies and groundwater systems including streams, rivers, lakes, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 4.1.5). 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, 2014f)

4.1.4.2 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 4.1.4-1 summarizes the major Illinois laws and permitting requirements relevant to the state's water resources.

Table 4.1.4-1: Relevant Illinois Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Illinois Complied Statutes, Chapter 415, Environmental Safety; various subchapters	Various	Water pollutant discharge, water well codes, public water supply, wastewater treatment, groundwater protection and other topics. (Illinois State Water Survey, 2016b)
Illinois National Pollutant Discharge Elimination System (NPDES) Permit Program	IEPA	Construction activities that disturb a total of one acre or more of surface soil. (IEPA, 2015l)
Clean Water Act (CWA) Section 401 permit	IDNR	In accordance with CWA Section 401, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from IDNR indicating that the proposed activity will not violate water quality standards. (IDNR, 2015b)
Construction in Floodways of Rivers, Lakes, and Streams Rule	IDNR	Construction in any stream floodway with a watershed of 640 acres or more in urban areas, or 6,400 acres in rural areas. (IDNR, 2014)

4.1.4.3 Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the IEPA, Illinois has 106,940 miles of streams, 91,456 lakes and ponds, and 63.95 miles of Lake Michigan shoreline (IEPA, 2014a). The state also has more than 3,000 inland lakes covering approximately 250,000 acres. These surface waters support a variety of uses including drinking water supply, aquatic habitat, fish consumption, and recreational activities across the state (IEPA, 2003).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains all the streams and rainfall to a common outlet (e.g., reservoir, bay). Illinois's waters (lakes, rivers, and streams) are divided into 25 major watersheds, or drainage basins (Figure 4.1.4-1). Visit http://www.epa.state.il.us/water/watershed/publications/watershed-guidance.pdf for information and additional maps about IEPA watersheds (CMAP, 2014).

The Mississippi River Watershed spans the entire western border with Iowa and Missouri. The Rock River Watershed is in northwestern Illinois and covers approximately 5,280 square miles (IEPA, 2006). The Kishwaukee River, Fox River, Des Plaines River, Lake Michigan, and Chicago/Calumet River watersheds encompass northeastern Illinois. The Green River, Spoon River, and La Moine River watersheds are located in western Illinois and lie along the Mississippi River watershed eastern border. The Illinois River Watershed extends from northcentral Illinois to the southwest. The Sangamon River, Mackinaw River, and Vermilion River (Illinois Basin) are located in central Illinois and border the Illinois River Watershed to the east. The Kankakee River, Iroquois River, Vermilion River (Wabash Basin), and Embarras River watersheds are located along the eastern border of Illinois. The Kaskaskia River watershed encompasses a large area in southern Illinois and includes some of Illinois' largest lakes such as Carlyle Lake. The Little Wabash River and the Wabash River watersheds are located in southeastern Illinois and include cropland, grassland, and upland forest. Southern Illinois is comprised of the Big Muddy River, Saline River, Cache River, and Ohio River watersheds. These watersheds encompass an ecologically rich area that includes forests, diverse animal and plant species, and many of the state's pristine streams (IDNR, 2001).

Freshwater

As shown in Figure 4.1.4-1, there are 15 major rivers in Illinois: Big Muddy River, Des Plaines River, Edwards River, Embarras River, Fox River, Green River, Illinois River, Kaskaskia River, Little Wabash River, Mississippi River, Ohio River, Rock River, Sangamon River, Spoon River, and Wabash River (IEPA, 2014a). The Mississippi River in the west, Ohio River in the south, and Wabash River in the east form the majority of the Illinois' borders and total approximately 911 miles (IEPA, 2014a). The Mississippi River is the longest in the Illinois with an approximate stretch of 581 miles. The Illinois River lies entirely within the state and is the second longest river in Illinois (IDNR, 2015c). Illinois also contains "more than 91,400 lakes and ponds of which 1,279 are publicly owned" (IEPA, 2014a). Some of the state's large lakes and dammed reservoirs provide flood control, hydropower generation, and drinking water sources (USEPA, 2009).

The major lakes in Illinois include Carlyle Lake, Lake Shelbyville, Lake Michigan, and Rend Lake. (USACE, 2015a) (IDNR, 2015d) (IEPA, 2015m) (IDNR, 2015e)

- Carlyle Lake is approximately 26,000 acres in size and located in southwestern Illinois within the Kaskaskia River Watershed. It is the largest manmade lake in Illinois and "provides flood control, water quality control and water supply to nearby communities;

recreation, fish and wildlife conservation; and is authorized to augment navigation flows downstream on the Kaskaskia River" (USACE, 2015a).

- Lake Shelbyville is approximately 11,000 acres in size and located in central Illinois within the Kaskaskia River Watershed. It was built by damming the Kaskaskia River to provide "flood control, recreation, water supply, and fish and wildlife conservation" (IDNR, 2015d).
- Lake Michigan is approximately 22,400 square miles in size and is the third largest of all the Great Lakes in area, and largest freshwater body entirely within the borders of the United States. The southern reach of the western shore of Lake Michigan extends 63 miles along the Illinois coastline. The lake serves as a recreational resource, one of the state's largest economic assets, and a major drinking water supply (IEPA, 2015m).
- Rend Lake is approximately 18,900 acres and located in southern Illinois within the Big Muddy River Watershed. The lake was created by damming the Big Muddy River and currently offers a prime location for various recreational activities such as waterfowl hunting (IDNR, 2015e).

4.1.4.4 Sensitive or Protected Waterbodies

Wild and Scenic Rivers

A segment of the Middle Fork Vermilion River is federally designated a National Wild and Scenic River in Illinois (Figure 4.1.4-1). The section of the river is in eastern Illinois and includes 17.1 miles designated as wild and scenic (National Wild and Scenic Rivers System, 2015). The Middle Fork Vermilion River is a diverse and scenic area in eastern Illinois characterized by "high bluffs and sandbars, surrounded by trees." The river provides an ideal environment for a variety of plants and animals (IDNR, 2015f).

In addition to federally designated Wild and Scenic Rivers, Illinois's Vermilion River Middle Fork Act "recognizes the outstanding natural, scenic, recreational, ecological, historical, and archaeological values" of the river. Therefore, the Middle Fork Vermilion River has been designated a State Scenic River to be protected and preserved "for the enjoyment of the people of the state of Illinois" (Illinois General Assembly, 2015c).

4.1.4.5 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,[63] the causes of impairment, and probable sources. Table 4.1.4-2 summarizes the water quality of Illinois's assessed major waterbodies by category, percent impaired, designated use,[64] cause, and probable sources. Figure 4.1.4-2 shows the Section 303(d) waters in Illinois as of 2010.

[63] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters (USEPA, 2015a).
[64] Designated Use: an appropriate intended use by humans and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply (USEPA, 2015a).

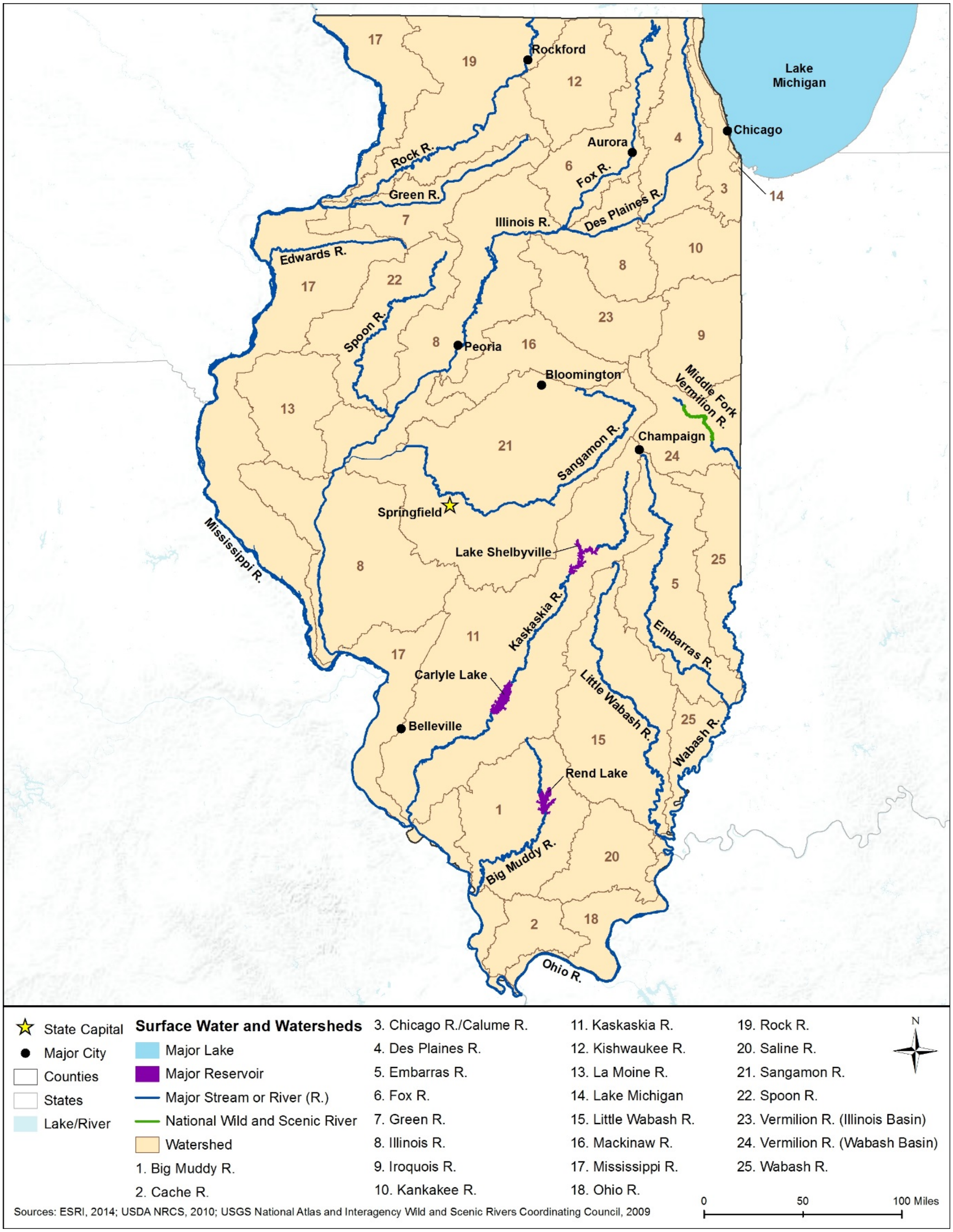


Figure 4.1.4-1: Major Illinois Watersheds, defined by IEPA, and Surface Waterbodies

As shown in Table 4.1.4-2, various sources affect Illinois's waterbodies, causing impairments. For example, Lake Michigan is an area of concern according to the IEPA, due mainly to contamination from polychlorinated biphenyls, mercury and pathogens, and exceedances for total phosphorus from stormwater and wastewater discharges and urban development of the Chicago area (IEPA, 2014b). More than half of Illinois's river and streams that have been assessed are impaired. Designated uses of the impaired rivers and streams include aquatic life, fish consumption, primary and secondary recreation, public/food processing water supplies, and habitat/hydrology. Atmospheric deposition[65] has affected Illinois' Great Lakes shoreline and Great Lakes open water, which have resulted in fish consumption advisories for many species (USEPA, 2010a) (IDPH, 2015a).

Table 4.1.4-2: Section 303(d) Impaired Waters of Illinois, 2010

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	14.3%	56.5%	aquatic life, fish consumption, primary and secondary recreation, public/food processing water supplies, and habitat/hydrology	pathogens,[c] oxygen depletion, mercury, polychlorinated biphenyls (PCBs)	atmospheric deposition,[d] agriculture, hydromodifications (e.g., impacts from hydrostructure flow regulations/modification), and municipal point source discharges
Lakes, Reservoirs, and Ponds	46.5%	97.4%	aquatic life, fish consumption, habitat/hydrology, and primary and secondary contact recreation, and public/food processing water supplies	turbidity, nutrients, algal growth, mercury, metals, invasive aquatic plants, and PCBs	agriculture, habitat alteration, recreation/tourism, and atmospheric deposition
Estuaries and Bays	100%	100%	aquatic life and fish consumption	PCBs, mercury, metals, other metals (e.g. chromium, cadmium, zinc), and nutrients such as phosphorus	atmospheric deposition, urban runoff/storm sewers, industrial point source discharges, and legacy pollutants
Great Lakes shoreline	100%	100%	fish consumption and primary contact recreation	PCBs, mercury, pathogens	atmospheric deposition, urban runoff/storm sewers, and municipal point source discharges

[65] Atmospheric deposition: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water (USEPA, 2015a).

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**
Great Lakes Open Water	9.9%	100%	aquatic life, fish consumption, primary and secondary recreation, and public/food processing water supplies	PCBs	atmospheric deposition

Source: (USEPA, 2010a)

[a] Some waters may be considered for more than one water type.
[b] Illinois 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: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water (USEPA, 2015a).

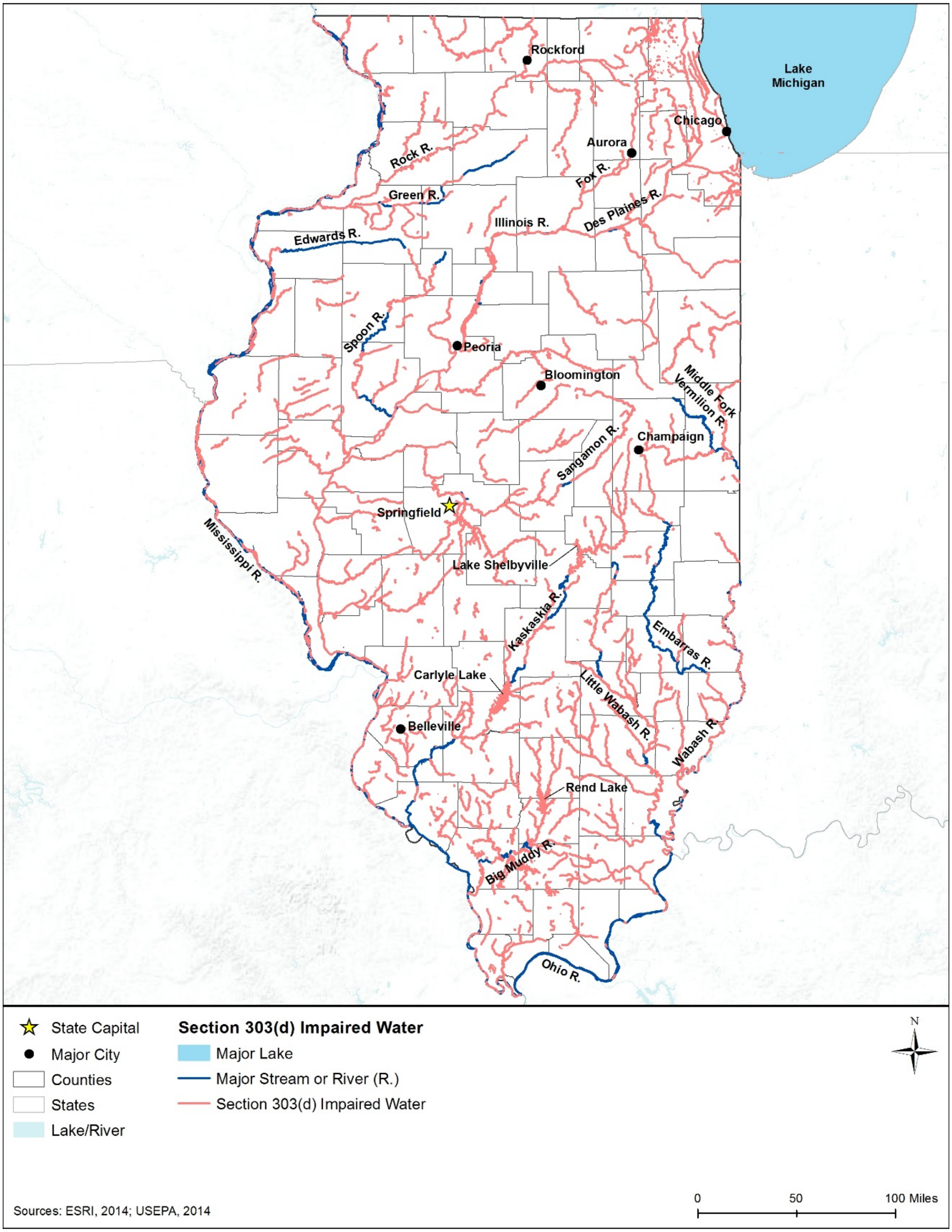


Figure 4.1.4-2: Section 303(d) Impaired Waters of Illinois, 2010

IEPA uses several programs to monitor streams, lakes, and groundwater throughout Illinois. Various chemical, physical, and biological conditions are monitored by IEPA, and statewide changes in these conditions are tracked and regularly reported in the Illinois biannual Integrated Water Quality Report and Section 303(d) List. The monitoring programs "range from comprehensive ambient monitoring of lakes and streams, to fixed-station groundwater monitoring, to specialized wastewater monitoring that assesses compliance or facility performance, to groundwater testing for herbicide-transformation products." Monitoring design varies with each program as they are based on waterbody type and primary objectives (IEPA, 2014a).

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

The primary type of floodplains in Illinois are riverine and lake floodplains (IDNR, 2006a). These floodplains occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous areas of Illinois, 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).

Lake coastal flooding can also occur in Illinois along the Lake Michigan shoreline when strong wind and storms increase lake water levels. Flood events of this type are less frequent and have not caused problems for Illinois for more than a decade (IEMA, 2013b).

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 Illinois, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, rapid snowmelt, over-development/impervious[66] surfaces, and climate change (IEMA, 2013b).

Flooding is the most common natural disaster in Illinois and accounts for more than 90 percent of the state's declared disasters. Approximately 7,400 square miles of land area in Illinois are subject to flooding. Based on historical flooding and flood disaster declarations, flood problems are most severe in counties near the Mississippi and Illinois rivers. Every county in the state has experienced at least one flood disaster over the past half century (IEMA, 2013b).

The Great Flood of 1993

Illinois received the most damage along the Mississippi River in recorded history. A wet winter and persistent heavy rainfall during the spring caused Illinois floodwaters to rise in March of 1993. Floodwaters did not recede until September of that year. Hardest hit areas were northwest and west-central Illinois between the Mississippi and Illinois rivers. Levee failure along the Mississippi River resulted in 39 counties declared as Federal Disaster Areas. Illinois also experienced significant impact to agricultural lands and transportation. The flooding destroyed or severely damaged 6,000 homes and displaced 16,000 people (IEMA, 2013b).

Source: (NWS, 1993)

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 887 communities in Illinois through the National Flood Insurance Program (NFIP) (FEMA, 2015a). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015b). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Illinois had 57 communities participating in the CRS (FEMA, 2014c).[67]

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

[67] A list of the 57 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

4.1.4.7 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, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

Illinois's principal aquifers consist of carbonate-rock[68] and sandstone aquifers,[69] and unconsolidated sand and gravel aquifers of alluvial and glacial origin.[70] Over one billion gallons of groundwater is used in Illinois each day for drinking water, power generation, agriculture, and industry. Generally, the water quality of aquifers in east central Illinois are suitable for drinking and daily water needs. Groundwater availability is most prevalent in Illinois' major river valleys and northern third of the state where one or more principal aquifers reside. Southern Illinois lacks "thick, coarse glacial deposits…and relatively low-yielding bedrock" and, therefore, has poor groundwater quality (University of Illinois, 2015a). Statewide, the most serious threats to groundwater quality include disposal activities, storage and treatment, facility treatment and recreation, and agricultural activities (IEPA, 2014c).

Table 4.1.4-3 provides details on aquifer characteristics in the state and Figure 4.1.4-3 shows Illinois's principal and sole source aquifers. Two other aquifers, Mississippi River Valley alluvial aquifer and Southeastern Coastal Plain aquifer system, are in small portions of the southern tip of Illinois, as shown in Figure 4.1.4-3 (USGS, 1986). These two aquifers are more extensive in other states and represent a relatively small area within Illinois, and thus are not discussed in detail.

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

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

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

Table 4.1.4-3: Description of Illinois's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Cambrian-Ordovician Aquifer System These aquifers consist mainly of multilayered sedimentary rock with sandstone, dolomite, shale, and shaly sandstone.	Northern and small portion of western Illinois	Suitable for most uses. Water is hard and can contain concentrations of dissolved solids, sulfate, and iron that exceed secondary maximum contaminant level for drinking water.
Mississippian aquifers These aquifers consist mainly of thick-bedded limestones and sandstones with shale and siltstone.	Western and eastern Illinois	Dissolved-solids concentrations and hardness is extremely variable. Water is moderately hard to very hard. Slight acidity in groundwater partially dissolves the limestone, thus increasing the concentration of calcium and magnesium.
Aquifers of Alluvial and Glacial Origin These aquifers consist mainly of the sand, gravel, and bedrock eroded by the glaciers.	Throughout the state	Suitable for most uses. Some areas of Illinois have high nitrate concentrations. Water is generally hard with high iron concentrations.
Ozark Plateaus Aquifer System These aquifers consist mainly of dolomite and limestone.	Southern Illinois and along southwestern border of Illinois.	Suitable for most uses. Water is hard with dissolved-solids concentration increasing toward the northeast as aquifers dip into the Illinois Basin.
Silurian-Devonian aquifers These aquifers consist mainly of limestone and dolomite.	Western, northwestern (includes Driftless Area),[a] and northeastern Illinois	Generally, the water is adequate for most uses. Iron and sulfate concentrations are locally high, and the water is hard.

Source: (USGS, 1986), (USGS, 1995)

[a] An area in extreme northwest Illinois characterized by its lack of "drift," sediment deposited across the state by glaciers.

Sole Source Aquifers

The U.S. Environmental Protection Agency (USEPA) defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015b). Illinois has one designated SSA, the Mahomet Aquifer system, within the state (as shown in Figure 4.1.4-3). The aquifer system is a source of drinking water for more than half of the population in east-central Illinois (USEPA, 2015c). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015b).

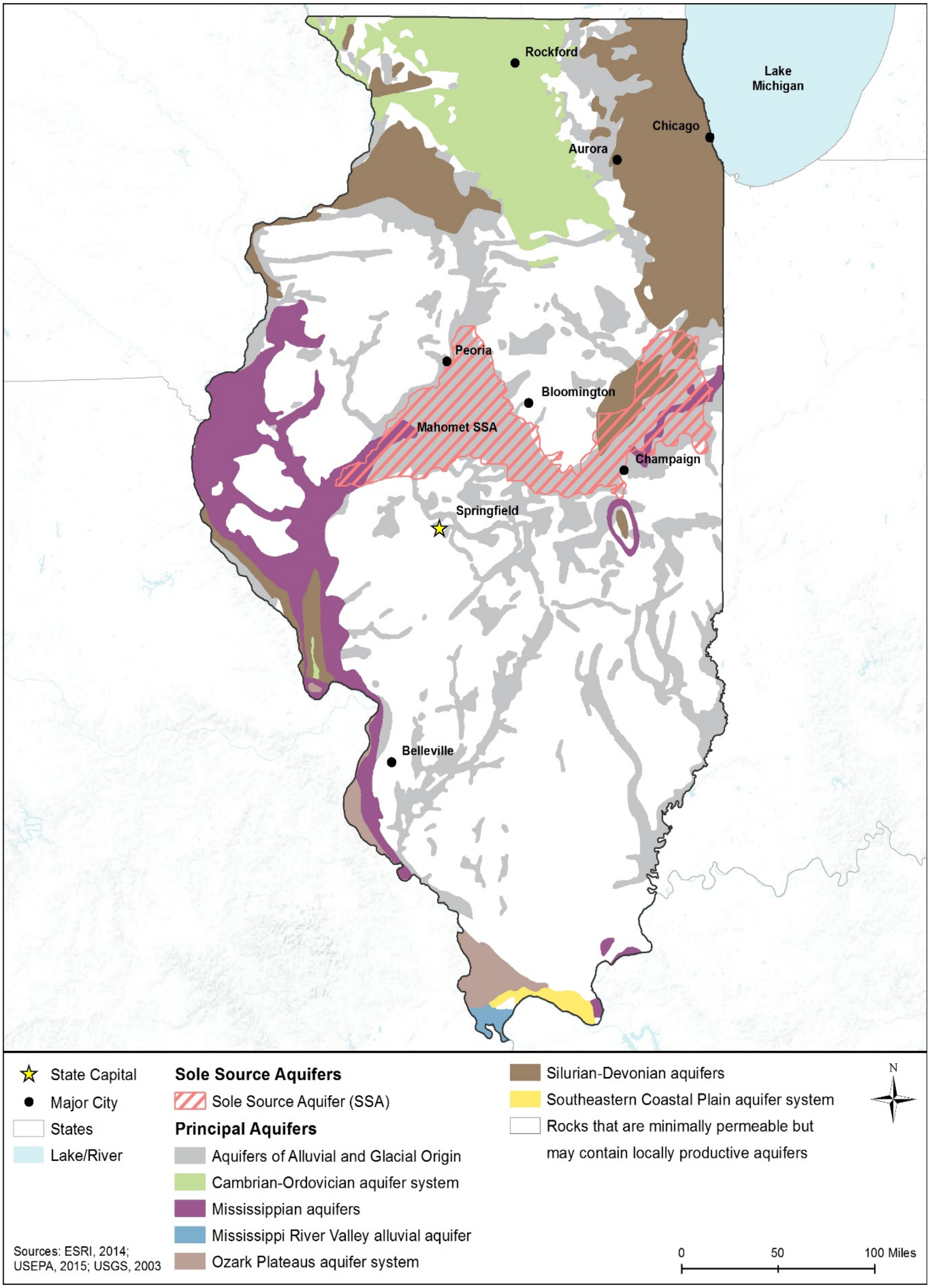


Figure 4.1.4-3: Principal and Sole Source Aquifers of Illinois

4.1.5 Wetlands

4.1.5.1 Definition of the Resource

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

The Environmental Protection Agency 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.

4.1.5.2 Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, explains the pertinent federal laws to protecting wetlands in detail. Table 4.1.4-4 summarizes the major Illinois state laws and permitting requirements relevant to the state's wetlands.

Table 4.1.5-1: Relevant Illinois Wetlands Laws and Regulations

State Law/Regulation	Regulatory Authority	Applicability
CWA Section 404 permit, Illinois regional conditions	U.S. Army Corps of Engineers (USACE), Philadelphia District	The Nationwide Permits (NWP) program does not authorize certain activities in Critical Resource Waters, which include wetlands that are tributaries to the Animas, North Platte, Roaring Fork, Cache la Poudre, Florida, Big Thompson, Blue, Illinois, Dolores, Eagle, Gunnison, Laramie, North Platte, Roaring Fork, Los Pinos, North Fork Gunnison, Piedra, Rio Grande, San Juan, San Miguel, South Platter, Uncompahgre, White, Yampa, Bear, Clear, Sand, Medano, Northwater, Trapper, Abrams, Battlement, Rapid, Boulder, St. Vrain Creeks, and Smith Fork Rivers.
Illinois Discharge Permit System Regulations	Illinois Environmental Protection Agency (IEPA)	Construction activities that disturb a total of one acre or more of surface soil.

Sources: (USACE, 2015b), (IEPA, 2015l)

[a] Critical Resource Waters: include designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment (ILDNR, 2015).

4.1.5.3 Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Three of these systems are present in Illinois, as detailed in Table 4.1.4-5.

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 35 percent salty) water chemistry; minimal influence from rivers or estuaries. Where wave energy is low, mangroves, or mudflats may be present.
- The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that usually semi enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and the ocean water is at least occasionally diluted by freshwater runoff from the land.
- Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt or greater.
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy at least 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, and all wetlands that occur in tidal areas where the salinity is below 5 percent. The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013)

Three of these systems—Riverine, Lacustrine, and Palustrine—are present in Illinois, as detailed in Table 4.1.4-5. In Illinois, the main type of wetland is palustrine (freshwater) wetlands found across the state, from northern Illinois to the large Cypress swamps along the Cache River in southern Illinois (USFWS, 2015a). Table 4.1.4-5 uses 2014 NWI data to characterize and map Illinois wetlands on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known.

As shown in Figure 4.1.4-4 and Figure 4.1.4-5, palustrine wetlands are found throughout the state, with large areas occurring in southern Illinois along the cypress swamps of the Cache River, while Riverine and Lacustrine are found throughout the state (USFWS, 2015a). The map codes and colorings in Table 4.1.4-5 correspond to the wetland types in the figures.

Table 4.1.5-2: Illinois Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description	Occurrence	Amount (acres)[a]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.	Throughout the state, particularly in southern Illinois	806,537
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.		
Palustrine emergent wetlands	PEM	Palustrine emergent wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens, present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens[71], prairie potholes, and sloughs.		198,149
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	143,727
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[b], and other miscellaneous wetlands are included in this group.	Throughout the state	591
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 with most in central Illinois	3,861
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, but including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are generally less than 8.2 feet deep.	Throughout the state with most in central Illinois	55,694
			TOTAL	**1,208,559**

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

71 Low land that is covered wholly or partly with water unless artificially drained and that usually has peaty alkaline soil and characteristic flora (as of sedges and reeds) (Merriam Webster, 2016).

[a] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted (USFWS, 2015b).
[b] Saline seep is an area where saline groundwater discharges at the soil surface. These wetland types are characterized by saline soils and salt tolerant plants (City of Lincoln, 2015).

Palustrine Wetlands

In Illinois, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, wet meadows, and ponds). Palustrine forested wetlands (PFO) are the most abundant and widely distributed wetland in Illinois, with high concentrations of bottomland forests in the southern third of the state along the Mississippi and Illinois rivers. The palustrine emergent wetlands (PEM) of Illinois include shallow marshes and wet meadows. These wetlands are located throughout the state with highest concentration in northeastern Illinois on land adjacent to Lake Michigan and along the Mississippi River (IDNR, 2015g). Shallow marshes and wet meadows are most often affected by drainage and farming (Suloway & Hubbell, 1994). Deep marshes are found across the state in areas where deep water has accumulated for long time periods of time, including plains and high mountains. Many deep marshes are located in northeastern Illinois and near impoundment lakes such as Lake Shelbyville and Carlyle Lake in southcentral Illinois (see Figure 4.1.4-4 and Figure 4.1.4-5). Major Illinois Watersheds) (IDNR, 2015g) (Suloway & Hubbell, 1994). Palustrine scrub-shrub wetlands (PSS) include swamps and are the least common palustrine wetland in Illinois. Swamps are concentrated along the Illinois River and in southern Illinois. Swamps most often contain plant species such as the bald cypress and water tupelo (Suloway & Hubbell, 1994).

Significant loss to Illinois' wetlands has led to the state's passing of the Interagency Wetland Policy Act of 1989 to improve the quality and quantity of the state's wetland resource base. In 1989, Illinois passed the Interagency Wetland Policy Act to "preserve, enhance, and create wetlands where possible and avoid adverse impacts to wetlands." The Act establishes an Interagency Wetlands Committee and State Wetland Mitigation Policy. The Policy declares that each state agency will "preserve wetlands as a priority of action when they develop construction or land management plans." Furthermore, a Wetland Compensation Act will be developed and implemented if no other feasible alternative exists and adverse impact to wetlands are unavoidable (IDNR, 2015h).

Lacustrine and Riverine Wetlands

Lacustrine and riverine wetlands are less common in Illinois than palustrine wetlands. Therefore, they are not discussed in great detail. Lacustrine wetlands are found throughout the state but are mostly concentrated in central Illinois along the many impoundments of the Illinois River. Riverine wetlands are not common in Illinois, due in part to alterations of rivers and streams for human uses (Suloway & Hubbell, 1994).

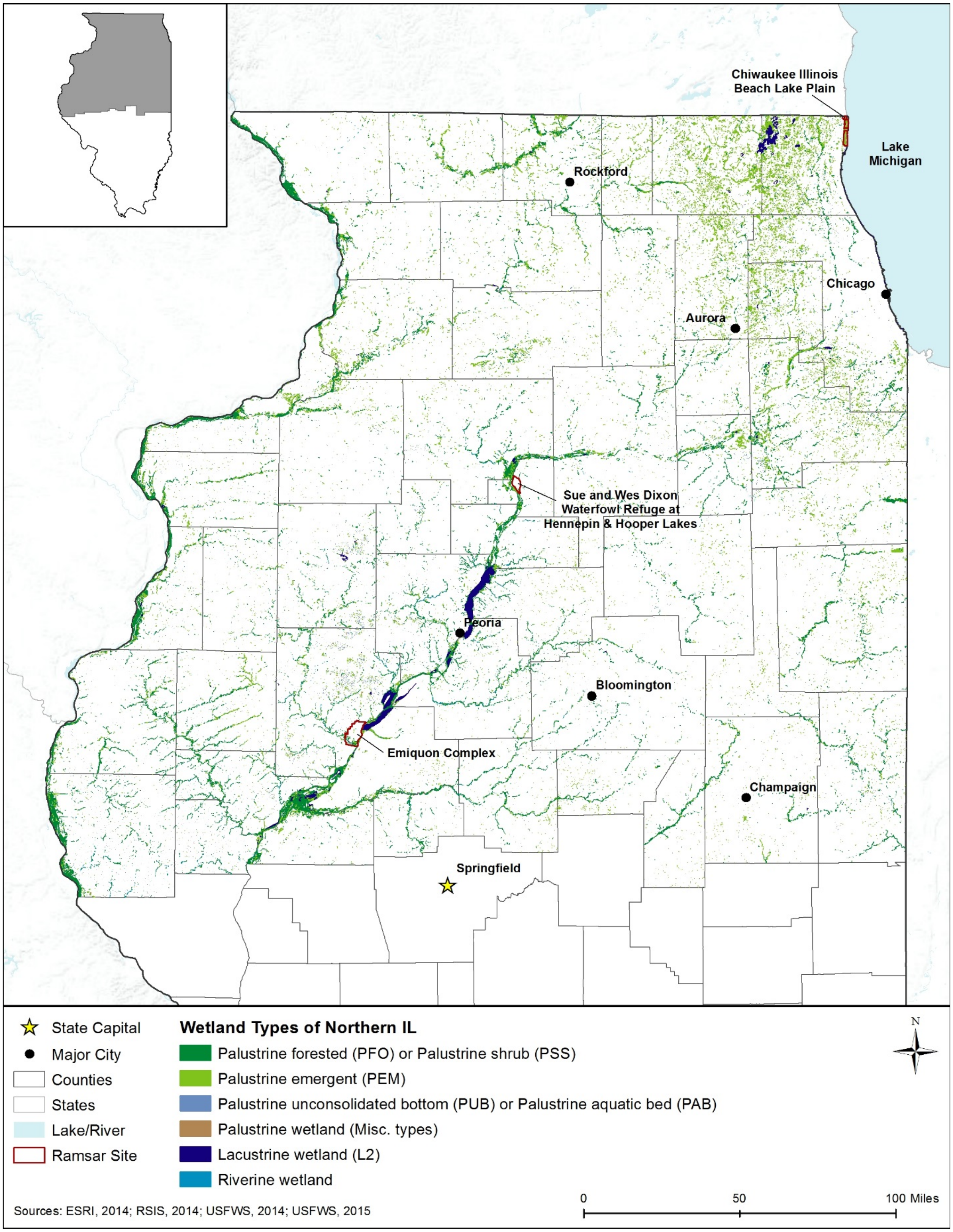


Figure 4.1.5-1: Wetlands by Type, in Northern Illinois, 2014

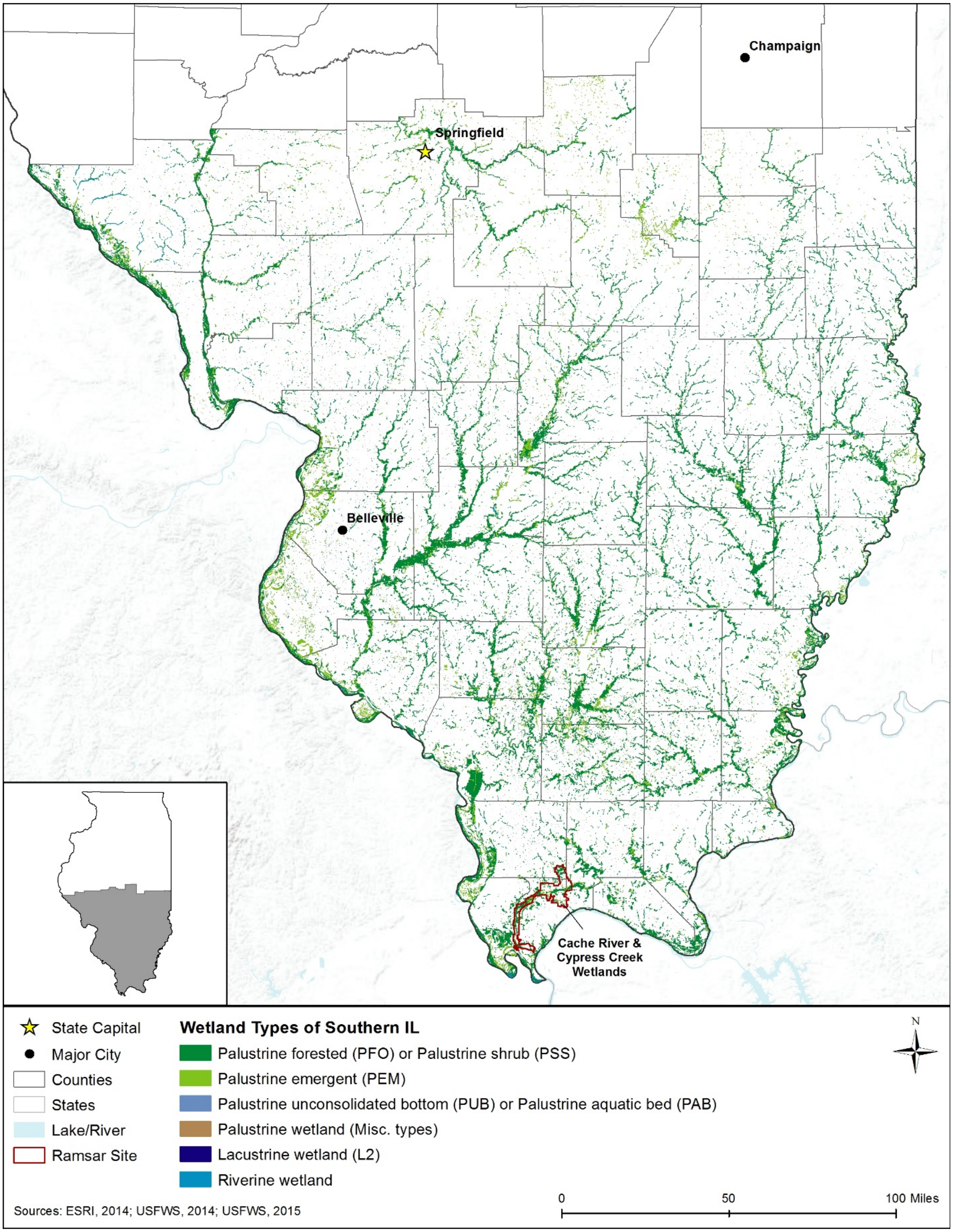


Figure 4.1.5-2: Wetlands by Type, in Southern Illinois, 2014

It is estimated that Illinois has lost approximately 90 percent of its wetlands since European settlement, dwindling from approximately eight million acres, to just over one million acres of wetlands today (Suloway & Hubbell, 1994). Although wetlands in Illinois encompass only 2.5 percent of total surface area in the state, more than 40 percent of the state's threatened and endangered plant, bird, and animal species benefit from the habitat they provide (University of Illinois, 2015b). Current threats to wetlands in Illinois include discharge of pollutants from unbuffered runoff, pesticides, and sediments from cropland and construction sites (IDNR, 2015i).

4.1.5.4 Wetlands of Special Concern or Value

Illinois contains four sites designated as Wetlands of International Importance under the Ramsar Convention.[72]

- Emiquon Complex (Figure 4.1.5-3) is within the former natural floodplain of the Illinois River, and includes "bottomland lakes, side channels, sloughs, marsh, bottomland hardwood forests, and wet, mesic, and dry prairies." Diverse terrestrial and aquatic species are found within the site, including both resident and migratory animal species, such as Neotropical songbirds and paddlefish. The site also offers many recreational and education opportunities. Emiquon Complex is currently threatened by high sedimentation rates, invasive species, pollution, and altered hydrology in the areas not protected by levees (Ramsar, 2012a).

Figure 4.1.5-3: Emiquon Complex

Source: (University of Illinois, 2014)

- Cache River and the Cypress Creek Wetlands are located "at the juncture of four ecological provinces" and "represent the northernmost extension of the Mississippi Embayment." The site supports 103 regionally endangered or threatened species, including many waterfowl species that feed, rest and nest within the site's habitat. The autumn and spring migrations of the canvasback ducks occurs over this site on the Mississippi flyway. Flood events in the Cache River basin cause discharge of organic matter, nutrients, and significant fish numbers into the Ohio and Mississippi river systems. Main threats to the Cache River and Cypress Creek Wetlands include the clearing of land for agricultural use, which has led to increased sedimentation, erosion, and loss of riparian areas (Ramsar, 1994).
- Chiwaukee Illinois Beach Lake Plain is in northeast Illinois along the southwestern shore of Lake Michigan. The site includes six wetland types and two federally-listed Threatened and Endangered species (the eastern prairie fringed orchids [*Plantanthera leucophaea*] and the piping plover [*Charadrius melodus*]). Additionally, the site provides an ideal habitat for

[72] The Ramsar Convention is the "oldest of the modern global intergovernmental environmental agreements. The treaty was negotiated through the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory waterbirds." (Ramsar Convention 2014).

Illinois' threatened Blanding's turtle (*Emydoidea blandingii*) and many migratory birds along the eastern Illinois coast. The site is currently threatened by invasive plant species, agricultural conversion, and urban development (Ramsar, 2015).

- Sue and Wes Dixon Waterfowl Refuge at Hennepin and Hooper Lakes includes "a complex system of backwater lakes, marshes, wet prairie, savannah, and forest." The site offers an ideal habitat for many federal or state endangered and threatened species, including 22 birds such as the Peregrine Falcon (*Falco peregrinus*) and the Common Moorhen (*Gallinula chloropus*). Additionally, the site provides many recreational opportunities including canoeing, hiking, and bird watching. The site is currently threatened by fires, invasive species, and pesticide residues from agricultural activities (Ramsar, 2012b).

Important Wetland Sites in Illinois

- There are 47 State Wildlife Areas designated for the benefit of wildlife-related public recreation. To learn more about state Wildlife Areas, visit www.dnr.illinois.gov/Parks/Pages/default.aspx.
- National Natural Landmarks (NNL) range in size from 53 acres to over 6,500 acres. There are 18 NNLs in Illinois, which are owned by a variety of landowners including the U.S. Forest Service, Illinois Department of Natural Resources, the University of Illinois, County Forest Preserve Districts, The Nature Conservancy, and private individuals (NPS, 2012a). Visit www.nature.nps.gov/nnl/state.cfm?State=IL to learn more about Illinois'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 Illinois Department of Natural Resources, land trusts such as Great Rivers Land Trust, and easements managed by natural resource conservation groups such as Illinois Nature Preserves Commission. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), Illinois Nature Preserves Commission holds over 107,000 acres in conservation easements in Illinois (NCED, 2015).

For more information on Illinois's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 4.1.8 Visual Resources, and Section 4.1.7 Land Use, Recreation, and Airspace.

4.1.6 Biological Resources

4.1.6.1 Definition of the Resource

This chapter describes the biological resources of Illinois. Biological resources include terrestrial[73] vegetation, wildlife, fisheries and aquatic[74] habitats, and threatened[75] and endangered[76] species as well as species of conservation concern. Illinois supports a wide diversity of biological resources ranging from cypress swamps in the south to wetlands and bogs in the northern part of the state, with several different types of prairies and forests in between (McClain, 1997).

4.1.6.2 Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in Illinois are summarized in detail in Appendix C, Environmental Laws and Regulations. Table 4.1.6-1 summarizes major state laws relevant to the biological resources of Illinois.

Table 4.1.6-1: Relevant Illinois Biological Resources Laws and Regulations

Law/Regulation	Regulatory Agency	Applicability
Illinois Endangered Species Protection Act (520 Illinois Compiled Statutes [ILCS] 10/1)	Endangered Species Protection Board and Illinois Department of Natural Resources (IDNR)	This Act was established in 1972 to protect endangered and threatened species and their habitats. A review of the Illinois listed species is required every 5 years, ensuring that it is kept up-to-date.
Illinois Fish and Aquatic Life Code (515 ILCS 5/1-1)	IDNR	This Code requires transport permits for certain species under the law to protect against harmful invasive species and to ensure the health and viability of native and recreational species.
Illinois Noxious Weed Law (505 ILCS 100/1)	Illinois Department of Agriculture	Each county has a Control Authority to develop and coordinate a program for the control and eradication of noxious weeds.
Illinois Exotic Weed Law (525 ILCS 10/1-10/5)	IDNR	Deems it illegal to buy, sell, offer for sale, distribute or plant seeds, plants or plant parts of exotic weeds without a permit issued by the IDNR
Illinois Herps Act (Illinois Administrative Code [IAC]17-880)	IDNR	Regulates collection, take, and possession of reptiles and amphibians in Illinois.
Illinois Insect Pest and Plant Disease Act (505 ILCS 90)	IDNR	No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or release any living insect pests, plant diseases, or plant material infested with insect pests or plant diseases.

[73] Terrestrial: "Pertaining to the land" (USEPA, 2015d).
[74] 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, 2015d).
[75] 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)).
[76] 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)).

4.1.6.3 Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology,[77] soils, climate,[78] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[79] 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) (USDA, 2015a) (World Wildlife Fund, 2015). Ecoregion boundaries often coincide with geographic regions of a state. In Illinois, the climate is roughly similar throughout the state. The three main geographic regions of Illinois include the Central Plains, the Shawnee Hills, and the Gulf Coastal Plain.

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 (USEPA, 2016d). This section provides an overview of the terrestrial vegetation resources for Illinois at USEPA Level III (USEPA, 2016d).

As shown in Figure 4.1.6-1, the USEPA divides Illinois into six Level III ecoregions. The six ecoregions support a variety of different plant communities, and boundaries for these ecoregions are considered transitional. In general, the vegetation is more forested and the topography more rugged in the southern portion of the state, and prairie fauna and the topographical influences of glaciers are more common in the northern part of Illinois. Table 4.1.6-2 provides a summary of the general abiotic[80] characteristics, vegetative communities, and the typical vegetation found within each of the six Illinois ecoregions.

[77] "Geology is the study of the planet earth- the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin" (USEPA, 2015d).
[78] Climate: "The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more" (USEPA, 2015d).
[79] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015d).
[80] Abiotic: "Characterized by absence of life; abiotic materials include non-living environmental media (e.g., water, soils, sediments); abiotic characteristics include such factors as light, temperature, pH, humidity, and other physical and chemical influences" (USEPA, 2016g).

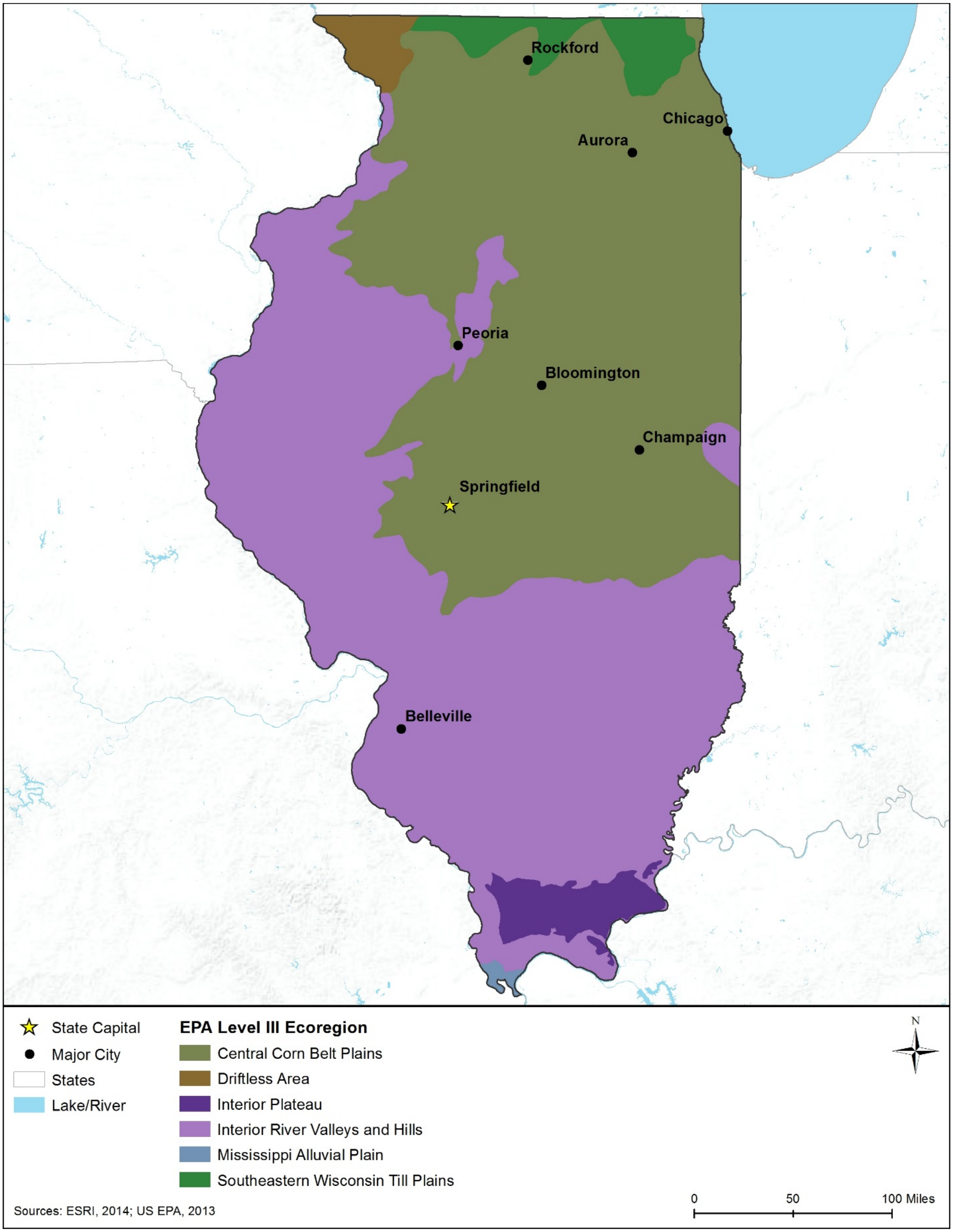


Figure 4.1.6-1: USEPA Level III Ecoregions in Illinois

Table 4.1.6-2: USEPA Level III Ecoregions of Illinois

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Region: Central Plains				
52	Driftless Area	This partly forested area lacks glacial till. Deeply divided hills, flat plateaus, and rolling uplands with caves and springs are typical of this region. This region includes the highest elevation in the state (Charles Mound) and the most relief (Niagara Escarpment). Streams are very dense in this area.	Maple-Basswood Forest and Bluestem Prairie	**Hardwood Trees –** American elm *(Ulmus americana)*, green ash *(Fraxinus pennsylvanica)*, silver maple *(Acer saccharinum)*, basswood *(Tilia americana)*, red oak *(Quercus rubra)*, sugar maple *(Acer saccharum*), black oak *(Quercus velutina)*, and white oak *(Quercus alba)* **Forbs/Grasses –** big bluestem *(Andropogon gerardii*), little bluestem *(Andropogon scoparius)*, prairie dropseed *(Sporobolus heterolepis)*, prairie violet *(Viola pedatifida)*
53	Southeastern Wisconsin Till Plains	Composed of glaciated, flat- to rolling-hill plains, becoming hillier to the south. Larger streams have broad floodplains and outwash[81] plains with moraine[82] areas are present. Lakes and marshes are common.	Mix of oak savanna, bluestem prairie, maple-basswood forest, and oak-hickory forest	**Hardwood Trees** – American elm, green ash, silver maple, basswood, red oak, sugar maple, black oak, white oak, bur oak *(Quercus macrocarpa)*, northern pin oak *(Quercus ellipsoidalis)*, chestnut oak *(Quercus prinus)*, pignut hickory *(Carya glabra)*, Bitternut hickory *(Carya cordiformis)*, shagbark hickory *(Carya laciniosa)* **Forbs/Grasses –** big bluestem, little bluestem, prairie dropseed, prairie violet
54	Central Corn Belt Plains	Composed of vast glaciated plains once dominated by prairie. Marshes and pothole lakes are common.	Tall-grass prairie in uplands and river valleys and moraines containing forests	**Forbs/Grasses** – big bluestem, little bluestem, prairie dropseed, prairie violet

[81] Outwash: "Glacial outwash is the deposit of sand, silt, and gravel formed below a glacier by meltwater streams and rivers. An outwash plain is an extensive, relatively flat area of such deposits" (USEPA, 2015d).
[82] Moraine: "A general term for unstratified and unsorted deposits of sediment that form through the direct action of, or contact with, glacier ice. Many different varieties are recognized on the basis of their position with respect to a glacier" (USEPA, 2015d).

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
72	Interior River Valleys and Hills	This region is between the forested Ozark Highlands and the flatter and less forested Central Corn Belt. This glacier-carved region is characterized by wide and flat-bottomed valleys.	Beech-Maple Forests, Woodlands, Marshes and Swamps	**Hardwood Trees –** sugar maple, American Beech *(Fagus grandifolia),* silver maple, American elm, green ash, basswood, red oak, cottonwood *(Populus deltoids),* bitternut hickory, white oak, river birch *(Betula nigra)* **Conifer Trees –** shortleaf pine *(Pinus echinata)*
Geographic Region: Shawnee Hills				
71	Interior Plateau	Greater relief and elevation than other ecoregions in the state. Soils are primarily derived from loess and residuum of underlying sandstone, siltstone, shale, and limestone (glacial till uncommon). Remains mostly forested.	Oak-Hickory Forest	**Hardwood Trees –** black oak, white oak, bur oak, northern pin oak, chestnut oak, pignut hickory, bitternut hickory, shagbark hickory
72	Interior River Valleys and Hills	This region is between the forested Ozark Highlands and the flatter and less forested Central Corn Belt. This glacier-carved region is characterized by wide and flat-bottomed valleys.	Beech-Maple Forests, Woodlands, Marshes and Swamps	**Hardwood Trees –** sugar maple and American Beech *(Fagus grandifolia)* silver maple, American elm, green ash, basswood, red oak, cottonwood *(Populus deltoids),* bitternut hickory, white oak, river birch *(Betula nigra)* **Conifer Trees –** Shortleaf pine *(Pinus echinata)*
Geographic Region: Gulf Coastal Plain				
73	Mississippi Alluvial Plain	This is an area of broad and nearly flat floodplains of the Mississippi River.	Southern floodplain forest.	**Hardwood Trees –** willow (*Salix* sp.), cottonwood, silver maple, green ash, bald cypress (*Taxodium distichum*) tupelo gum (*Nyssa sylvatica*), pin oak, bur oak, persimmon (*Diospyros virginiana*), pecan (*Carya illinoinensis*)

Sources: (USEPA, 2013a) (Fenneman, 1916) (NPS, 2015b) (Robertson, 2009) (Savanna Oak Foundation, 2015)

Communities of Concern

Currently, no vegetative communities of concern are listed in the state of Illinois. While Illinois does not specifically identify vegetation communities of concern, several Illinois natural communities are listed in the Illinois Wildlife Action Plan (IWAP) as priorities for restoration and management. Although these natural communities are listed in the IWAP, currently, there is no ranking system in place to rate these natural communities based on rareness within the state. In addition, the Illinois Natural History Survey (INHS) is currently updating the Illinois Natural Area Inventory (INAI). The update will reclassify important natural areas in Illinois (INAI, 2015).

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive plants. 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 (GPO, 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 of which are terrestrial, 19 aquatic, and 5 parasitic (USDA, 2014a).

Noxious weeds are a threat to Illinois's rangeland,[83] cropland, pastureland,[84] 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.[85] The Illinois Noxious Weed Law (505 ILCS 100/1) [86] stipulates that the Illinois Digital Archives (IDA) be responsible for the establishment of the statewide noxious weed list and updates to that list, as necessary. In addition, the Illinois Noxious Weed Law further stipulates that each county is responsible for implementing and enforcing noxious weed management through a county control authority. The state of Illinois also regulates more than 25 plants under the Exotic Weed Act (525 ILCS 10/1-10/5):[87]

- **Aquatic –** purple loosestrife *(Lythrum salicaria)*;
- **Shrubs –** Japanese honeysuckle *(Lonicera japonica),* multiflora rose *(Rosa multiflora),* common buckthorn *(Rhamnus cathartica),* glossy buckthorn *(Rhamnus frangula),* saw-toothed buckthorn *(Rhamnus arguta),* dahurian buckthorn *(Rhamnus davurica),* Japanese buckthorn *(Rhamnus japonica),* Chinese buckthorn *(Rhamnus utilis)*, kudzu *(Pueraria*

[83] Rangeland: "A Land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grass-like plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland" (USEPA, 2015d).
[84] Pastureland: "Land used primarily for the production of domesticated forage plants for livestock" (USEPA, 2015d)
[85] 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, 2015d).
[86] Illinois Noxious Weed Law (505 ILCS 100/1): http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1693&ChapterID=40.
[87] Illinois Exotic Weed Act (525 ILCS 10/1-10/5): http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1735.

lobata), exotic bush honeysuckles *(Lonicera maackii, Lonicera tatarica, Lonicera morrowii,* and *Lonicera fragrantissima),* exotic olives *(Elaeagnus umbellata, Elaeagnus pungens, Elaeagnus angustifolia),* salt cedar *(Tamarix)*; and

- **Terrestrial Forbs and Grasses –** poison hemlock *(Conium maculatum),* giant hogweed *(Heracleum mantegazzianum),* Oriental bittersweet *(Celastrus orbiculatus),* lesser celandine *(Ficaria verna),* teasel (all members of the *Dipsacus* genus), and Japanese, giant, and Bohemian knotweed *(Fallopia japonica, syn. Polygonum cuspidatum; Fallopia sachalinensis*; and *Fallopia x bohemica, resp.),* Marijuana *(Cannabis sativa),* Giant Ragweed *(Ambrosia trifida),* Common Ragweed *(Ambrosia artemisiifolia),* Canada Thistle *(Cirsium arvense),* Perennial Sowthistle *(Sonchus arvensis),* Musk Thistle *(Carduus nutans),* Perennial members of the sorghum genus, including Johnson grass *(Sorghum halepense),* sorghum almum, and other Johnson grass and sorghum crosses with rhizomes, and Kudzu *(Pueraria labata).* (525 ILCS 10/1-10/5).

4.1.6.4 Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Illinois, divided among mammals,[88] birds,[89] reptiles[90] and amphibians,[91] and invertebrates.[92] 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, nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within Illinois. 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 University of Illinois Extension (UIE), the state is home to approximately 44 mammal species, [93] 61 reptile species, more than 10,000 invertebrate species, 41 amphibian species, and 442 resident and migratory bird species (IOS, 2015) (UIE, 2015).

Mammals

Common and widespread mammalian species in Illinois include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridana*), woodchuck (*Marmota monax*), and eastern chipmunk *(Tamias striatus).* Mammals such as the bobcat *(Lynx rufus)* and river otter *(Lutra canadensis)* are uncommon or rare in Illinois due to restricted habitat or secretive behavior (UIE, 2015).

[88] 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, 2015d).
[89] Birds: “Warm-blooded vertebrates possessing feathers and belonging to the class Aves” (USEPA, 2015d).
[90] Reptile: “Cold-blooded, air-breathing vertebrates belonging to the class Reptilia, usually covered with external scales or bony plates” (USEPA, 2015d).
[91] Amphibian: “A cold-blooded vertebrate that lives in water and on land. Amphibians' aquatic, gill-breathing larval stage is typically followed by a terrestrial, lung-breathing adult stage” (USEPA, 2015d).
[92] Invertebrates: “Animals without backbones: e.g. Insects, spiders, crayfish, worms, snails, mussels, clams, etc.” (USEPA, 2015d).
[93] A 2009 estimate from the Illinois Department of Natural Resources puts the number of wildlife mammal species in the state at 58 to 62 total species (IDNR, 2009).

In Illinois white-tailed deer are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), furbearers, and upland and migratory game birds (IDNR, 2015j). The following 13 species of furbearers may be legally hunted or trapped in the Illinois: raccoon *(Procyon lotor),* red fox *(Vulpes vulpes),* gray fox *(Urocyon cinereoargenteus),* opossum *(Didelphimorphia),* coyote *(Canis latrans),* striped skunk *(Mephitis mephitis),* muskrat *(Ondatra zibethicus),* weasel *(Mustella spp.),* woodchuck *(Marmota monax),* badger *(Taxidea taxus),* beaver *(Castor canadensis),* mink *(Mustela vison),* and river otter *(Lontra canadensis)* (IDNR, 2015j).

Illinois has identified 20 mammals as Species in Greatest Need of Conservation (SGNC). Two of these species are federally listed as endangered under the Endangered Species Act (ESA). Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species. The SGNClist consists of at-risk species that are rare or declining, and can provide funding from State Wildlife Grants for efforts to reduce their potential to be listed as endangered. Although these species have been targeted for conservation they are not currently under legal protection, with the exception of those also listed under the ESA. The SGNClist is updated periodically and is used by the state to focus their conservation efforts and as a basis for implementing the Illinois State Wildlife Action Plan (IWAP) (IDNR, 2005).

Birds

The number of native bird species documented in Illinois varies according to the timing of the data collection effort, changes in bird taxonomy,[94] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., forests, prairies, large rivers and lakes, plains, etc.) found in Illinois support a large variety of bird species. "Eighty-three bird species, about 28 [percent] of the state's avian diversity, met criteria as [Species in Greatest Need of Conservation (SGNC)]" (IDNR, 2005).

Illinois is within the Mississippi Flyway. Covering the entire state of Illinois, the Mississippi Flyway spans from the Gulf of Mexico 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, lakes, and streams in Illinois during the winter. Golden eagles are generally found in drier portions of the state and may be found a variety of habitat types, but they generally nest in

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

mountains and cliffs. Similar to bald eagles, golden eagles are also found throughout the state during the winter season.

A number of Important Bird Areas (IBAs) have also been identified in Illinois. The International Birding Area (IBA) program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide key habitat for native bird populations. Generally, global IBAs are sites determined important for globally rare species or support bird populations 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 Illinois chapter of the National Audubon Society (NAS), a total of 91 IBAs have been identified in Illinois, including breeding,[95] migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, forests, and wetland/riparian[96] areas. These IBAs, which cover approximately 885,000 acres, are widely distributed throughout the state, although the largest concentrations of IBAs in the Chicago region around Lake Michigan and the southern tip of Illinois near the confluence of the Ohio and Mississippi Rivers. The largest IBA in the state is the Kaskaskia River Corridor, which covers approximately 197,000 acres within the southern region of the state (NAS, 2015). Many of these IBA's are an important migration stop and breeding ground for many waterfowl species. Figure 4.1.6-2 depicts the IBAs in Illinois.

A number of threatened and endangered birds are in Illinois. Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

[95] Breeding range: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015d).
[96] 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, 2015d).

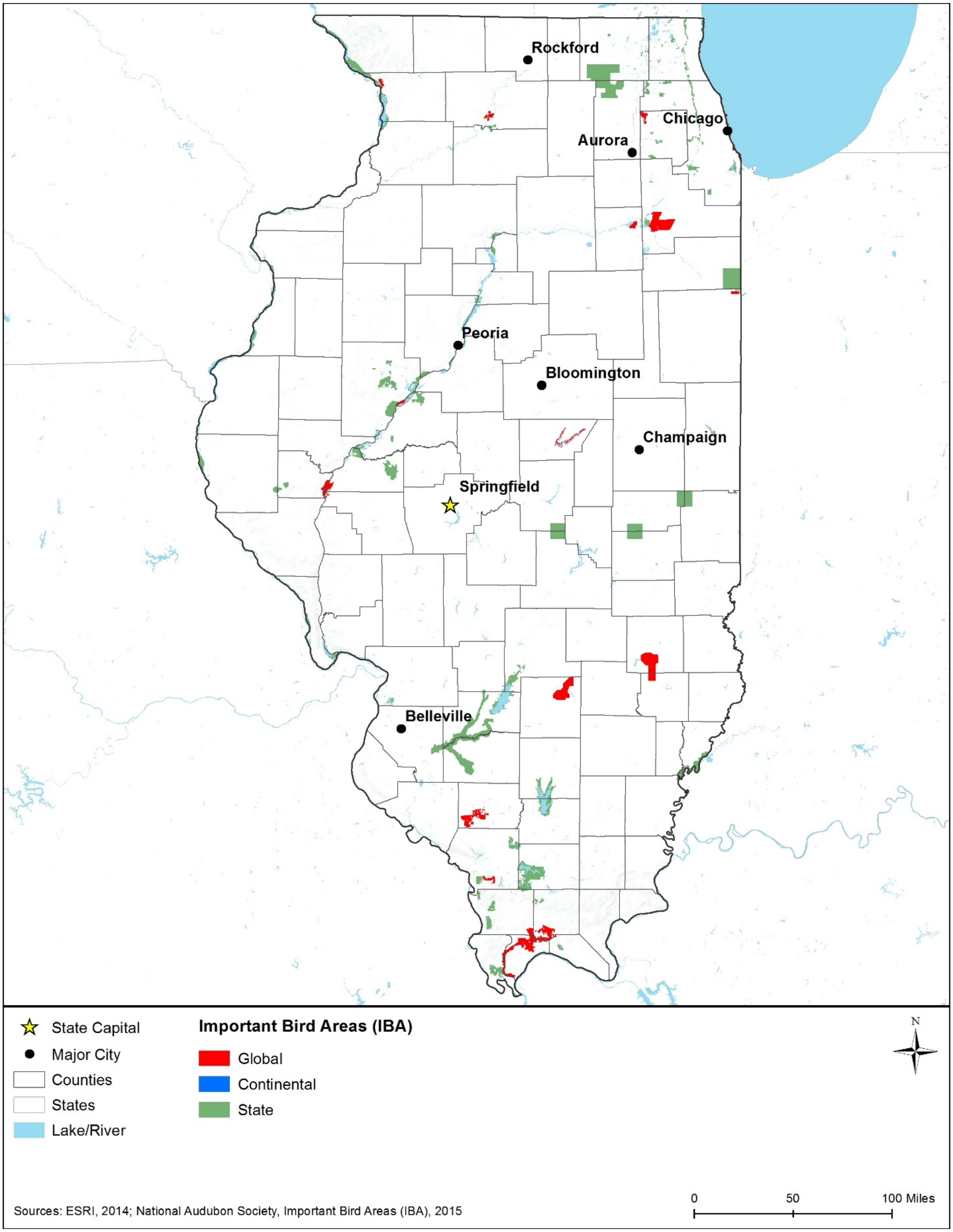


Figure 4.1.6-2: Important Birding Areas in Illinois

Reptiles and Amphibians

A total of 61 native reptile[97] and 41 amphibian species occur in the state of Illinois, including 20 salamanders, 21 frogs and toads,[98] 17 turtles, 6 lizards, and 38 snakes (UIE, 2015). These species occur in a wide variety of habitats throughout the state. Of the 102 native reptile and amphibian species, 37 SGNC have been identified (IDNR, 2005). Collection and take of Illinois reptile and amphibian species is regulated under the Herptiles-Herps Act (510 ILCS 68).[99]

Invertebrates

Illinois is home to a large number of invertebrates, including a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. There are 347 invertebrate species listed as SGNC in the state of Illinois (IDNR, 2005). In the United States, one third of all agricultural output depends on pollinators.[100] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity. As pollinators, bees play a crucial part pollinating flowering plants, which provide food, fiber, animal forage, and ecological services. As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009). Life history, distribution, and abundance information is limited to a small number of Illinois' invertebrates. Given this lack of information on invertebrate species within the state, Illinois has chosen to focus identification on SGNC.

Invasive Wildlife Species

Illinois has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select terrestrial wildlife species. IDNR maintains a list of injurious species presented in Illinois Administrative Rule (IAR) 805. The injurious species list includes 5 bird species, 7 mammal species, 1 reptile species, and 17 fish or aquatic species (IDNR, 2015k). Invasive insects also pose a large threat to Illinois' forest and agricultural resources. Insect pests and plant diseases are regulated under the Illinois Insect Pest and Plant Disease Act (IPPDA) (505 ILCS 90).[101] The IPPDA applies to all insect pests and plant diseases. Species such as the gypsy moth *(Lymantria dispar)*, hemlock woolly adelgid *(Adelges tsugae)*, emerald ash borer *(Agrilus planipennis)*, and Asian longhorn beetle *(Anoplophora glabripennis)* are known to cause irreversible damage to native forests. In addition, quarantines have been enacted in an effort to reduce the spread of many plant pests.[102] Currently, federal quarantines

[97] Note that the IDNR, 2005 reference lists 60 total reptile species for Illinois as of the publication date.
[98] Several species of mole salamanders and the wood frog are known to seasonally migrate in Illinois (IDNR, 2015z).
[99] Herptiles-Herps Act (510 ILCS 68/): http://www.ilga.gov/legislation/ilcs/ilcs5.asp?ActID=3563&ChapterID=41.
[100] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2015d).
[101] Illinois Insect Pest and Plant Disease Act (505 ILCS 90): http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1691.
[102] "Plant pest" is defined by 7 CFR §340.1 as "any living stage (including active and dormant forms) of insects, mites, nematodes, slugs, snails, protozoa, or other invertebrate animals, bacteria, fungi, other parasitic plants or reproductive parts thereof; viruses; or any organisms similar to or allied with any of the foregoing; or any infectious agents or substances, which can directly or indirectly injure or cause disease or damage in or to any plants or parts thereof, or any processed, manufactured, or other products of plants."

are in place that restrict the transport of plant materials with the potential to contain the emerald ash borer (USDA, 2015b).

In Illinois, feral swine adversely impact several native large and small mammals, including turkey, waterfowl, and deer (IDNR, 2015aa). They feed on reptiles and amphibians, destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and humans.

4.1.6.5 Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in Illinois, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. A distinctive feature of the Illinois landscape with regard to aquatic wildlife is the large river ecosystem of the Mississippi River. No essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in the state of Illinois. Critical habitat for threatened and endangered fish species, as defined by the ESA, does exist within Illinois and is discussed in Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

Illinois is home to approximately 207 species of freshwater fish grouped into 36 families, ranging in size from small darters and minnows to larger species such as salmon and sturgeon. A brief description of those families that contain common species and notable sport fish species is listed below (INHS, 2006). The Illinois Comprehensive Wildlife Conservation Plan and Strategy identifies “80 fish species as Species in Greatest Need of Conservation, representing about 38% of Illinois’ fish diversity” (IDNR, 2005). The SGNC species that fall within the common species or notable sport fish species are also presented below.

Illinois is home to 14 species of freshwater catfishes, including the brown bullhead *(Ameiurus nebulosus),* black bullhead *(Ameiurus melas),* and the yellow bullhead *(Ameiurus natalis).* Larger members of the catfish family include the channel catfish *(Ictalurus punctatus),* flathead catfish *(Pylodictis olivaris),* and the blue catfish *(Ictalurus furcatus).* These species are widespread throughout the state and found in almost any habitat (IDNR, 2005) (IDNR, 2015l). In addition, Illinois is home to six species of madtom, three of which are listed as SGNC. These are small catfish that are not large enough to be considered sportfish by most fishermen.

Approximately 62 species of minnows occur in Illinois. The minnows/carps family contains the largest number of species in Illinois. 21 of these species including 12 species of shiner are listed as SGNC. Common and widely distributed minnow species in Illinois include the common carp *(Cyprinus carpio),* creek chub *(Semotilus atromaculatus)* and common shiner *(Notropis cornutus).* Minnows are not typically a popular sportfish, but are a commercially important fish and an important prey source for larger fish and other wildlife (IDNR, 2005) (IDNR, 2015l).

The gar family contains three species in Illinois: the alligator gar *(Atractosteus spatula),* the longnose gar *(Lepisosteus osseus),* spotted gar *(Lepisosteus oculatus),* and shortnose gar *(Lepisosteus platostomus).* The alligator gar once extirpated from the state has been recently reintroduced into Illinois waters. Historically, alligator gar were an important sport and commercial fish species. Populations have declined rapidly in the last 50 years, but gar are still sought after by sport fishermen due their immense size and hard fighting (IDNR, 2005) (IDNR, 2015l).

Approximately 29 species of perches occur in Illinois, with 25 of these species being darters. 10 species of darter are listed as SGNC. Darters are small members of the perch family that are not considered to be sport fish sought after by fishermen. Walleye *(Etheostoma fusiforme)* and sauger *(Sander canadensis*) are larger members of the perch family and are important sport fish in Illinois. These species are common in the large rivers, lakes, and reservoirs throughout the state. Both walleye and sauger are listed as SGNC in Illinois (IDNR, 2005) (IDNR, 2015l).

Three species of pike occur in Illinois waters, the muskellunge *(Esox masquinongy),* northern pike *(Esox Lucius),* and the grass pickerel *(Esox americanus).* Grass pike are smaller member of the pike family and are typically found in weedy slews and backwaters. Northern pike and muskellunge are native to the northern glacial lakes of Illinois, but were introduced into other areas of the state to create fishing opportunities and are now found in bays of lakes and reservoirs with dense weed growth and submerged logs. Both the muskellunge and northern pike have a voracious predatory which has made them excellent sport fish avidly sought after by fishermen (IDNR, 2005) (IDNR, 2015l).

There are three species of the sturgeon family in Illinois: the shovelnose sturgeon *(Scaphirhynchus platorynchus),* the lake sturgeon *(Acipenser fulvescens),* and the endangered pallid sturgeon *(Scaphirhynchus albus).* The pallid sturgeon and the lake sturgeon are both listed as a SGNC. Because of their scarcity, sturgeon are no longer an important commercial fish species. The depression in populations of sturgeon is the result of over-collection of these species for caviar beginning in early colonial times and loss of habitat (IDNR, 2005) (IDNR, 2015l).

The sunfish family includes 16 species in Illinois, many of which are common throughout the state and highly popular with sport fishermen. The most commonly encountered species are the bluegill *(Lepomis macrochirus),* black crappie *(Pomoxis nigromaculatus),* largemouth bass *(Micropterus salmoides),* and smallmouth bass *(Micropterus dolomieu).* These sunfish species live in a wide variety of habitats, including rocky, cool lakes streams, and reservoirs (IDNR, 2005) (IDNR, 2015l).

Illinois waters are home to 13 species of the trout family including the brook trout *(Salvelinus fontinalis),* brown trout *(Salmo trutta),* rainbow trout *(Oncorhynchus mykiss*), and lake trout *(Salvelinus namaycush).* Illinois is also home to coho salmon *(Oncorhynchus kisutch),* Chinook salmon *(Oncorhynchus tshawytscha),* and pink salmon *(Oncorhynchus gorbuscha).* The majority of these species inhabit the cold waters of Lake Michigan in northeastern Illinois. Trout and Salmon are popular game fish avidly sought after by fishermen (IDNR, 2005) (IDNR, 2015l).

The American eel *(Anguilla rostrata)* is the only member of the eel family in the state of Illinois and is listed as a SGNC. American eels were once found throughout much of eastern and central

North America, but their current distribution is limited by dams. In Illinois, American eels are found primarily in deep pools of large rivers and streams. American eels spend the majority of their life in freshwater but they migrate to the Atlantic Ocean to spawn (IDNR, 2005) (IDNR, 2015l).

Shellfish and Other Invertebrates

Freshwater mussels are an important food source for many wildlife species such as waterfowl, fish, muskrat, and other furbearers. Mussels are also important water quality indicators, as they often require streams with a high oxygen content that have not been degraded by sedimentation. "Twenty-nine species of Illinois' 61 extant freshwater mussels were identified as Species in Greatest Need of Conservation (48%)--an additional 19 species are extinct or extirpated" (IDNR, 2005). River diversions, impoundments, and dredging activities are the primary threats to freshwater mussel species (IDNR, 2005). Section 4.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known Illinois freshwater invertebrates include a variety of crayfish, fairy shrimp, amphipods[103], and pill bug species. Twenty-two species of freshwater crustaceans are listed as SGNC in the state of Illinois (IDNR, 2005).

Invasive Aquatic Species

Illinois has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select aquatic invasive species. According to IAR Part 805 Injurious Species,[104] it is illegal to possess, sell, import, or release the following species into the waters of the state:

- **Aquatic Invertebrates –** zebra mussels (*Dreissena polymorpha, D. bugensis*), mitten crabs (*Eriocheir sp*), rusty crayfish (*Orconectes rusticus*), killer shrimp (*Dikerogammarus villosus*), yabby (*Cherax destructor*), and golden mussel (*Limnoperna fortune*)
- **Fish –** walking catfish (*Clarias batrachus*), black carp (*Mylopharyngodaon piceus*), European rudd (*Scardinius erythophthalmus*), round goby (*Neogobius melanostomus*), tubenose goby (*Proterhinus marmoratus*), ruffe (*Gymnocephalus cernuus*), silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Hypophthalmichthys nobilis*), stone moroko (*Pseudorasbora parva*), zander (*Sander lucioperca*), wels catfish (*Silurus glanis*), and snakeheads. (Family: *Channidae*)

[103] Amphipod: "A small, shrimp-like crustacean" (USEPA, 2015d).
[104] General Assembly of Illinois Administrative Code, Title 17: Conservation, Chapter I: Department of Natural Resources, Subchapter B: Fish and Wildlife, Part 805 Injurious Species, Section 805.20 Listing of Injurious Species: ftp://www.ilga.gov/JCAR/AdminCode/017/017008050000200R.html.

4.1.6.6 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 state of Illinois. The USFWS has identified 20 federally endangered[105] and 11 federally threatened[106] species known to occur in Illinois (USFWS, 2016a). Of these 31 federally listed species, two of them have designated critical habitat[107] (USFWS, 2016b). One candidate species[108] is identified by USFWS as occurring within the state, an invertebrate called the Rattlesnake-master borer moth (USFWS, 2016c). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends taking these species into consideration during environmental planning because they could be listed in the future (USFWS, 2014a). The 31 federally listed species are 3 mammals, 3 birds, 1 fish, 15 invertebrates, 9 plants, plus 1 candidate species (USFWS, 2015c), are discussed in detail under the following sections. Figure 4.1.6-3 depicts the critical habitat in Illinois for the Hine's emerald dragonfly (*Somatochlora hineana*) and the rabbitsfoot mussel (*Quadrula cylindrical*). 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

Two endangered and one threatened bat are federally listed for Illinois as summarized in Table 4.1.6-3. The gray bat *(Myotis grisescens)* and Northern Long-eared Bat *(Myotis septentrionalis)* have statewide distribution and the Indiana Bat *(Myotis sodalist)* is primarily found in central and southern portions of the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Illinois is provided below.

[105] 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)).
[106] 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)).
[107] Critical habitat includes “the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species” (16 U.S.C §1532(5)(A)).
[108] Candidate species are plants and animals that the USFWS has “sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities” (USFWS, 2014a).

Table 4.1.6-3: Federally Listed Mammal Species of Illinois

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Gray Bat	*Myotis grisescens*	E	No	Limestone Karst caves in southern and west-central Illinois
Indiana Bat	*Myotis sodalis*	E	No	Trees and snags, caves, and abandoned mines; central and southern Illinois
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Caves and mines, upland forests and woods; statewide distribution in Illinois

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Gray Bat. The gray bat is the largest of its genus in the eastern U.S., with a forearm span of 40-46 mm and a weight of 7-16 grams (USFWS, 1997a). This species was federally listed as endangered in 1976 (41 FR 17736 17740, April 28, 1976) (USFWS, 2015e). It is geographically restricted is found year-round almost exclusively in limestone karst caves in southern and Midwestern states, known to occur from Kansas and Oklahoma east to Virginia and North Carolina (USFWS, 1997a). In the winter months, these bats hibernate[109] in deep, narrow caves due to their strict thermoregulatory requirements and in the summer months their maternity caves are almost always located near bodies of water for foraging purposes, and young are born in late May or early June (USFWS, 1997a). In Illinois, the gray bat is at the northern portion of its range, present in the extreme southern and mid-central part of the state in eight counties (USFWS, 2015f).

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

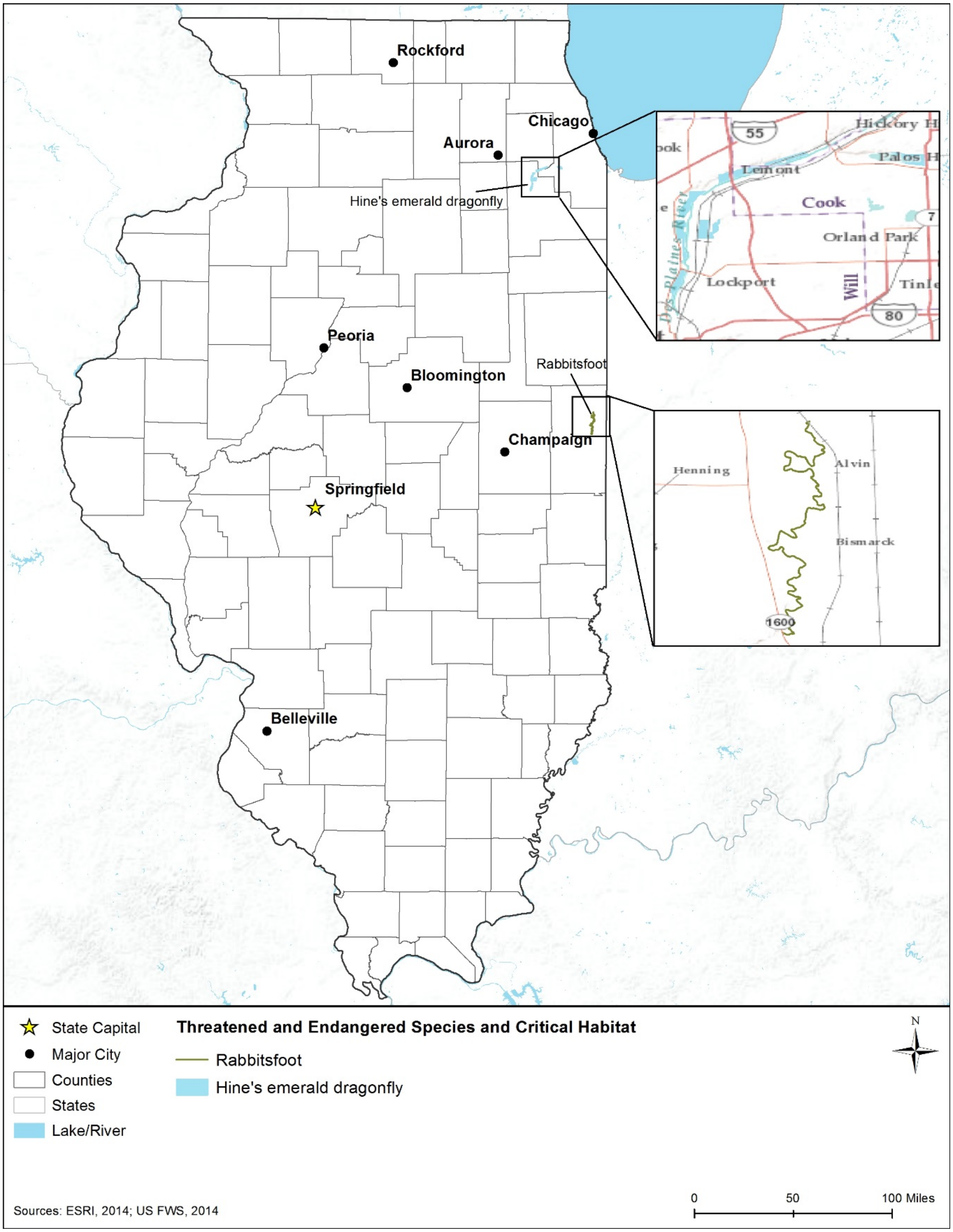


Figure 4.1.6-3: ESA Designated Critical Habitat for the Hine's Emerald Dragonfly and Rabbitsfoot Mussel in Illinois.

Threats to this species are largely due to human-induced disturbances. The majority of the gray bat population utilizes only a handful of caves, making them extremely vulnerable. Current threats to this species include human disturbance, habitat loss and degradation[110] due to flooding, and commercialization of caves such as adding gates that alter the air flow, humidity, and temperature of caves (USFWS, 1997a). Disturbances of maternity caves from late May through mid-June are especially detrimental (USFWS, 1997a).

Indiana Bat. Photo credit: USFWS

Indiana Bat. The Indiana bat is a small, insectivorous[111] mammal that was originally federally listed as "in danger of extinction" under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was grandfathered into the ESA of 1973 as an endangered species (16 U.S.C. §1531 *et seq.*). These small bats measure approximately 3.0 to 3.5 inches with a wingspan of 9.5 to 10.5 inches. They have dull grayish chestnut fur and strongly resemble the more common little brown bat *(Myotis lucifugus)* (USFWS, 2007). Gray bats hibernate in limestone caves throughout the range, from southern states to Midwestern and eastern states, including Illinois, from late fall to early spring in very large numbers (averaging 500 – 1000 bats per cluster). Females give birth in the summer and raise their young in a maternity roost[112] tree, sometimes with as many as a dozen to 100 females in one tree. They choose trees with cavities or loose bark in sunny locales, in forested or semi-forested areas. They may also choose to nest in human-made structures, such as abandoned buildings and bridges. They feed on flying insects near their roost location (USFWS, 2015h).

In 2009, only 387,000 Indiana bats were known to exist in its range, less than half of the population of 1967 (USFWS, 2015i). Regionally, this species is currently found in the central and eastern U.S., from Vermont west to Illinois, Missouri, and Arkansas, and south and east to Georgia. In Illinois, they are found in the central and southern regions of the state (USFWS, 2015j).

The threats to this species include the disturbance and intentional killing of hibernating and maternity colonies, disturbances to air flow in caves from the improper installation of security gates, habitat fragmentation[113] and degradation, the use of pesticides or other environmental contaminants, and White Nose Syndrome (USFWS, 2015i) (USFWS, 2015h). White Nose

[110] Degradation: "The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards" (USEPA, 2015d).
[111] Insectivorous: "An animal that feeds on insects" (USEPA, 2015d).
[112] Roost: "A place where a flying animal, usually a bird or bat, can sleep or rest, usually by perching or hanging" (USFWS, 2015l).
[113] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate" (USEPA, 2015d).

Syndrome is a rapidly spreading fungal disease that afflicts hibernating bats (USGS-NWHC, 2015).

Northern Long-eared Bat. The northern long-eared bat was listed as endangered in 2013 (78 FR 72058 72059, Dec. 02, 2013) and was relisted as threatened in 2015 (80 FR 17973 18033, April 2, 2015). It is "a medium-sized bat with a body length of 3 to 3.7 inches and a wingspan of 9 to 10 inches" with medium brown fur on its back, light brown fur on its underside; as its name suggests, this bat has notably long ears for its genus (USFWS, 2015k). Suitable winter habitat includes caves and abandoned mines, while trees and snags provide suitable roosting habitat the remainder of the year (USFWS, 2015k). The northern long-eared bat's range includes 38 states from the east coast to the north-central U.S. (USFWS, 2015m). In Illinois, this bat species can be is believed or known to exist statewide (USFWS, 2015n).

The main threat to this bat is white-nose syndrome, which began in New York in 2006 and is now found in at least two-thirds of the bat's range. The USFWS estimates species numbers have declined up to 99 percent based on historical hibernacula counts as a result of this disease (USFWS, 2015k). Because populations have declined so dramatically, development activities that permanently or temporarily remove forested habitat now have a greater potential to directly or indirectly effect the northern long-eared bat depending on the time of year habitat impacts occur. Protection of hibernacula using gates to exclude human entry and minimizing the loss or disturbance of roosting summer habitat are recommended to prevent further loss of this species (USFWS, 2015n) (USFWS, 2015m).

Birds

Two threatened and one endangered bird are federally listed in Illinois, as summarized in Table 4.1.6-4. Piping Plovers *(Charadrius melodus),* Red Knots *(Calidris canutus rufa),* and Least Terns *(Sterna antillarum)* are considered to be very rare in the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in the state is provided in Table 4.1.6-4.

Table 4.1.6-4: Federally Listed Bird Species of Illinois

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Piping Plover	*Charadrius melodus*	T	No	Beaches and shorelines along alkali lakes, reservoirs; very rare migrant in Illinois.
Red Knot	*Calidris canutus rufa*	T	No	Occurs as a rare migrant along shorelines in Illinois.
Least Tern	*Sterna antillarum*	E	No	Bare alluvial and dredged spoil islands; rare in the breeding season in southern Illinois and uncommon migrant statewide.

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Piping Plover. The piping plover is a small, migratory shorebird that was first listed as endangered in 1985 for the Great Lakes watershed of both the U.S. and Canada, and as threatened in the remainder of its range in the U.S. (50 FR 50726 50734, December 11, 1985) (USFWS, 2015o). It is approximately 6.5 to 7 inches in length with a wingspan up to 19 inches and weighs between 1.5 to 2.3 ounces (USFWS, 2015o). 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. 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[114] in the Northern Great Plains (USACE, 1988). The piping plover is a rare migrant in Illinois with the last known breeding occurring in 1979 (IDNR, 2006b).

The threats to piping plovers include destruction and degradation of preferred habitat resulting from construction and development activities and water control structures, nest predation,[115] and nest abandonment caused by human presence or disturbance (USACE, 1988) (USFWS, 2001a).

Red Knot. The red knot was recently listed as a threatened species in 2014 (79 FR 73705 73748, December 11, 2014). It is a medium-sized shorebird; it is approximately 9 inches in length with a wing span up to 20 inches, making it among the largest of the small sandpipers (USFWS, 2005a). This species 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, 2005a) (USFWS, 2014b). In Illinois, the red knot may be a rare migrant along shorelines or in large wetland complexes (USFWS, 2015j).

Current threats to the red knot include sea level rise, climate change, and reduced food availability at their migration stopover sites (USFWS, 2014b).

Least Tern. The least tern is a 9-inch long, grey and white gull, with black markings on its head and a wingspan of approximately 20 inches. The species was federally listed as endangered in 1985 (50 FR 21784 21792, May 28, 1985). Suitable habitat for least terns consists of relatively unvegetated sandbars near rivers, reservoirs and other open water habitat (USFWS, 2014c). The least tern is an uncommon migrant and local summer resident in southern Illinois, and is a rare migrant and post-breeding wanderer in the rest of the state (IDNR, 2006b).

Least Tern. Photo credit: USFWS

Suitable habitat for least terns consists of relatively unvegetated sandbars near rivers,

[114] Palustrine wetlands: "Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens" (USEPA, 2015d).
[115] Predation: "The act or practice of capturing another creature (prey) as a means for securing food" (USEPA, 2015d).

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).

Fish

Only one federally listed endangered fish occurs in the state of Illinois – the pallid sturgeon *(Scaphirhynchus albus)* which may be found in the Mississippi River. Information on the habitat, distribution, and threats to the survival and recovery of this species in in the state is provided in Table 4.1.6-5.

Table 4.1.6-5: Federally Listed Fish Species of Illinois

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Pallid Sturgeon	*Scaphirhynchus albus*	E	No	Large-river obligate dwelling in bottom of dynamic channels of the Mississippi River

Source: (USFWS, 2015d)

[a] E = Endangered

Pallid Sturgeon. The pallid sturgeon is a long slender fish growing up to 6 feet in length and 80 pounds in weight. The species is pale in coloration with a shovel shaped snout, armored body, and skeleton made of cartilage. The pallid sturgeon 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 sturgeon was listed as endangered in 1990 (55 FR 36641 36647, September 6, 1990) and its range extends the length of the Missouri and Mississippi Rivers (USFWS, 2015p). In Illinois, the pallid sturgeon is found in the Mississippi River and its range may also extend into the Kaskaskia River, a tributary to the Mississippi River (USFWS, 2014d).

Pallid Sturgeon. Photo credit: USFWS

The Pallid sturgeon prefers large rivers with strong currents; they can withstand a wide range of turbidity[116] 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, 2013c).

[116] Turbidity: "The cloudy appearance of water caused by the presence of suspended and colloidal matter. Turbidity indicates the clarity of water and is an optical property of the water based on the amount of light reflected by suspended particles" (USEPA, 2015d).

Invertebrates

There are 15 invertebrate federally listed species in Illinois, 14 listed as endangered and 1 listed as threatened. Additionally, Illinois has 1 candidate invertebrate species, the Rattlesnake-master Borer Moth *(Papaipema eryngii).* The majority of these species (11) are mussels found in rivers in various parts of the state, while the rest are insects, snails, and crustaceans. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Illinois is provided in Table 4.1.6-6.

Table 4.1.6-6: Federally Listed Invertebrate Species of Illinois

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Clubshell	*Pleurobema clava*	E	No	Vermillion River
Fanshell	*Cyprogenia stegaria*	E	No	Large rivers with sand and gravel and moderate current; found in the Wabash River in eastern portion of Illinois
Higgins Eye Pearlymussel	*Lampsilis higginsii*	E	No	Mississippi River from Rock River to Steel Dam
Hine's Emerald Dragonfly	*Somatochlora hineana*	E	Yes	Calcareous and slow-moving waters of the Des Plaines River in northeastern Illinois
Illinois Cave Amphipod	*Gammarus acherondytes*	E	No	Dark portions of cave streams in Monroe and St. Clair counties in southwestern Illinois
Iowa Pleistocene Snail	*Discus macclintocki*	E	No	Leaf litter of algific talus slopes
Karner Blue Butterfly	*Lycaeides melissa samuelis*	E	No	Open, sandy clearings in northeastern Illinois near Lake Michigan
Orange-foot Pimpleback	*Plethobasus cooperianus*	E	No	Sand and gravel substrate in clear waters of Ohio River.
Pink Mucket Pearlymussel	*Lampsilis abrupta*	E	No	Major rivers and their tributaries with mud and sand in shallow riffle areas; southern Illinois in the Ohio River
Rabbitsfoot	*Quadrula cylindrica*	T	Yes	Shallow area of streams and rivers with sand and gravel along the banks; Ohio River, North Fork Vermilion, and Vermilion Rivers in Illinois
Rattlesnake-master Borer Moth	*Papaipema eryngii*	C	No	Undisturbed prairie and woodland openings that contain food plant, the rattlesnake-master; in 8 counties statewide
Scaleshell Mussel	*Leptodea leptodon*	E	No	Illinois River and the Marseilles Pool in the northeastern part of the state
Sheepnose Mussel	*Plethobasus cyphyus*	E	No	Shallow areas in larger rivers and streams
Snuffbox Mussel	*Epioblasma triquetra*	E	No	Small- to medium-sized creeks in areas with a swift current and some larger rivers

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Spectaclecase Mussel	*Cumberlandia monodonta*	E	No	Western Illinois, in portions of the Mississippi River

Source: (USFWS, 2015d) (USFWS, 2016c)

[a] E = Endangered, T = Threatened, C = Candidate

Clubshell Mussel. The clubshell mussel *(Pleurobema clava)* grows to about 3 inches in length, and has a straw-yellow or light brown shell with green rays (USFWS, 1994). It is a federally endangered species as designated in 1993 (58 FR 5638 5642, January 22, 1993). Preferred habitat for the clubshell is clean, loose sand and gravel in rivers or stream beds of up to four inches in depth. The clubshell occurs in less than five percent of its historic range and is only found in portions of 13 streams. This species requires clean, flowing streams or small rivers to fertilize and hatch their eggs and sufficient populations of host fish where the larvae further develop until they settle in the stream bed. In Illinois, this mussel is present in the north fork of the Vermillion River (USFWS, 2015j).

Threats to the species include agricultural and industrial pollution, invasive species, and changes in stream flow or impacts to fish hosts (USFWS, 1997b).

Fanshell. The fanshell *(Cyprogenia stegaria)* is a medium-sized freshwater mussel with a subcircular light green to yellow shell with green rays (USFWS, 1991). It was federally listed as endangered in 1990 (55 FR 25591 25595, June 21, 1990). Suitable habitat for the fanshell consists of large rivers with sand and gravel and moderate current. For their reproductive cycle, these mussels require stable, undisturbed habitat and host fish to complete the mussel's larvae development. Regionally, this species in known to occur from Virginia west to Illinois and in Alabama, with a non-essential experimental population in Tennessee. In Illinois, it is known to occur in the eastern region of the state, in White County, along the Wabash River (USFWS, 2015j).

The current threats to the fanshell include dams and reservoirs, as both dams and reservoirs flood suitable habitat location reducing the abundance of sand and gravel along with the presence of host fish. Additionally, water quality degradation is another threat to the survival of the fanshell. Silt and pollution from dredging, agriculture, and industrial runoff have become a major cause for the reduction of these mussels (USFWS, 1997c).

Higgins Eye Pearlymussel. The Higgins eye pearlymussel *(Lampsilis higginsii)* is a larger river mussel species which was listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976) (USFWS, 2004). The species is usually found in mussel beds with at least 15 other types of mussels, in portions of rivers with firm, loose bottoms such as sand and gravel, and not clay or concrete. The river environment should be deep with a moderate flow. The species' range is primarily limited to the northern third of the Mississippi River tributaries from between Louisiana and Indiana to between Minnesota and Wisconsin. Within Illinois, the species is found in Rock River, a tributary to the Mississippi River (USFWS, 2015q) and in the Mississippi River in the northeastern part of the state in Rock Island County (USFWS, 2004).

The primary limiting factor to the Higgins eye pearlymussel is the threat of invasive species such as the Zebra mussel, which has intensively impacted mussel communities in various locations throughout the species' range (USFWS, 2004).

Hine's Emerald Dragonfly. The Hine's emerald dragonfly has a dark green metallic body with yellow stripes on its sides and bright green eyes (USFWS, 2006). The adults have a wingspan of 3.5-3.7 inches (USFWS, 2001b). It is one of the most endangered dragonflies in the United States and was listed as endangered in 1995 (60 FR 5267 5273, January 26, 1995). Suitable habitat for this species is restricted to wetlands comprised of slow-moving, calcareous[117] groundwater seepages in marshes and sedge[118] meadows which are bordered by forest (USFWS, 2001b). Females lay their eggs in marshes, where immature dragonflies live for 2-4 years before emerging as adults (USFWS, 2006).

Almost 3,000 acres of critical habitat has been designated for this species along the Des Plains River in Will, Cook, and DuPage counties in the northeastern part of Illinois (USFWS, 2010a) (Figure 3.1.6-2). Threats to the dragonfly primarily include habitat loss due to agriculture and human development, successional[119] habitat progression, and alterations to biological and hydrological systems (USFWS, 2001b).

Illinois Cave Amphipod. The Illinois cave amphipod *(Gammarus acherondytes)* is a light gray-blue crustacean with small eyes. Mature males measure up to 0.8 inches long while females measure up to 0.6 inches long (USFWS, 2002a). The Illinois cave amphipod was listed as endangered in 1998 (63 FR 46900 46910, September 3, 1998). This species inhabits the dark portions of subterranean caves in the Salem Plateau in southern Illinois (USFWS, 2002a). The Salem Plateau is part of the Illinois sinkhole plain, and karst features are abundant in this region. Very little is known about the biology or life history of this species, and it has never been widely distributed; the caves where it is found are not interconnected (USFWS, 1998).

Habitat loss and degradation of groundwater quality resulting from urbanization, agricultural activities, and an influx of human and animal waste are the principle threats to this species. The karst area where this species is found is characterized by numerous surface sinkholes which are extensively connected through fractures in the surface to caves, making surface and subsurface contamination of water a real threat (USFWS, 2002a).

Iowa Pleistocene Snail. The Iowa Pleistocene snail *(Discus macclintocki)* is brown or greenish-white in color and measures about 0.2 inches across its shell (USFWS, 2015r). It was listed as endangered in 1978 (43 FR 28930, August 2, 1978). Fossilized shells indicate that this species was much more wide-spread during cooler glacial periods (USFWS, 2015r). It is now found at about 30 sites in Iowa and Illinois (USFWS, 2015r), and only one (1) of those sites is in the state of Illinois, in the Driftless Area in Joe Davies County in the northeastern part of the state (USFWS, 1984a). The Iowa Pleistocene snail has very specific temperature and moisture

[117] Calcareous: "Of or containing calcium carbonate, calcium, or limestone" (USEPA, 2015d).
[118] Sedge: "Plants of the family Cyperacae that resemble grasses, but have solid stems" (USEPA, 2015d).
[119] Succession: "The process by which a plant or animal community successively gives way to another until a stable state is reached" (USEPA, 2015d).

requirements that make its habitat rare; they exist only on botanically diverse, undisturbed, algific slopes (USFWS, 1984b).

The biggest threat to this species is climate change and subsequent alteration of the specific habitat conditions this snail requires. This snail is also threatened by loss of its natural habitat and misapplication of pesticides (USFWS, 2015r).

Karner Blue Butterfly. The Karner blue butterfly *(Lycaeides melissa samuelis)* is generally a dark blue or brownish-silver butterfly with orange accents and a black trim. The species is small, with a wingspan of approximately 1 inch, and has been federally listed as endangered since 1992 (57 FR 59236 59244, Dec 14, 1992) (USFWS, 2015s). Their range extends across 12 states from Minnesota to Maine, including Wisconsin (USFWS, 2008a) and they are restricted open dry sandy areas with clearings supporting wild blue lupine (USFWS, 2008a). The species occurs in Lake County in the extreme northeastern corner of Illinois, adjacent to Lake Michigan (USFWS, 2015t).

The staple food for the caterpillars is wild lupine (*Lupinus perennis*) which restricts the Karner blue butterfly's distribution. Two hatches occur every year, one approximately in April, and another in June. Primary threats to this species include habitat loss and degradation from land development and the lack of natural disturbances from fire and grazing. These disturbances would normally maintain the early successional communities required by this species and wild lupine (USFWS, 2008a).

Orange-foot Pimpleback. Also known as the orange-footed pearly mussel, the orange-foot pimpleback *(Plethobasus cooperianus*) is a mussel that measures between 3.5 and 4 inches long, with a large and heavy shell marked by irregular growth rings (USFWS, 1984c). It was among the first invertebrate species to gain federal protection in 1976, under the Endangered Species Act (41 FR 24062 24067, June 14, 1976). The orange-foot pimpleback buries itself in the substrate of rivers in sand and gravel areas and only its feeding siphons and the edge of its shell are exposed (USFWS, 2015u). As larvae, it is parasitic and attaches itself to the gills of a host fish until it has grown a shell (USFWS, 2015u). Habitat for this species was once widespread, but current populations in Illinois exist in the southern part of the state, in the Ohio River.

Threats to this species include dams and reservoirs, which separate upstream and downstream populations and eliminate sand and gravel substrate, siltation from industrial activity and development, and pollution from agricultural and industrial runoff (USFWS, 1984c).

Pink Mucket Pearlymussel. The endangered pink mucket pearlymussel *(Lampsilis abrupta)* is a medium size mussel with a smooth yellowish-brown round shell. This species was federally listed as endangered in 1976 (41 FR 24062 24067, June 14, 1976). The pink mucket was historically known to occur from Oklahoma east to Virginia and Illinois south to Louisiana; however, due to different factors the populations of these species have decreases and are now only known to occur in small populations throughout its historical range. Suitable habitat for the pink mussel consists of major rivers and their tributaries with mud and sand in shallow riffle areas. In Illinois, it is known to occur in the Ohio River in Massac County (USFWS, 2015j).

Threats to the survival of this species include dams that disrupt the natural flow, impoundment, and water quality degradation (USFWS, 1997d).

Rabbitsfoot Mussel. The threatened rabbitsfoot mussel *(Quadrula cylindrica cylindrical)* is a medium- to large-sized freshwater mussel that can grow up to 6 inches in length. The shell of the rabbitsfoot mussel is generally yellowish, greenish, or olive in color and turns yellowish brown with age (USFWS, 2015v). The rabbitsfoot mussel was federally listed as threatened in 2013 (78 FR 57076 57097, September 17, 2013). It has been estimated that these mussels have been eliminated from about 64 percent of its existing historical range and only about 10 of the populations that exists are considered to be large enough to be viable for long term (USFWS, 2011a) (USFWS, 2015w). In Illinois, it is found in the north-central portion of the state, in the Ohio River, North Fork Vermillion River, and Vermillion River (USFWS, 2015j).

The rabbitsfoot is a sedentary filter feeder that obtains its oxygen and food from the water column. The rabbitsfoot prefers the shallow area of streams and rivers with sand and gravel along the banks. These mussels seldom burrow and instead use the gravel along the banks as refuge in fast moving rivers and streams. For reproduction this species prefers a stable and undisturbed habits with a sufficient population of host fish including shiners of the genera *Cyprinella*, *Luxilus*, and *Notropis* (USFWS, 2011a).

A critical habitat designation was recorded in 2015 at 31 stream segments where the mussels are known to occur (80 FR 24691 24774, April 30, 2015), illustrated in Figure 3.1.6-2. Critical habitat for rabbitsfoot mussel is at river mile 28.5 of the Ohio River, measuring from the Tennessee River confluence to the Lock and Dam near Olmstead, and also 17.7 river mile of the North Fork Vermillion River and 4.5 river mile of Middle Branch North Fork Vermillion River (GPO, 2015a). The current threats to the rabbitsfoot mussels include the loss of habitat, isolation of populations, range restrictions, sedimentation, and presence of exotic non-native species (USFWS, 2011a).

Rattlesnake-master Borer Moth. The rattlesnake-master borer moth measures approximately 1.4 inches and has purple brown coloration with yellow rings and white dots on its wings (USFWS, 2014e). The rattlesnake-master borer moth was listed as a candidate species in 1989 (54 FR 554 579, January 6, 1989). Regionally, the species is known from Arkansas, Illinois, Kentucky, North Carolina, and Oklahoma (USFWS, 2014e). In Illinois, the rattlesnake-master borer moth exists in eight (8) counties statewide (USFWS, 2015j).

Suitable habitats for the rattlesnake-master borer moth are undisturbed prairie and woodland openings that contain their only food plant, rattlesnake-master. Threats to the species include habitat loss, fragmentation, degradation, and modification from agriculture, development, flooding, invasive species, and secondary succession. Rattlesnake-master is not known to occur in disturbed areas, and the extensive loss of undisturbed prairie in the United States has resulted in the remaining remnants that could support rattlesnake-master generally to be small and isolated. The rattlesnake-master borer moth's dependence on rattlesnake-master as its only larval food source makes the moth's potential habitat very narrow, which is likely limiting for this species (USFWS, 2014e).

Scaleshell Mussel. The scaleshell mussel *(Leptodea leptodon)* is a smooth brownish green freshwater mussel of approximately 4 inches in length with paper-thin shell and lighter brown markings. The scaleshell was federally listed as endangered in 2001 (66 FR 54808 54832, October 30, 2001) (USFWS, 2015x). Historically, the scaleshell mussel once occurred in 56 rivers of the Mississippi River Basin but in the last 25 years only been documented in 18 streams, 3 of which it presently can be found. In Illinois, the species is known in the Illinois River and the Marseilles Pool in Grundy County (USFWS, 2015j).

Though each mussel produces more than 400,000 larvae (approximately double comparable mussels), the scaleshell has specific host requirements met by the freshwater drum *(Aplodinotus grunniens) and* requires specific ranges for temperature, flow, and oxygen in its habitat, which limit species populations. Present threats to the scaleshell include: declining oxygen levels in streams (eutrophication), sedimentation from mining and dredging operations, contamination from municipal and industrial wastes or agricultural run-off, competition from non-native species (such as the Asian clam and Zebra mussel), and impoundment of rivers which modify stream and river hydrology (USFWS, 2010b).

Sheepnose Mussel. The sheepnose mussel *(Plethobasus cyphyus)* is a medium-sized freshwater mussel that grows to about five inches. The sheepnose shell is a light yellow to dull yellowish brown with dark ridges (USFWS, 2012a). After multiple status reviews since 2004, the USFWS listed the sheepnose mussel as endangered in 2012 (77 FR 14914 14949, March 13, 2012). The sheepnose mussel lives in large rivers and streams with moderate to swift currents and feed on suspended algae, bacteria, detritus, and microscopic animals. This species prefers shallow shoal habitats above course sand and gravel. For reproduction the sheepnose prefers a stable undisturbed habitat with the presence of sauger (Sander canadensis), its only host fish (USFWS, 2012a). This species historically occurred in most of the Mississippi River, but has been eliminated from two-thirds of location where it once occurred and now only occurs in 25 streams (USFWS, 2012a). In Illinois, it is known to occur in eight counties associated with major rivers (USFWS, 2015j).

Threats include sedimentation, dams that restrict natural flow, habitat reduction, water quality degradation, contaminations of nutrients, and invasive species of zebra mussels (*Dreissena polymorpha*) (USFWS, 2011b) (USFWS, 2012a).

Snuffbox Mussel. The endangered snuffbox mussel *(Epioblasma triquetra)* was listed as endangered in 2012 (77 FR 8632 8665, February 14, 2012). It is a small to medium-sized freshwater mussel that grows from 1.8 to 2.8 inches. The snuffbox has a yellow, green, or brown triangular shell with green rays (USFWS, 2012b). The snuffbox total population has been reduced by 62 percent from its historical range and currently only occurs in 79 streams and 14 rivers compared to 210 streams and lakes in its historical range (USFWS, 2012b). In Illinois, it is in the mid-eastern portion of the state in Cokes, Cumberland, and Douglas counties (USFWS, 2015j).

The snuffbox mussels inhabit small- to medium-sized creeks, lakes, and rivers and feed on suspended algae, bacteria, and dissolved organic material. This species prefers shoal habitats with swift current to sand and gravel as they usually burrow deep in sand. Current threats to this species include sedimentation, pollution, and water quality degradation, dams that restrict natural flow, and invasive non-native species of zebra mussels (USFWS, 2012b).

Spectaclecase Mussel. The spectaclecase mussel *(Cumberlandia monodonta)* is a freshwater mussel that was first listed as federally endangered in 2012 (77 FR 14914 14949, April 12, 2012). As its name suggest, its brownish to black shell is large, up to 9 (nine) inches long, with a somewhat curved appearance and moderate inflation (USFWS, 2012c). Suitable habitat for the spectaclecase mussel includes sheltered areas in large rivers. This species spends its entire life partially or completely buried in river bottom substrate, and some specimens have been recorded to be up to 70 years old (USFWS, 2012c). The spectaclecase mussel has experienced a 55 percent decrease in distribution and only occurs in 20 of the 44 streams it once inhabited in the central region of the U.S. (USFWS, 2012c). In Illinois, it is known to occur in 9 counties in the western portion of the state where the Mississippi River flows (USFWS, 2015y).

The current major threat to the survival of this species is habitat loss and impairment, with dams and impoundments being major contributors (USFWS, 2014f). Dams alter the natural flow and temperature regime of rivers, blocking fish passage, which are necessary to prevent fragmentation and connect populations. Sedimentation of rivers, pollution, channelization, and invasive zebra mussels also pose threats to this species (USFWS, 2012c).

Plants

There are 9 federally listed plants in the state of Illinois. Only one of them, the Leafy-prairie Clover *(Dalea foliosa),* listed as endangered. The majority of these plants are associated with prairie and riverine or shoreline habitats, all of which have undergone major changes due to land development, including loss of habitat and altered hydrology. Information on the habitat, distribution, and threats to the survival and recovery of each of these plant species is provided in Table 4.1.6-7.

Table 4.1.6-7: Federally Listed Plant Species of Illinois

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Decurrent False Aster	*Boltonia decurrens*	T	No	Sandy, open floodplains along the Illinois River
Eastern Prairie Fringed Orchid	*Platanthera leucophaea*	T	No	Ranges from prairie to marsh edges and sedge meadows in eastern and west-central part of Illinois
Lakeside Daisy	*Hymenoxys herbacea*	T	No	Dry, rocky prairies in Tazewell and Will counties
Leafy Prairie-clover	*Dalea foliosa*	E	No	Prairie remnants on thin soil over limestone
Mead's Milkweed	*Asclepias meadii*	T	No	Virgin prairies
Pitcher's Thistle	*Cirsium pitcheri*	T	No	Active lakeshore grassland dunes near Lake Michigan

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Illinois	Habitat Description
Prairie Bush-clover	*Lespedeza leptostachya*	T	No	Dry to arid tallgrass prairies with gravelly soil
Price's Potato-bean	*Apios priceana*	T	No	Wet floodplain forests, shrubby swamps; extirpated in Illinois
Small Whorled Pogonia	*Isotria medeoloides*	T	No	Mixed-deciduous[120]/coniferous forest; in Randolph County in southwestern Illinois

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Decurrent False Aster. The decurrent false aster *(Boltonia decurrens)* is a perennial plant[121] that grows 59-79 inches in height and is characterized by conspicuous decurrent leaves 2-6 inches long (USFWS, 1988). The species was listed as threatened in 1988 (53 FR 45851 45861, November 14, 1988). Decurrent false aster is found on moist, sandy soils of prairie wetlands along river floodplains and is reliant on periodic flooding (USFWS, 1997e). This plant was historically found in this habitat from Le Salle, IL on the Illinois River downstream to St. Louis, MO on the Mississippi River (USFWS, 1988). In Illinois, populations of decurrent false aster are located along the Illinois River in 20 counties (USFWS, 1988).

Current threats to this species include siltation, loss of habitat, and herbicides (USFWS, 1997e). All of these threats are linked to land development and agriculture, the first due to poorly managed soils and the second due to conversion of wet prairies and the construction of levees. Several populations have been discovered in areas of low-intensity agriculture, as the decurrent false aster thrives with occasional disturbance (USFWS, 1997e).

Eastern Prairie Fringed Orchid. The eastern prairie fringed orchid (*Platanthera leucophaea*), also known as the eastern prairie orchid, was listed as threatened in 1989 (54 FR 39857 39863, September 28, 1989). It grows between 8 to 40 inches in height with a stalk of up to 40, white flowers, each with three fringed lips and a nectar tube (USFWS, 2015z). Regionally, this species is known to occur sparsely from Maine south to Georgia and eastern to Illinois. It was formerly known in the tallgrass prairie across the northern two thirds of the state of Illinois, but with conversion to agriculture it is now only present in the Chicago area and eastern and west-central part of the state (USFWS, 1999).

The prairie orchid grows in a variety of habitats, from wetlands to prairies and requires full sun. Seedlings require soil fungi (called mycorrhizae) to establish themselves and develop more complete root systems. Seed capsules mature over the growing season and are dispersed by the wind from late August through September (USFWS, 2015aa). Plants may only flower once every few years. Threats to the eastern prairie orchid include altered hydrology, invasive plant species, succession to woody vegetation, foot traffic, and collection (USFWS, 1999).

[120] Deciduous: "Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally" (USEPA, 2015d).
[121] Perennial plants: "Plants that live for more than two growing seasons. Perennial plants either die back after each season (herbaceous plants) or grow continuously (shrubs)" (USEPA 2015am).

Lakeside Daisy. Lakeside daisy *(Hymenoxys herbacea)* is a perennial plant with bright yellow flowers that blooms from late April to early June (USFWS, 1990). It was listed as threatened in 1988 (53 FR 23742 23745, June 23, 1988). It has oblanceolate to lanceolate leaves that are dark green in color, although leaves are paler if the plant is experiencing drought. Leaf length varies widely, from less than an inch to over 6 inches (USFWS, 1996). The lakeside daisy requires full sun and occurs on outcrops of dolomite or limestone bedrock and on dry, gravelly prairies on terraces or on hills associated with river systems (USFWS, 1990). In Illinois, the lakeside daisy is now restricted to dry, rocky prairies in Tazewell and Will counties.

The primary threats to the lakeside daisy is habitat loss due to quarries or other disturbances, such as mining activities and fill disposal, and habitat succession (USFWS, 1990).

Leafy Prairie-clover. Leafy prairie-clover *(Dalea foliosa)* is a perennial that flowers from mid-July to late August, producing 1 to 10 lavender flowering structures (USFWS, 1996). Leaves are 0.2 to 0.5 inches long, composed of alternate, oddly pinnately compound leaflets (USFWS, 1997f). It was listed as endangered in 1991 (56 FR 19953-19959, May 1, 1991). Its habitat type is dolomite prairie, and the leafy prairie-clover favors a wet spring and fall and a dry summer (USFWS, 1997f). In Illinois, this plant is found in open, sunny areas near the Des Plains River in northeast Illinois (USFWS, 2016d).

The biggest threat to this clover is loss of habitat through land development, including commercial and residential development and road construction (USFWS, 1997f).

Mead's Milkweed. Mead's milkweed *(Asclepias meadii)* is a tallgrass herb characterized by a single stem which grows up to 16 inches tall, and was listed as threatened in 1988 (53 FR 33992 33996, September 1, 1988). The species has hairless leaves, a white wax coating, and a singular cluster of flowers at the top (USFWS, 2005b). Regionally, the species' range extends from eastern Kansas to southern Illinois to southern Wisconsin. Mead's milkweed occurs in Illinois on virgin tallgrass prairie remnants in DuPage, Henry, Saline, Vermillion, and Will counties (USFWS, 2015j).

Habitat for the species includes "moderately wet to moderately dry upland tallgrass prairie or glade/barren habitat characterized by vegetation adapted for drought and fire," which include stable prairie habitats. Threats to the species include habitat loss from farming and commercial development, habitat fragmentation which reduce genetic diversity and pollinators, and hay mowing, which occurs in agricultural areas and can eliminate the early stages of the species' lifecycle (USFWS, 2005b).

Pitcher's Thistle. The Pitcher's thistle (*Cirsium pitcheri*) is an approximately 3 foot tall thistle which has many branches extending from one stem, with light pink flowers which develop from silvery leaf clusters after five to eight years of growth (USFWS, 2002b). The species was listed as threatened in 1988 (53 FR 27137 27141, July 18, 1988). Regionally, the Pitcher's thistle lines the coastlines of Lake Superior, Lake Michigan, and Lake Huron, from Michigan through Indiana and Illinois to Wisconsin. Within Illinois, the species sporadically lines the shoreline of Lake Michigan in Lake County (USFWS, 2015j).

Habitat for the Pitcher's thistle includes early successional beaches and active grassland dunes along freshwater shorelines, consisting of clumped populations, which can be separated by large gaps in between occurrences. Threats to the species include "shoreline development, dune stabilization, recreation, and invasive non-native plants and insects," along with erosion by high lake levels (USFWS, 2002b).

Prairie Bush-clover. The prairie bush-clover (*Lespedeza leptostachya*) is a perennial plant member of the pea family, with pinkish-cream flowers, clover-like leaves, and a silvery gloss which was listed as threatened in 1987 (52 FR 781 785, January 9, 1987) (USFWS, 2015ab). The species' range primarily extends from Iowa to the shore of Lake Michigan, reaching north to the twin cities and south to central Illinois. Within Illinois, the species is known or believed to occur in 9 counties statewide (USFWS, 2015j).

Habitat for the prairie bush-clover consists of tallgrass prairie regions, with moderately moist soils that are typically utilized for cropland, though the species has continued to thrive on slopes and rocky areas with similar soils. Threats include conversion of prairie tallgrass areas to cropland, "overgrazing, agricultural expansion, herbicide application, urban expansion, rock quarrying, and transportation right-of-way maintenance and rerouting; hybridization with the more common round-headed bush clover" (USFWS, 2015ab).

Price's Potato-bean. The Price's potato-bean *(Apios priceana)* is a perennial vine with leaves measuring 8 – 12 inches long, alternate, and composed of 5 to 9 leaflets 1.6-4 inches long The greenish-white or brownish pink flowers are tipped with magenta and measure 0.4 inches long, blooming from mid-July to mid-August (USFWS, 1993). The Price's potato-bean was listed as threatened in 1990 (55 FR 429 433, January 5, 1990). Its habitat is comprised of open, wooded areas, in forest gaps and in open, low areas near streams and rivers, and prefers lightly disturbed area (USFWS, 1993) (USFWS, 2015ac). In Illinois, this species is extirpated, but it has been known to exist in wet floodplain forests and shrubby swamps in the southwestern part of the state (USFWS, 2015ac) (USFWS, 2015j).

The narrow habitat requirements of this species mean that habitat succession and lack of regular, light disturbance threaten populations. Major threats to this species include cattle, which graze and trample the plant, timber harvesting, and herbicides, especially in rights-of-way where this species has been known to flourish (USFWS, 1993) (USFWS, 2015ac).

Small Whorled Pogonia. The small whorled pogonia was federally listed as endangered in 1982 (47 FR 39827 39831, September 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852 50857, October 6, 1994). The small whorled pogonia is a member of the orchid family which grows between 10 to 14 inches in height with greenish yellow flowers (USFWS, 2008b). It occurs in mixed-deciduous or mixed-deciduous/coniferous forest of varying successional stages (USFWS, 1992). Regionally, this species is known to occur in sparse distributions from Maine south to Georgia and eastern to Illinois, in 17 Eastern States (USFWS, 2008b). In Illinois, it exists in only Randolph County, in the southwestern part of the state (USFWS, 2015ad).

The small whorled pogonia occurs in hardwood stands that include beech, birch, maple, oak, hemlock, and hickory that have an open understory,[122] preferring acidic soils along small streams that have a thick layer of litter (USFWS, 2008b). One distinct feature of this species is that it can remain dormant underground for multiple years before reappearing (USFWS, 1992). Current threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2008b).

4.1.7 Land Use, Recreation, and Airspace

4.1.7.1 Definition of the Resource

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

Land Use and Recreation

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

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

[122] Understory – “The layer of forest located underneath the canopy. Here, smaller trees and shrubs grow, replacing older trees as they die” (USEPA, 2015d).

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

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

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

4.1.7.2 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 Illinois. 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. Table 4.1.7-1 identifies Illinois state statutes that address the safety of the airspace and flight safety in the state.

Table 4.1.7-1: Relevant Illinois Airspace Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State of Illinois Local Planning and Technical Assistance Act (20 Illinois Compiled Statutes 662)	Illinois Department of Commerce and Economic Opportunity (IDCEO)	Provides state-level guidance for land use planning.
Illinois Compiled Statutes, Airport Transportation, Chapter 620	IDOT	Address the safety of the airspace and flight safety at public airports and obstruction to airspace considerations.

Sources: (Illinois General Assembly, 2015d) (Illinois General Assembly, 2015e)

4.1.7.3 Land Use and Ownership

For the purposes of this analysis, land use in Illinois has been classified into primary land use groups based on coverage type as forest and woodlands, agricultural, and developed land. Land ownership within Illinois has been classified into four main categories: private, federal, state, and tribal.

Land Use

Table 4.1.7-2 identifies the major land uses by coverage type in Illinois. Agricultural land comprises the largest portion of land use with 67.4 percent of Illinois' total land area occupied by this category (Table 4.1.7-2 and Figure 4.1.7-1). Forest and woodland is the second largest area of land use with 15.1 percent of the total land area. Developed areas account for approximately 11.5 percent of the total land area. The remaining percentage of land includes surface water, public land, and other land covers, shown in Figure 4.1.7-1, that is not associated with specific land uses (USGS, 2011).

Table 4.1.7-2: Major Land Use in Illinois by Coverage Type

Land Use	Square Miles[a]	Percent of Land
Agricultural Land	39,042.5	67.4%
Forest and Woodland	8,732.3	15.1%
Developed Land	6,716.0	11.5%
Surface Water	2,698.9	4.7%
Public Land and other Land Covers	753	1.3%

Source: (USGS, 2011)

[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.

Forest and Woodland

Forest and woodland areas can be found throughout most of Illinois. However, forest and woodland areas are concentrated in western and southern Illinois. Most of the forestland is in the Shawnee National Forest in southern Illinois. Most forest and woodland areas throughout Illinois are privately owned (approximately 83 percent) (USFS, 2015a). Section 4.1.6.3, Vegetation, presents additional information about terrestrial vegetation.

State Forests

State Forests account for 33 square miles of state land and are managed by the Illinois Department of Natural Resources, Division of Forest Resources. The mission of the Illinois Division of Forest Resources is, “To protect, perpetuate, restore, conserve, and manage the forest and related resources of Illinois, both public and private, rural and urban; and to ensure for future generations the greatest economic, scientific, and social benefits that can only be provided through a forest ecological system” (Illinois Division of Forest Resources, 2014).

Private Forest and Woodland

Approximately 83 percent of Illinois' total forest and woodland, is owned collectively by nearly 206,000 families and individuals and 265,000 private groups. Most private owners hold less

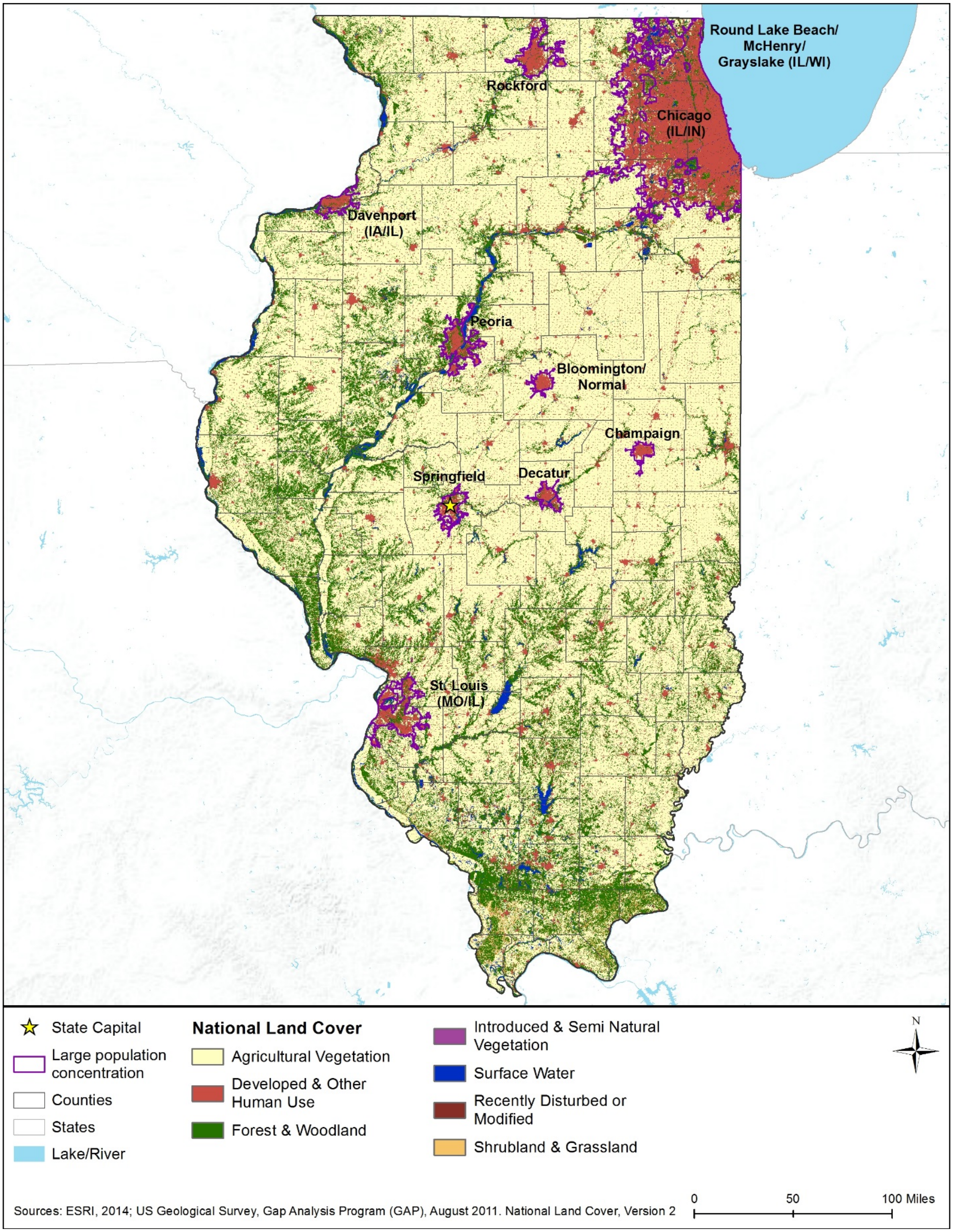


Figure 4.1.7-1: Major Land Use Distribution by Coverage Type

than 10 acres of forest and woodland. The primary objectives for owning forest are for aesthetics, forestland as part of a farm or residential site, and a family asset to pass to heirs. Owners have harvested timber on approximately 11 percent of privately owned forestland during 2000 to 2005 (USFS, 2009c). For additional information regarding forest and woodland areas, see Section 4.1.6.3, Vegetation, and Section 4.1.8, Visual Resources.

Agricultural Land

Agricultural land throughout the state, with the largest concentrations in central and east-central Illinois (Figure 4.1.7-1). Approximately 67.4 percent of Illinois' total land area is classified as agricultural land (approximately 39,042 square miles). In 2012, there were 75,087 farms in Illinois and 86 percent were owned and operated by families or individuals, with the average farm size of 359 acres (USDA, 2014b). Some of the state's largest agricultural uses include corn, soybean, dairy, hay, wheat, and hogs (USDA, 2014c). For more information by county, access the U.S. Department of Agriculture (USDA) Census of Agriculture website (http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Illinois/).

Developed Land

Developed land in Illinois tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 4.1.7-1). Although only 11.5 percent of Illinois land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 4.1.7-3 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 4.1.7-1 shows where these areas are located within the Developed land use category.

Table 4.1.7-3: Top Five Developed Metropolitan Areas (2014 estimate)

Metropolitan Area	Population Estimate
Chicago (IL/IN)	8,018,716
St. Louis (MO/IL)	372,895
Rockford	296,863
Peoria	266,921
Round Lake Beach/McHenry/Grayslake (IL/WI)	259,811
Total Estimated Population of Metropolitan Areas	**9,215,206**
Total State Estimated Population	**12,880,580**

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

Land Ownership

Land ownership within Illinois has been classified into four main categories: private, federal, state, and tribal (Figure 4.1.7-2).[123]

[123] 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.

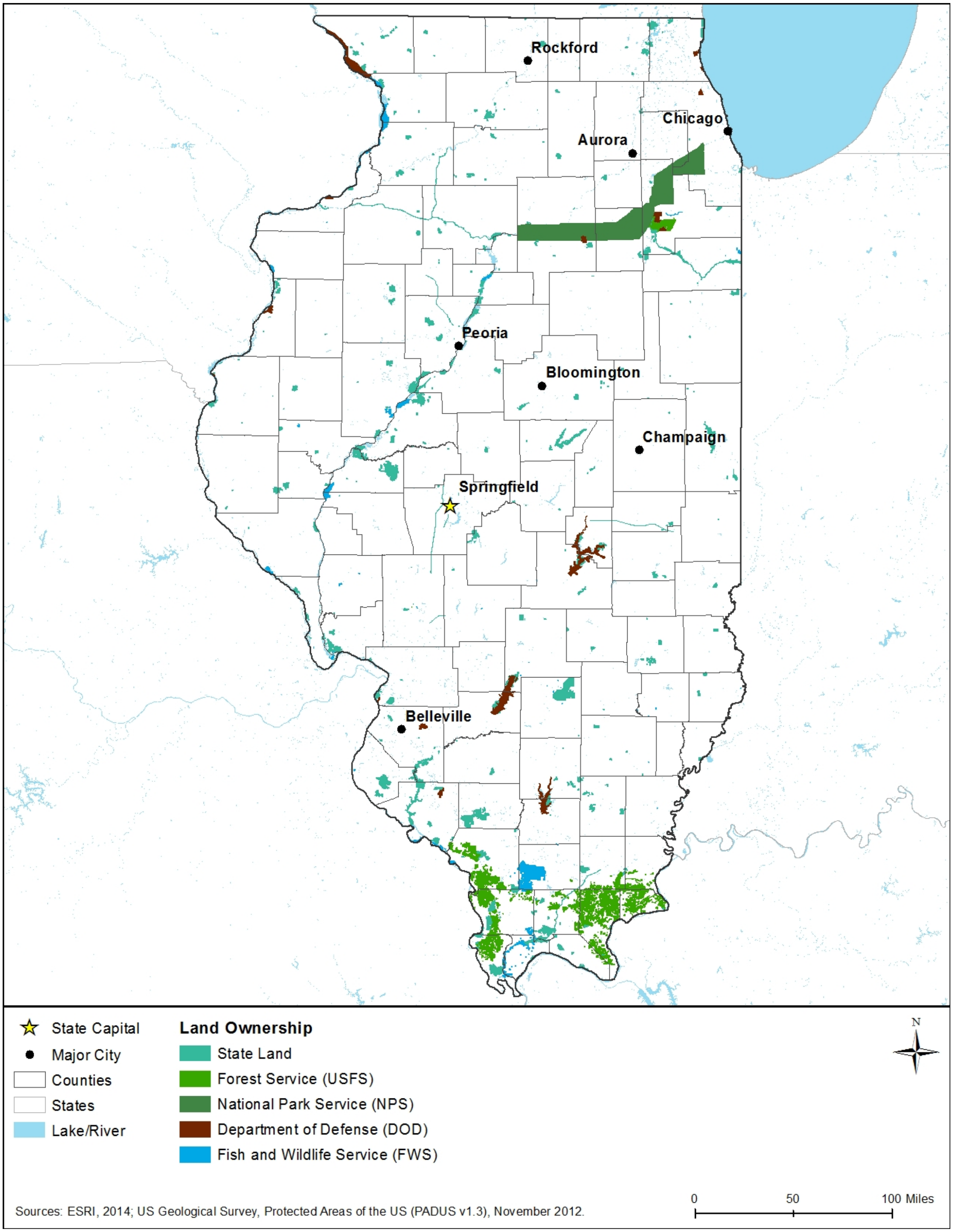


Figure 4.1.7-2: Land Ownership Distribution

Private Land

The majority of land in Illinois is privately owned and primarily falls within the agricultural land, developed land, and forest and woodland (Figure 4.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas. Private land exists in all regions of the state.[124]

Federal Land

The federal government manages 1,416 square miles (two percent) of Illinois land with a variety of land types and uses, including historic sites, military bases, and national forests (Figure 4.1.7-2) (USGS, 2012d), (USGS, 2014g). Four federal agencies manage the majority of federal lands throughout the state (Table 4.1.7-4 and Figure 4.1.7-2). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.

Table 4.1.7-4: Federal Land in Illinois

Agency	Square Miles	Representative Type
Department of Defense (DoD)	193	Military Bases, Fort, Arsenal
USFWS	162	Wilderness Areas
Forest Service	492	National Wildlife Refuges (NWRs), Wilderness Areas, National Forests
National Park Service (NPS)[a]	569	Pullman National Monument, Lincoln Home Historic Site
Total	**1,416**	

Sources: (USGS, 2012d) (USGS, 2014g)

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

- The DoD owns and manages 193 square miles used for military bases, forts, and an arsenal (DoD, 2014);
- The USFWS owns and manages 162 square miles consisting of 10 National Wildlife Refuges in Illinois, with 3 located within the Illinois River National Wildlife and Fish Refuges (USFWS, 2015c);
- The USDA Forest Service owns and manages 492 square miles set aside as the Midewin National Tallgrass Prairie and the Shawnee National Forest (USFS, 2015a); and
- The NPS manages 569 square miles consisting of a National Historic Site and a National Monument, as well as three affiliated areas. (NPS, 2014e) (USGS, 2012d) (USGS, 2014g)

State Land[125]

The Illinois state government owns approximately 740 square miles of land. This land is comprised of Fish and Wildlife Areas, State Parks, Conservation Areas, Natural Areas, and State Forests (Table 4.1.7-6).

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

[125] 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.

Table 4.1.7-5: State Land in Illinois

Agency	Square Miles[a]	Representative Type
Illinois Department of Natural Resources (IDNR)	158	Fish and Wildlife Areas
IDNR	200	State Parks
IDNR	117	Conservation Areas
IDNR	73	Natural Areas
IDNR	34	State Forests
IDNR	9	State Recreation Areas
IDNR	13	State Habitat Areas
IDNR	2	Other

Source: (IDNR, 2012) (USGS, 2012d) (USGS, 2014g)

[a] Acres are not additive due to overlapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management Areas.

- The IDNR manages 158 square miles consisting of 56 Fish and Wildlife Areas, which includes 3 fish facilities, 3 state wildlife areas, and 3 game propagation centers;
- The IDNR manages 200 square miles consisting of 65 State Parks;
- The IDNR manages 117 square miles consisting of 20 Conservation Areas;
- The IDNR manages 73 square miles consisting of 116 Natural Areas;
- The IDNR manages 34 square miles consisting of 7 State Forests;
- The IDNR manages 9 square miles consisting of 13 State Recreation Areas, which includes state boating access areas;
- The IDNR manages 13 square miles consisting of 38 State Habitat Areas; and
- The IDNR manages 12 square miles consisting of 1 memorial, 4 museums, and 18 other department properties. (IDNR, 2012) (USGS, 2012d) (USGS, 2014g)

Tribal Land

There are no tribal lands currently located in the state.

4.1.7.4 Recreation

Illinois is a diverse state, with major urban areas in the northeast, several industrial cities, university towns, and more than half the state developed for agriculture. Correspondingly, there are a wide range of natural and built environment recreation venues across the state. Large recreational sites, such parks and forests, are usually managed by federal, state, and local agencies. 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 Illinois. For information on visual resources, see Section 4.1.8, Visual Resources, and for information on the historical significance of locations, see Section 4.1.11, Cultural Resources.

Northwest Region

Illinois' Northwest Region is bordered on the west by the Mississippi River, and contains more rugged topography than the plains that typify the rest of the state (see Figure 4.1.7-3).[126]

The Mississippi River Project includes campgrounds along the upper Mississippi River shoreline in Illinois. The Thomson Causeway, Blanding Landing, and Fisherman's Corner are campgrounds on backwater of the Mississippi River, with recreation including swimming beaches, boating, fishing, and other water activities; hiking, bicycling, and other trail use; camping; and seasonal licensed hunting (Recreation.gov 2015).

The Johnson-Sauk Trail State Recreation Area is on the state's glacial moraine, with activities including: boating, fishing, and other water activities; hiking, cross-country skiing, and other trail use; camping, playgrounds, and picnicking; and seasonal licensed hunting (IDNR, 2015m). In the same general area, the Hennepin Canal State Trail is 155 miles from the Illinois River to the Rock River, with hiking, horseback riding, and snowmobiling; fishing, camping, and boating are also available (IDNR, 2016).

[126] 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.

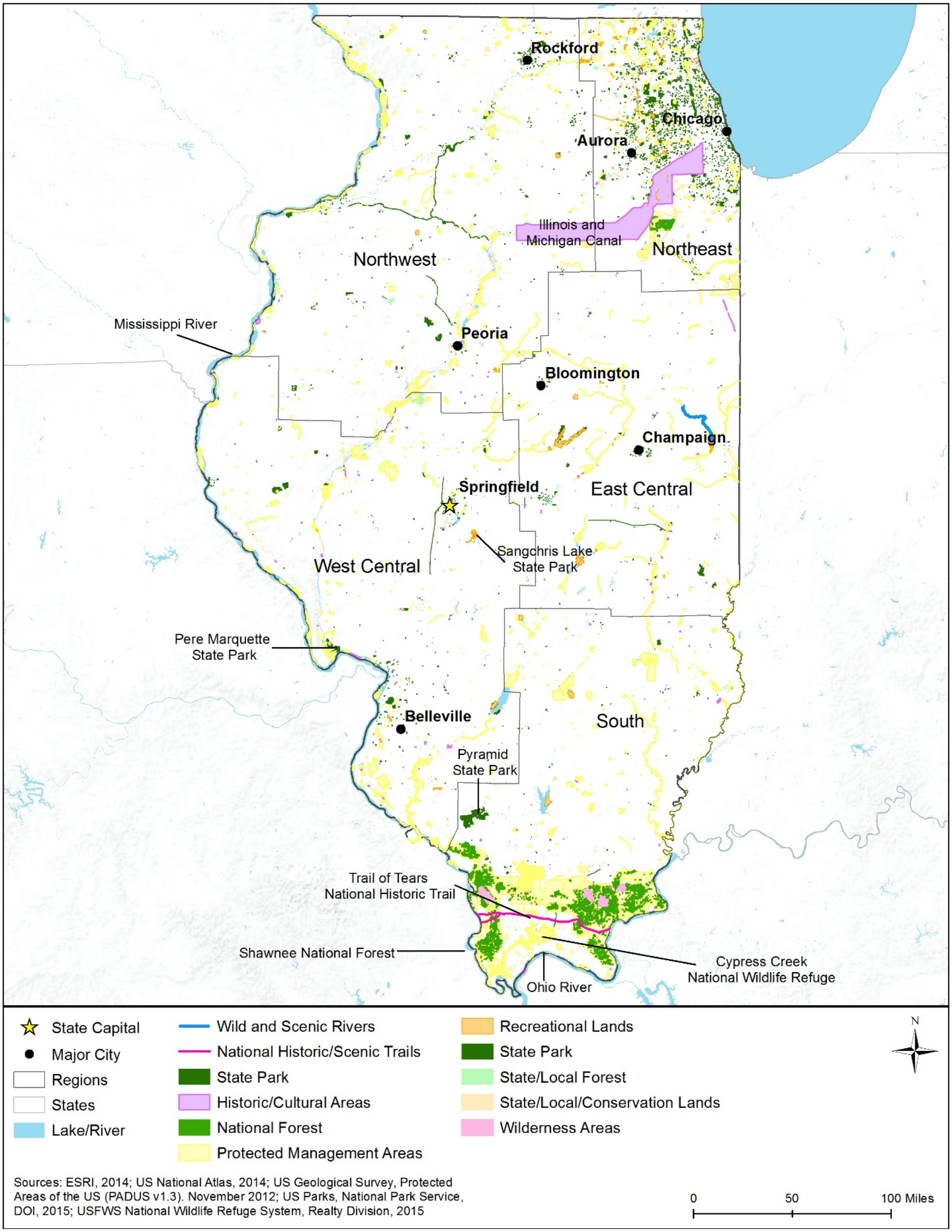


Figure 4.1.7-3: Illinois Recreation Resources

Northeast Region

The Northeast Region consists primarily of Chicago and its suburbs, with activities on Lake Michigan as well as parks with outdoor recreation (see Figure 4.1.7-3). Chicago is a popular destination with recreational venues including Millennium Park, Hyde Park, and the Navy Pier, as well as museums including the Field Museum and the Adler Planetarium (Illinois Office of Tourism, 2015).

The Illinois Beach State Park on Lake Michigan is the only beach ridge shoreline in Illinois, and North Point Marina is the Great Lakes' largest marina. The William W. Powers State Recreation Area is on Wolf Lake on Chicago's southeast side. The parks have swimming beaches, boating, fishing, self-contained underwater breathing apparatus (SCUBA) diving, and other water activities; hiking, bicycling, metal detecting, and other trail use; camping; and seasonal licensed hunting. (IDNR, 2015n) (IDNR, 2015o) (IDNR, 2015p)

West Central Region

The West Central Region is comprised mainly of prairie and the Mississippi River Valley, and is bordered to the west by the Mississippi River (see Figure 4.1.7-3). This region is known for recreational opportunities near to the Mississippi River and locations significant due to affiliation with President Abraham Lincoln's life.

The Pere Marquette State Park is popular for birdwatching; it is the overwintering area for hundreds of bald eagles. The Mississippi River State Fish and Wildlife Area is known for operating four ferries and boating opportunities along over 40 miles of the Mississippi and Illinois Rivers. Recreational opportunities in West Central Region state parks include: hiking, bicycling, horseback riding, rock climbing, geocaching, and other trail use; camping and picnicking; boating, fishing, and other water activities; and licensed, seasonal hunting. (IDNR, 2015q) (IDNR, 2015r)

The Lincoln Home National Historic Site in Springfield and the surrounding neighborhood are popular visitor locations, tours are available. Also associated with President Lincoln are the New Salem State Historic Site, the Abraham Lincoln Presidential Museum and Library, and the Lincoln Tomb at the Oak Ridge Cemetery. (NPS, 2016a)

East Central Region

Illinois' East Central Region, part of the Interior Plains, is comprised mainly of rolling prairies, marshes, and mesic forests (see Figure 4.1.7-3). Common activities in this region include hunting, hiking, and river and lake recreation.

The Iroquois County State Wildlife Area is known for deer and upland game hunting; hiking and snowmobiling are also popular (IDNR, 2015s). Spitler Woods, a State Natural Area, has camping, hiking, and other day use activities (IDNR, 2015t). The Shelbyville State Fish and Wildlife Area is known for activities on Lake Shelbyville: fishing, boating, and swimming at the lake beaches (Shelby County Tourism 2015) (IDNR, 2015d).

South Region

The South Region is known for hiking trails, quaint towns, and the Ozark Hills. It is bordered to the west by the Mississippi River, the Ohio River to the south and east, and the Wabash River to the east (see Figure 4.1.7-3).

The Shawnee National Forest includes several well-known hiking areas, including the Garden of the Gods, the Pomona Natural Bridge, the Little Grand Canyon, and the Giant City State Park. Recreational opportunities include: hiking, bicycling, horseback riding, rock climbing, geocaching, and other trail use; camping and picnicking; lake and pond fishing, non-motorized boating, swimming, and other water activities; and licensed, seasonal hunting of big game and small game. (USFS, 2015b) (IDNR, 2015u)

The Trail of Tears National Historic Trail passes to the south of the Trail of Tears State Forest, which contains trails for hiking, horseback riding, and one designed for cross-country running. Recreational opportunities include camping, picnicking, and licensed, seasonal deer and small game hunting. (IDNR, 2015v)

4.1.7.5 Airspace

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

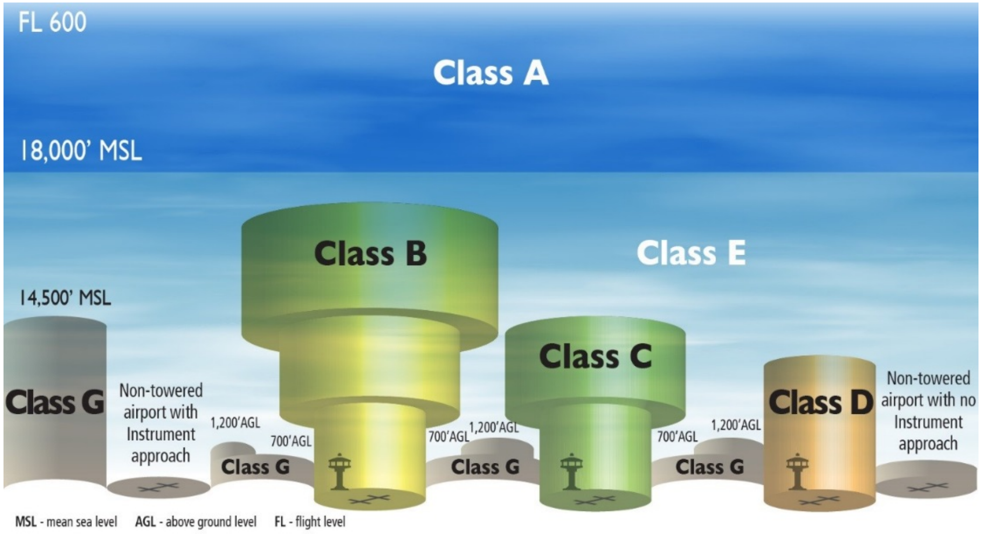
Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 4.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[127] service is based on the airspace classification (FAA, 2008).

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



Source: Derived from (FAA, 2008)

Figure 4.1.7-4: National Air Space Classification Profile

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[128]. Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[129]
- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **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).

[128] 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)
[129] IFR – Rules for the conduct of flights under instrument meteorological conditions. (FAA, 2015c)

Uncontrolled Airspace

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

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 4.1.7-6).

Table 4.1.7-6: 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 a Memorandum of Agreement (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, 2015c) (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 4.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 4.1.7-7: 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; and • 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 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, 2015c) (FAA, 2008)

Aerial System Considerations

Unmanned Aerial Systems

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

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

Balloons

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

4.1.7.6 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. aboveground 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, 2015d).

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.

Illinois Airspace

The Illinois Division of Aeronautics (AERO) is under the jurisdiction of the IDOT. Their stated mission is "to regulate and supervise all aeronautical activity within the state. The division provides safe, efficient, and reliable air transportation for Constitutional Officers, IDOT employees, and other agencies of state government. The Division of Aeronautics is responsible for coordinating and implementing programs concerning air safety, airport construction, and other aeronautical related areas in Illinois. The primary role of the division is to provide modal integrity to air transportation missions, objectives and activities within IDOT. (IDOT, 2015e)" There are four bureaus within the AERO (Administrative Services, Air Operations, Airport Engineering, and Aviation Safety) that work together in the development of the aviation transportation system and to assure aviation safety. There are three FAA Flight Standards District Offices (FSDOs) for Illinois in Des Plaines (Chicago O'Hare), Springfield, and West Chicago (West Chicago-DuPage) (FAA, 2015b).

Illinois 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) Figure 4.1.7-5 presents the different aviation airports/facilities residing in Illinois, while Figure 4.1.6-6 and Figure 4.1.6-7 present the breakout by public and private airports/facilities. There are approximately 737 airports within Illinois as presented in Table 4.1.6-8, and Figures 4.1.6-6 and 4.1.6-7 (USDOT, 2015).

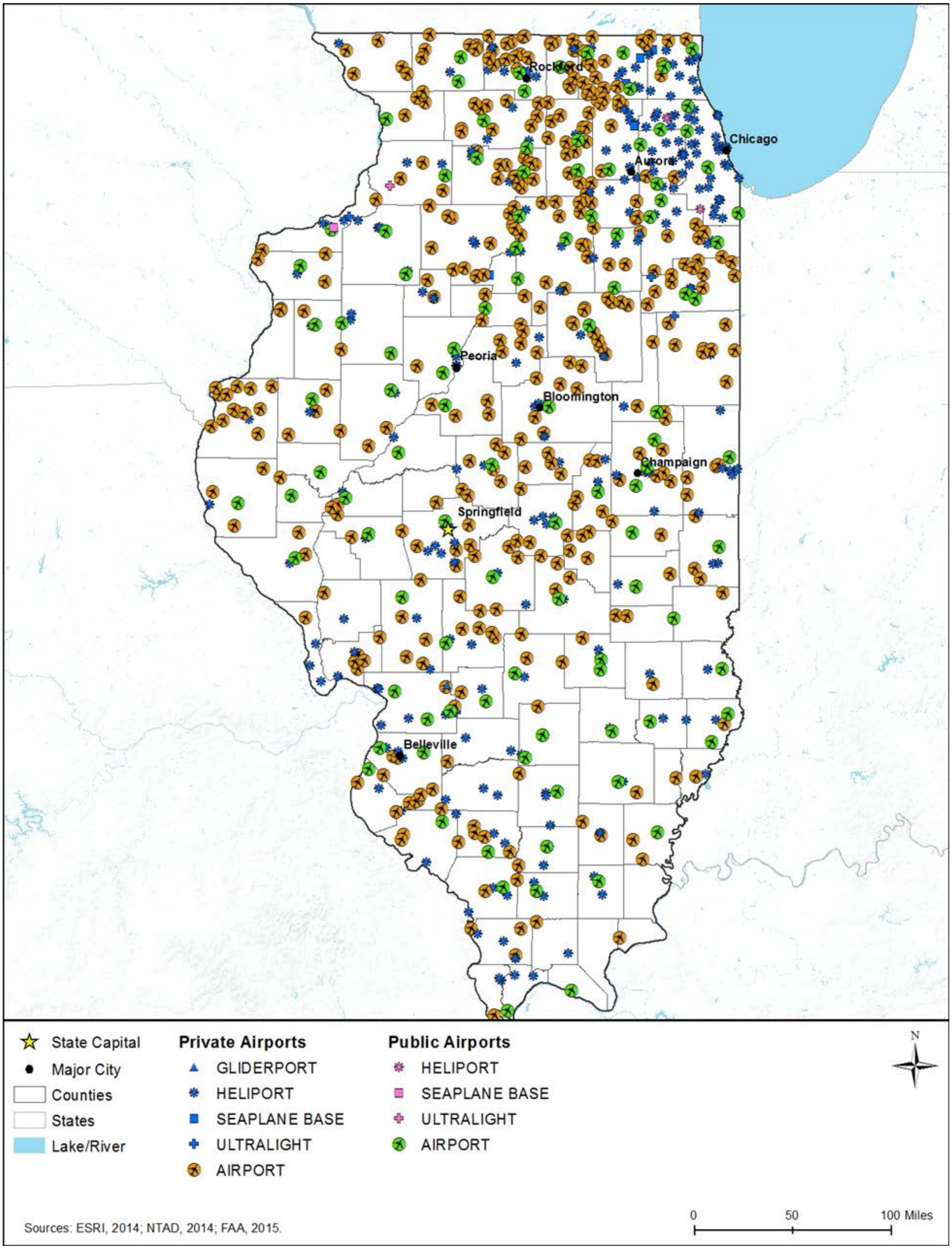


Figure 4.1.7-5: Composite of Illinois Airports/Facilities

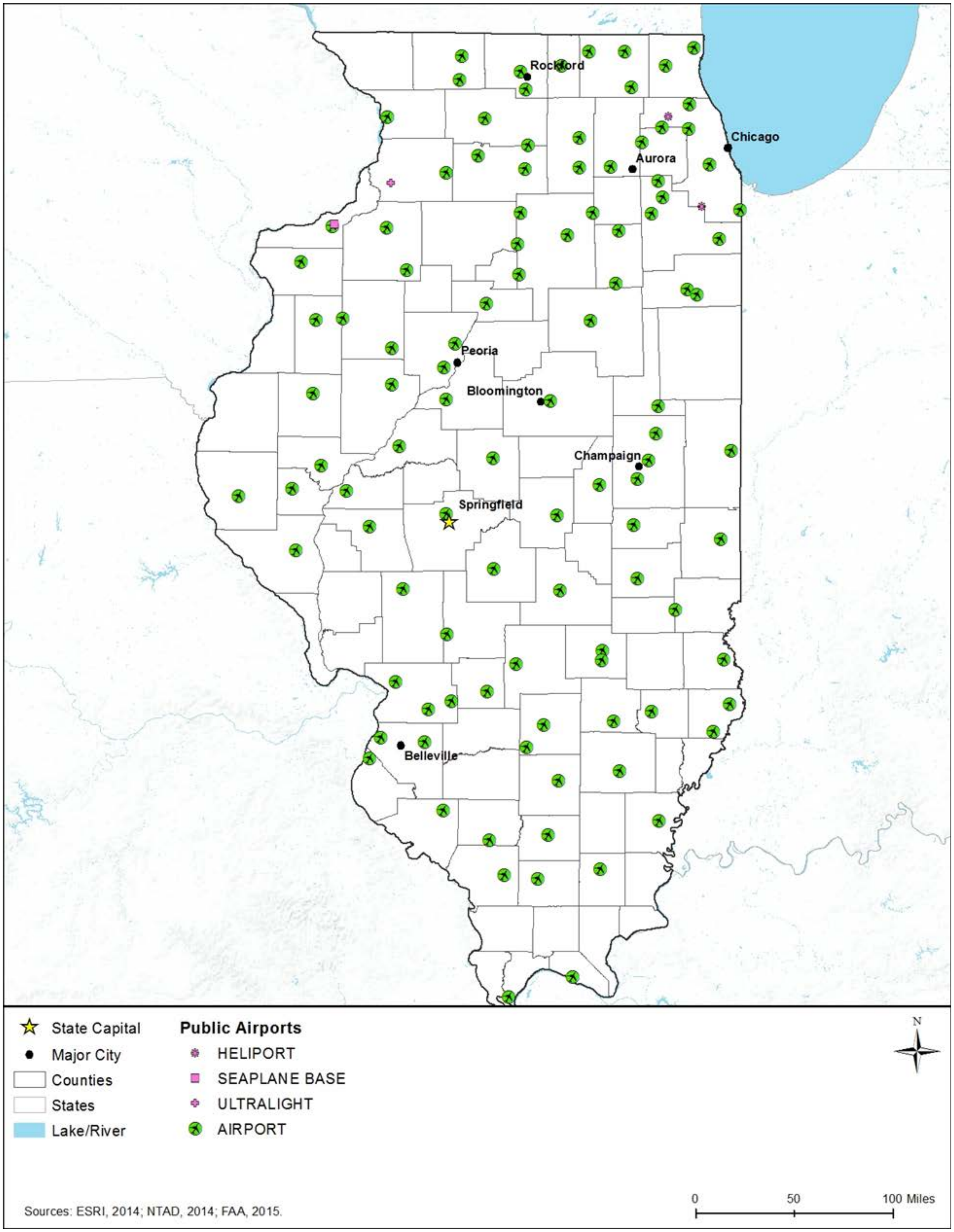


Figure 4.1.7-6: Public Illinois Airports/Facilities

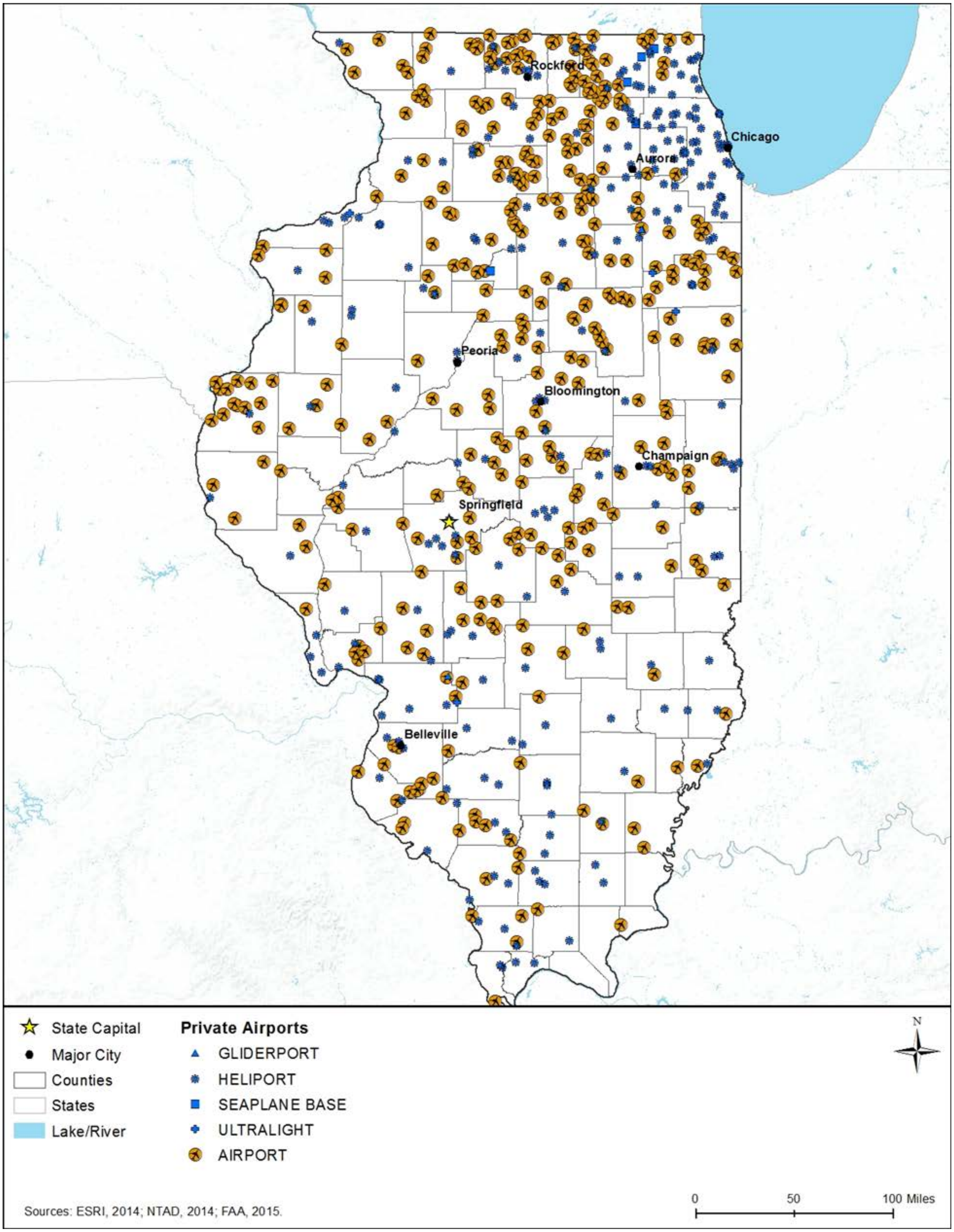


Figure 4.1.7-7: Private Illinois Airports/Facilities

Table 4.1.7-8: Type and Number of Illinois Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	105	370
Heliport	2	247
Seaplane	1	5
Ultralight	1	4
Balloonport	0	0
Gliderport	0	2
Total	**109**	**628**

Source: (USDOT, 2015)

There are Class B, C, and D controlled airports for Illinois as follows:

- One Class B –
  - Chicago O'Hare International
- Five Class C –
  - Champaign-Urbana, University of Illinois-Willard
  - Chicago Midway
  - Moline, Quad City
  - Greater Peoria Regional
  - Springfield Capital
- Twelve Class D –
  - St. Louis Regional - Alton
  - Scott Air Force Base/Mid-America Airport - Belleville
  - Bloomington/Normal Airport - Bloomington
  - St. Louis Downtown-Parks Airport - Cahokia
  - Carbondale-Murphysboro, Southern Illinois Airport - Carbondale
  - Aurora Municipal Airport - Chicago
  - DuPage Airport - Chicago
  - Waukegan Regional Airport - Chicago, IL
  - Decatur Airport - Decatur, IL
  - Williamson County Regional - Marion
  - Greater Rockford Airport - Rockford
  - Chicago Executive Airport - Wheeling (FAA, 2012c)

SUAs (i.e., four MOAs) located in Illinois are as follows:

- Howard –
  - East – 9,000 feet MSL to, but not including, FL 180
  - West – 10,000 feet MSL to, but not including, FL 180

- Pruitt –
    - A – 500 feet Above Ground Level (AGL) to 6,000 feet MSL; The airspace 1,500 feet AGL and below within a three NM radius of the following airports is excluded from the MOA: Greater Beardstown, Pittsfield Penstone, and Schoy-Rush
    - B – 500 feet AGL to 3,000 feet MSL (FAA, 2015e)

The Red Hills MOA (6,000 feet MSL to, but not including, FL 180) of Indiana extends into the southeast portion of Illinois. The SUAs for Illinois are presented in Figure 4.1.7-8. There are no TFRs (See Figure 4.1.7-8) (FAA, 2015f). MTRs in Illinois, presented in Figure 4.1.7-9, consist of six Visual Routes, two Instrument Routes, and two Slow Routes.

UAS Considerations

NPS signed a policy memorandum on June 19, 2014 that "directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the [NPS]" (NPS, 2014d). There are two NPS units within the state of Illinois required to comply with this agency directive, including the Lincoln Home and the Pullman National Monument (NPS, 2014e).

Obstructions to Airspace Considerations

Several references in Illinois statues address airspace hazards. As defined in the Airport Zoning Act of the Illinois Compiled Statutes (ILCS), 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 an airport or is otherwise hazardous to such landing or taking‑off of aircraft" (Illinois General Assembly, 2015d). Illinois Statutes, Zoning to Eliminate Airport Hazards Act, regulate structures, as it obtains to potential impacts to navigable airspace. This act is to assure unobstructed conditions for safe flight within the air traffic pattern of a public airport (Illinois General Assembly, 2015d).

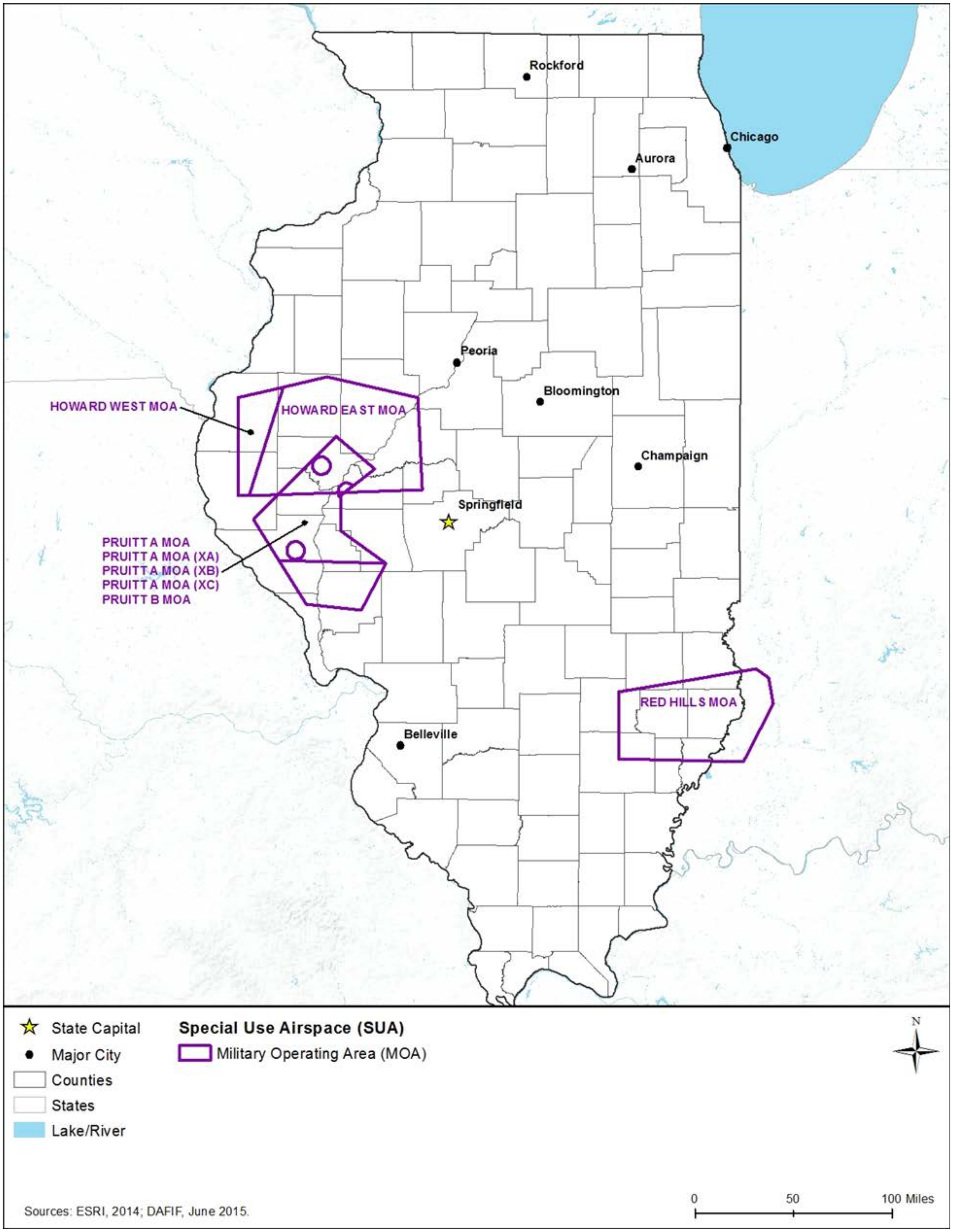


Figure 4.1.7-8: SUAs in Illinois

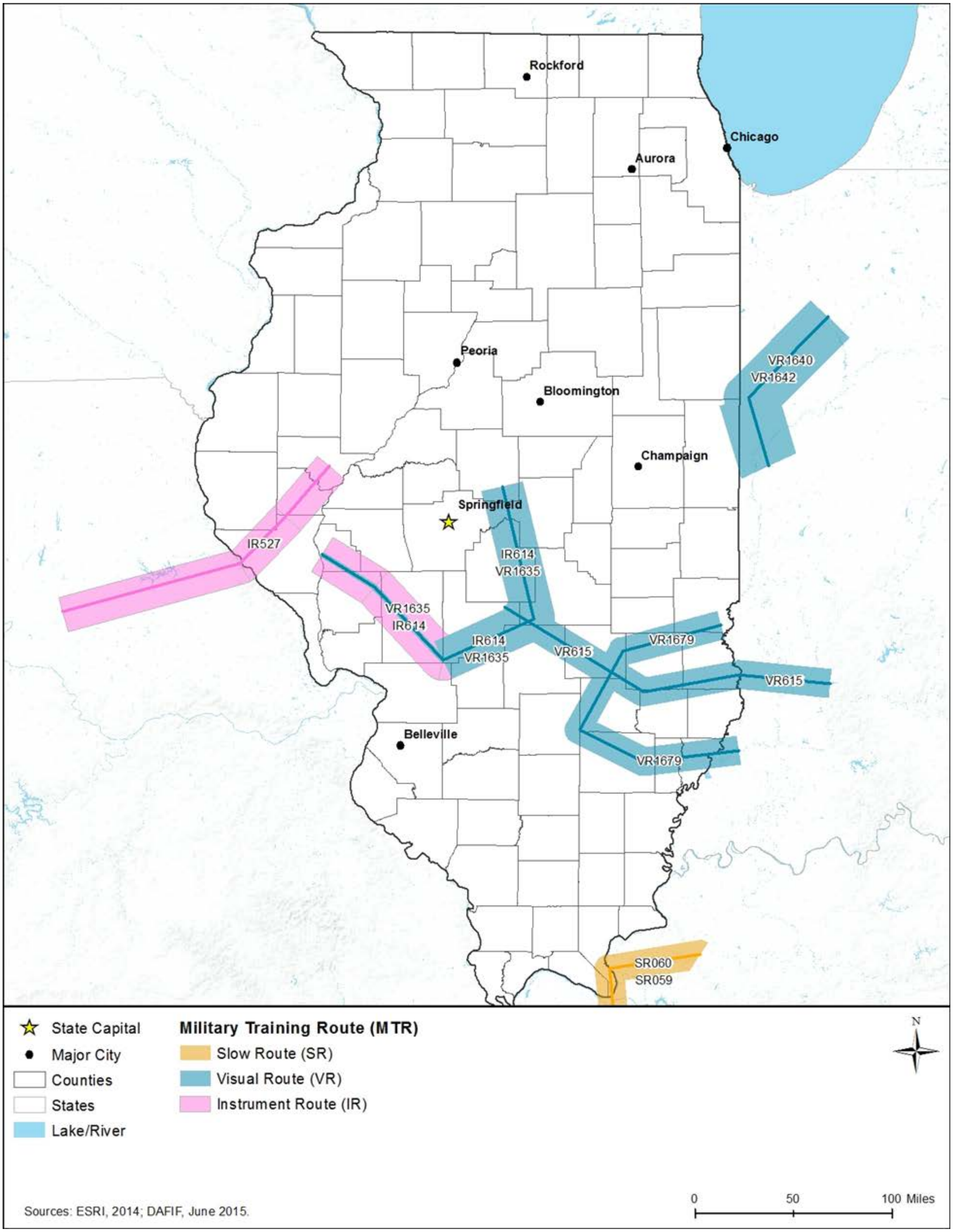


Figure 4.1.7-9: MTRs in Illinois

4.1.8 Visual Resources

4.1.8.1 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, lake views, unique geological formations, rivers, and constructed landmarks such as bridges, memorials, cultural resources, or statues are considered visual resources. For some, cityscapes are valued visual resources; for others, views of natural areas are valued visual resources. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and National Historic Preservation Act 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)

4.1.8.2 Specific Regulatory Considerations

Table 4.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 4.1.8-1: Relevant Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Description
(526 ILCS 30) Illinois Natural Areas Preservation Act	Illinois Department of Natural Resources (IDNR)	Establishes program of natural areas preserves stating they "are of value for scientific research, for teaching, as reservoirs of natural materials not all of the potential uses of which are now known, as habitats for rare and vanishing species, as places of historic and natural interest and scenic beauty and as living museums of the native landscape wherein one may envision and experience primeval conditions in a wilderness-like environment."

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

4.1.8.3 Character and Visual Quality of the Existing Landscape

From the Chicago skyline to prairie land and forested areas, Illinois has a wide range of visual resources. Northern Illinois is dominated by the Chicago metropolitan area, a densely populated city and suburban landscape comprised of high rise buildings, major industrial areas, apartment houses, and single family homes. The area also contains a number of local parks and semi-natural areas. The Mississippi River cuts through this metropolis, separating Illinois from Iowa, with both sides of the river containing developed landscapes. Central Illinois is mostly flat prairie landscapes, with the exception of areas along the Illinois and Mississippi Rivers. The area is characterized by small towns and cities with agricultural landscapes. The landscape of Southern Illinois contains warmer climate vegetation and agricultural crops. The area tends to be more rugged, including the Shawnee Hills. (USGS 2012) (USGS 2011)

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.

4.1.8.4 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 4.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Illinois, there are 1,819 NRHP listed sites, which include 2 National Heritage Areas and 88 National Historic Landmarks.

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, 2011). These areas help tell the history of the United States. Based on this criteria, NHAs in Illinois may contain scenic or aesthetic areas considered visual resources or visually sensitive. There are two NHAs in Illinois: the Abraham Lincoln NHA and the Illinois and Michigan Canal National Heritage Corridor (Figure 4.1.8-1) (IDNR, 2015ab).

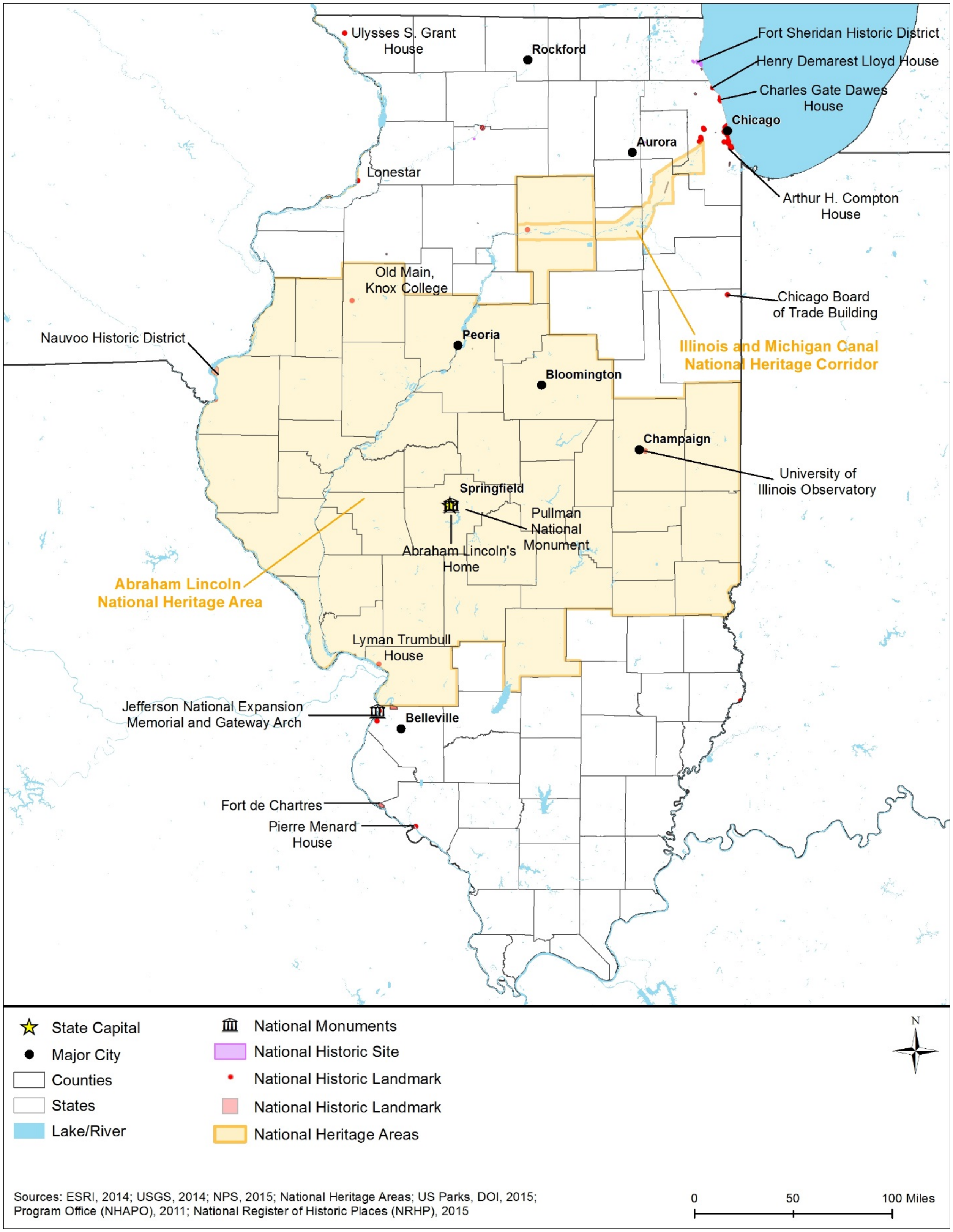


Figure 4.1.8-1: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive

National Historic Landmarks

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). Figure 4.1.8-1 displays the locations of NHLs within Illinois. NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016c). 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 Illinois, there are 89 NHLs, including sites such as the Lyman Trumbull House, Fort de Chartres, and the Pierre Menard House (Figure 4.1.8-1) (NPS, 2015d). By comparison, there are over 2,500 NHLs in the United States (NPS, 2015h). Figure 4.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

State Historic Sites

Covering over 2,000 years of history, the Illinois Historic Sites Division manages 56 historic sites and memorials throughout the state. Examples of state historic sites include the Lincoln Monument, Old State Capitol, and the Wild Bill Hickok Memorial. For additional information regarding these properties and resources, see Section 4.1.11, Cultural Resources. In addition, the Illinois State Historic Preservation Office (SHPO) maintains an online property database at http://www.illinois.gov/ihpa/Experience/Sites/Pages/Default.aspx.

4.1.8.5 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 4.1.7-3 in Section 4.1.7, Land Use, Recreation, and Airspace, identifies parks and recreational resources that may be visually sensitive in Illinois. For additional information about recreation areas, including national and state parks, see Section 4.1.7, Land Use, Recreation, and Airspace.

State Parks and Forests

State parks contain natural, historic, cultural, and/or recreational resources of significance to Illinois residents and visitors. There are 65 state parks and 7 state forests throughout Illinois (Figure 4.1.8-5) most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (IDNR, 2015w).

Table 4.1.8-2 presents a sampling of state parks and their associated visual attributes. Figure 4.1.8-2 shows the water view of Sangchris Lake State Park. For a complete list of state parks and forests, visit the Illinois Department of Natural Resources website (http://www.dnr.illinois.gov/Parks/Pages/AllParks.aspx) (IDNR, 2015w).

Table 4.1.8-2: Examples of Illinois State Parks and Associated Visual Attributes

State Park	Visual Attributes
Beall Woods	River, forest, and woodland views
Sangchris Lake	Lake, forest, and woodland views
Wolf Creek	Lake, forest, and woodland views
Apple River Canyon	River, canyon, forest, and woodland views; deep ravines; limestone bluffs
Moraine Hills	Wetland, lake, forest, woodland views

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

Figure 4.1.8-2: Sangchris Lake State Park

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

National Park Service

National Parks are managed by NPS and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Illinois, there are two NPS areas and five affiliated areas, such as National Historic Trails and National Heritage Areas. The two NPS areas in Illinois are Pullman National Monument and Lincoln Home National Historic Site (Figure 4.1.8-3). Figure 4.1.8-5 identifies the NPS areas and affiliated areas located in Illinois. For additional information regarding parks and recreation areas, see Section 4.1.7, Land Use, Recreation, and Airspace.

Figure 4.1.8-3: Lincoln Home National Historic Site

Source: (NPS, 2016a)

National Forests

National Forests, owned and managed by the U.S. Department of Agriculture (USDA) Forest Service, may contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Illinois, there are two National Forests: Midewin National Tallgrass Prairie and Shawnee National Forest (USFS, 2015a) (USDA, 2016).

Federal and State Trails

There are three National Historic Trails (Lewis & Clark, Mormon Pioneer, and Trail of Tears) in Illinois that may contain visual resources (NPS, 2014f). State-designated trails include hiking, backpacking, and cycling trails. These trails contain visual resources such as historic views, forest and woodland views, and scenic vistas of valleys and gorges. There are over 270 state designated hiking trails covering more than 700 miles in Illinois. There are also a number of biking and cycling trails within state parks and recreational areas (IDNR, 2015y).

The National Trails System Act authorized the designation of National Recreational Trails near urban areas (American Trails 2015). There are over 1,100 National Recreation Trails across the nation administered by the U.S. Forest Service, U.S. Army Corps of Engineers, USFWS, local or state governments, and non-profit organizations (National Recreation Trails, 2015).

4.1.8.6 Natural Areas

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

National Wilderness Areas

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

Illinois is home to eight federally managed National Wilderness Areas (Figure 4.1.8-5) (Wilderness.net, 2016):

- Bald Knob;
- Bay Creek;
- Burden Falls;
- Clear Springs;
- Crab Orchard;
- Garden of the Gods;
- Lusk Creek; and
- Panther Den.

Rivers Designated as National or State Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. A portion of only one river, the Vermillion River, has been designated a National Wild and Scenic River in Illinois (Figure 4.1.8-4 and Figure 4.1.8-5) (National Wild and Scenic Rivers System, 2015).

Figure 4.1.8-4: Vermillion River Wild and Scenic River

Source: (National Wild and Scenic Rivers System, 2015)

National Wildlife Refuges (NWR) and State Wildlife Management Areas

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, 2015ae). There are 9 NWRs in Illinois (Figure 4.1.8-5):[130]

- Chautauqua NWR;
- Crab Orchard NWR;
- Cypress Creek NWR;
- Hackmatack NWR;
- Emiquon NWR;
- Meredosia NWR;
- Middle Mississippi River NWR;
- Two Rivers NWR; and
- Upper Mississippi National Wildlife and Fish Refuge.

Visual resources within these NWRs include views and sites of creeks, rivers, wildlife, and naturally vegetated areas. Additionally, the IDNR's Division of Parks and Recreation owns and manages 56 State Fish and Wildlife Areas (IDNR, 2012) (IDPR, 2015).

[130] 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.

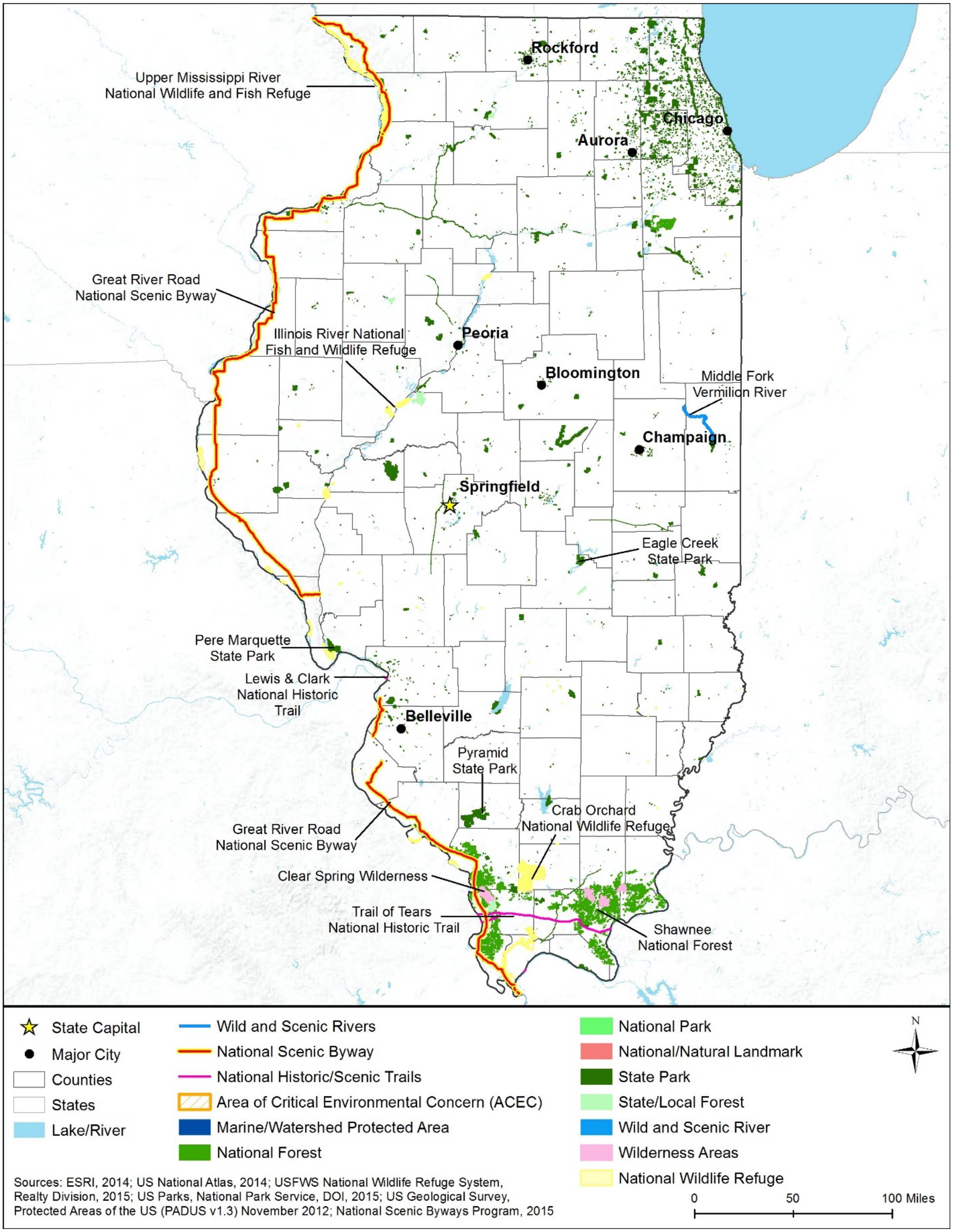


Figure 4.1.8-5: Natural Areas that May be Visually Sensitive

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014g). These landmarks may be considered visual resources or visually sensitive. In Illinois, 18 NNLs exist entirely or partially within the state (Table 4.1.8-3). Some of the natural features located within these areas include "large river and small stream valley ecosystems, diverse glacial landforms, and remnants of forest and prairie communities that once dominated the Illinois landscape" (NPS, 2012a). For example, Little Grand Canyon Area contains scenic sandstone outcrops, ravine slope forest, and hill prairies (Figure 4.1.8-6).

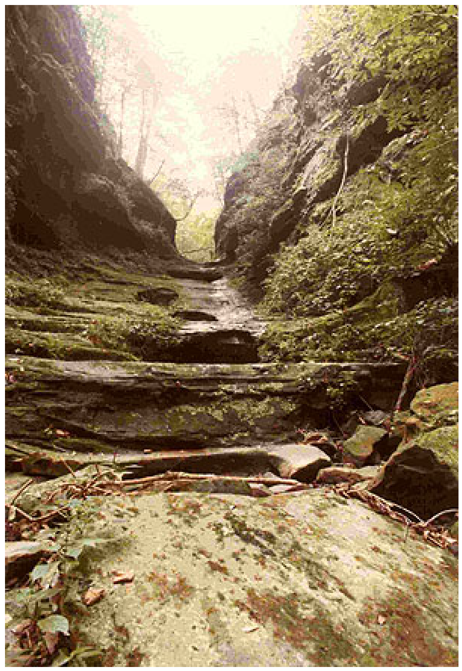


Figure 4.1.8-6: Little Grand Canyon Area

Source: (NPS, 2012b)

Table 4.1.8-3: Illinois National Natural Landmarks

NNL Name	
Illinois Beach Nature Preserve	Volo Bog Nature Preserve
Mississippi Palisades	Wauconda Bog Nature Preserve
Busse Forest Nature Preserve	Markham Prairie
Funks Grove	Allerton Natural Area
Forest of the Wabash	Fults Hill Prairie Nature Preserve
Giant City Geological Area	Bell Smith Springs
Little Grand Canyon Area	LaRue-Pine Hills Ecological Area
Lower Cache River Swamp	Horseshoe Lake Nature Preserve
Lusk Creek Canyon	Heron Pond-Little Black Slough Natural Area

Source: (NPS, 2012a)

4.1.8.7 Additional Areas

National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA) (FHWA, 2015c). Illinois has seven designated National Scenic Byways (Figure 4.1.8-5):

- Great River Road: 2,069 miles through Arkansas, Illinois, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Tennessee, and Wisconsin, along the length of the Mississippi River. "Through its charming river towns and metropolitan cities, historic sites and cultural artifacts, today's Great River Road still links resources, people, and history" (FHWA, 2015d).
- Historic National Road: 824.2 miles through Illinois, Indiana, Maryland, Ohio, Pennsylvania, and West Virginia. "The Historic National Road was the nation's first federal funded interstate highway. Today, visitors experience a physical timeline, including classic inns, tollhouses, diners, and motels that trace 200 years of American history" (FHWA, 2015e).
- Historic Route 66: 2,451 miles beginning in Chicago, Illinois through Missouri, Kansas, Oklahoma, Texas, New Mexico, and Arizona before ending in Santa Monica, California.
- Illinois River Road: 291 miles in north-central Illinois along the Illinois River. "The Illinois River Valley imparts feelings of awe at the power of the river winding its way through a land form carved by glacial melt water" (FHWA, 2015f).
- Lincoln Highway: 178.8 miles through northern Illinois. "Travel through urban cityscapes, cozy riverfront towns, and rolling prairie on Illinois' 179-mile portion of the Lincoln Highway" (FHWA, 2015g).
- Meeting of the Great Rivers Scenic Route: 33 miles in western Illinois, along the Missouri border. "Here, the Missouri, Mississippi, and Illinois Rivers meet to form a 35,000-acre floodplain. Historic 18th-century river towns, islands, bars, points, and bends create beautiful scenery beneath limestone bluffs that are covered by forests extending over nearly 20,000 acres" (FHWA, 2015h).
- Ohio River Scenic Byway: 943 miles through Illinois, Indiana, and Ohio. "This history-rich byway meanders along the banks of the Ohio River, hugging its shoreline and offering almost continuous views of the river" (FHWA, 2015i).

Historic National Road is also a designated All-American Road as it is considered a "destination unto itself" and provides an "exceptional traveling experience" for travelers (FHWA, 2002).

4.1.9 Socioeconomics

4.1.9.1 Definition of the Resource

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

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes. 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 (see Section 1.8, Overview of Relevant Federal Laws and Executive Orders). This PEIS addresses environmental justice in a separate section (Section 4.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 4.1.7, Land Use, Recreation, and Airspace), infrastructure (Section 4.1.1, Infrastructure), and aesthetic considerations (Section 4.1.8, Visual Resources).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau[131] and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of

[131] 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

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 U.S Census Bureau's American Community Survey (ACS). The ACS is the U.S. Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which are 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.

4.1.9.2 Specific Regulatory Considerations

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

4.1.9.3 Communities and Populations

This section discusses the population and major communities of Illinois and includes the following topics:

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

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.

Statewide Population and Population Growth

Table 4.1.9-1 presents the 2014 estimated population and population density of Illinois in comparison to the Central region[132] and the nation. The estimated population of Illinois in 2014 was 12,880,580. The population density was 232 persons per square mile (sq. mi.), which is considerably higher than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Illinois was the fifth largest state by estimated population among the 50 states and the District of Columbia, 24th by land area, and had the thirteenth greatest population density (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f).

Table 4.1.9-1: Land Area, Estimated Population, and Population Density of Illinois

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Illinois	55,519	12,880,580	232
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

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

Estimated population growth is an important subject for this PEIS, given FirstNet's mission. Table 4.1.9-2 presents the population growth trends of Illinois from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth rate decreased in the 2010 to 2014 period compared to 2000 to 2010, from 0.33 percent to 0.10 percent. The growth rate of Illinois in the latter period was lower than the rate of the region, at 0.45 percent, and the nation, at 0.81 percent.

Table 4.1.9-2: Recent Population Growth of Illinois

Geography	Estimated Population			Numerical Estimated Population Change		Rate of Estimated Population Change (AARC)[a]	
	2000	2010	2014	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
Illinois	12,419,293	12,830,632	12,880,580	411,339	49,948	0.33%	0.10%
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, 2015g; U.S. Census Bureau, 2015e)

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

[132] The Central region is comprised of the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Illinois, 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.

future. The U.S. Census Bureau does not prepare population projections for the states. Therefore, Table 4.1.9-3 presents estimated 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 Proximity One, a private sector demographic and economic data and analysis service (ProximityOne, 2015) (UVA 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 Illinois's estimated population will increase by approximately 1,228,733 people, or 9.5 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.57 percent, which is higher than the historical growth rate from 2010 to 2014 of 0.10 percent. The projected growth rate of the state is similar to that of the region (0.60 percent) and less than the projected growth rate of the nation (0.80 percent).

Table 4.1.9-3: Projected Estimated Population Growth of Illinois

Geography	Estimated Population 2014	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
Illinois	12,880,580	13,669,506	14,549,119	14,109,313	1,228,733	9.5%	0.57%
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, 2015e; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)

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

Population Distribution and Communities

Figure 4.1.9-1 presents the distribution and relative density of the estimated population of Illinois. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015h).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the U.S. Census Bureau based on the 2010 census (U.S. Census Bureau, 2015z; U.S. Census Bureau, 2015d). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. Figure 4.1.9-1 shows that Chicago is the state's most densely populated area.

Additional areas representing the state's top 10 population concentrations are distributed through the state, as are many smaller population concentrations.

Table 4.1.9-4 provides the populations of the 10 largest population concentrations in Illinois, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[133] In 2010, the largest population concentration by far was the Illinois portion of the Chicago area, which had over 8 million people. The state had no other population concentrations over 1 million; the next largest population concentration was the Illinois portion of the St. Louis area, with 372,895 people. The smallest of these 10 population concentrations was the Decatur area, with a 2010 population of 93,863. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Round Lake Beach/McHenry/Grayslake area (Illinois portion), with an annual growth rate of 2.30 percent. Two of these population concentrations (the Decatur area and the Davenport area, Illinois portion) experienced population declines during this period.

Table 4.1.9-4 also shows that the top 10 population concentrations in Illinois accounted for 77.0 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 103.0 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.

[133] U.S. 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, U.S. Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the U.S. 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.

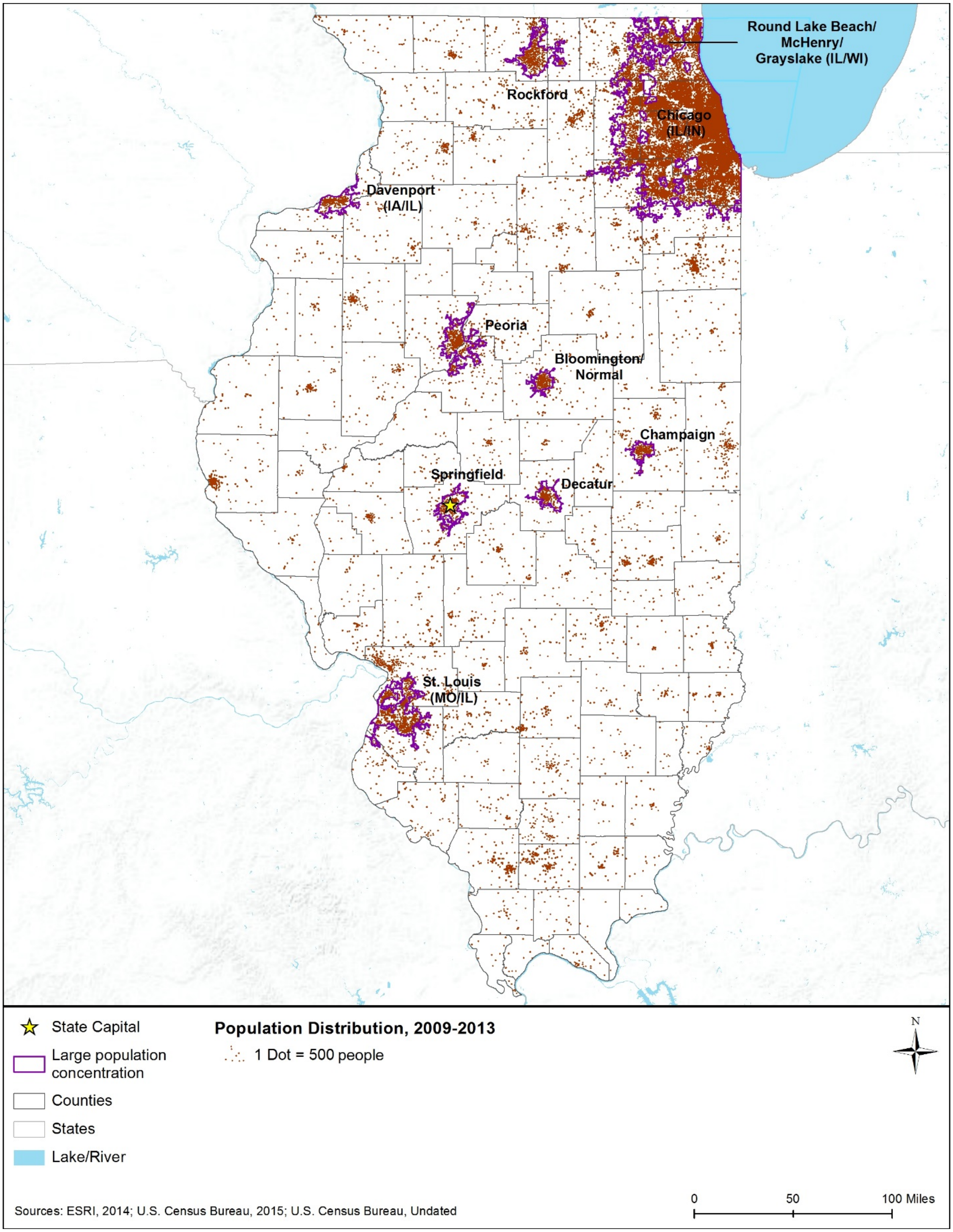


Figure 4.1.9-1: Estimated Population Distribution in Illinois, 2009–2013

Table 4.1.9-4: Population of the 10 Largest Population Concentrations in Illinois

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Bloomington/Normal	112,415	132,600	133,968	9	20,185	1.67%
Champaign	123,938	145,361	146,495	7	21,423	1.61%
Chicago (IL/IN) (IL Portion)	7,754,524	8,018,716	8,049,044	1	264,192	0.34%
Davenport (IA/IL) (IL Portion)	138,954	137,150	137,176	8	(1,804)	-0.13%
Decatur	96,454	93,863	93,740	10	(2,591)	-0.27%
Peoria	247,172	266,921	266,914	4	19,749	0.77%
Rockford	270,414	296,863	295,360	3	26,449	0.94%
Round Lake Beach/McHenry/Grayslake (IL/WI) (IL Portion)	207,062	259,811	258,460	5	52,749	2.30%
Springfield	153,516	161,316	161,623	6	7,800	0.50%
St. Louis (MO/IL) (IL Portion)	357,391	372,895	370,850	2	15,504	0.43%
Total for Top 10 Population Concentrations	**9,461,840**	**9,885,496**	**9,913,630**	**NA**	**423,656**	**0.44%**
Illinois (statewide)	**12,419,293**	**12,830,632**	**12,848,554**	**NA**	**411,339**	**0.33%**
Top 10 Total as Percentage of State	**76.2%**	**77.0%**	**77.2%**	**NA**	**103.0%**	**NA**

Sources: (U.S. Census Bureau, 2015z; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)
AARC = Average Annual Rate of Change (compound growth rate)
*The large population increase from 2000 to 2010 reflects a relatively modest change in the area definition for the Belgrade urban cluster, from 7.2 sq. mi. in 2000 to 10 sq. mi. in 2010.

4.1.9.4 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 4.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 4.1.9-5 compares several economic indicators for Illinois to the Central region and the nation. The table presents two indicators of income[134] – 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 4.1.9-5, the per capita income in Illinois in 2013 ($29,856) was $2,328 higher than that of the region ($27,528), and $1,672 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 4.1.9-5 shows that in 2013, the MHI in Illinois ($56,212) was $4,167 higher than that of the region ($52,045), and $3,962 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 4.1.9-5 compares the unemployment rate in Illinois to the Central region and the nation. In 2014, Illinois's statewide unemployment rate of 7.1 percent was higher than the rates for both the region (5.7 percent) and the nation (6.2 percent).[135]

Table 4.1.9-5: Selected Economic Indicators for Illinois

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Illinois	$29,856	$56,212	7.1%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

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

[134] The U.S. 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, 2015ab).

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

Figure 4.1.9-2 and Figure 4.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015ac) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 4.1.9-1 (U.S. Census Bureau, 2015z; U.S. Census Bureau, 2015d). Following these two maps, Table 4.1.9-6 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 Illinois.

Figure 4.1.9-2 shows that, at the county level, MHI in 2013 had a variable distribution across the state, with high and low MHI levels occurring throughout the state. Many of the counties in the southern tip of the state had MHI levels below the national average. Table 4.1.9-10 shows that MHI was above the state average ($56,797) in three of the 10 population concentrations, and was highest in the Illinois portion of the Round Lake Beach/McHenry/Grayslake area ($72,372). MHI was lowest in Champaign area ($40,382).

Figure 4.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. Similar to the figure for MHI, this figure shows a highly variable distribution of unemployment rates throughout the state. When comparing unemployment in the population concentrations to the state average (Table 4.1.9-6), four areas had a 2009–2013 unemployment rate that was higher than the state average. These areas were Rockford, Decatur, and the Illinois portions of Chicago and Round Lake Beach/McHenry/Grayslake.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 4.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the U.S. Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was slightly higher in Illinois than in the Central region and the nation. The percentages of government workers and self-employed workers were slightly lower in the state than in the region and nation.

By industry, Illinois has a mixed economic base and some notable figures in the table are as follows. Illinois had similar percentage of workers in most industries, when compared to the Central region and the nation. All state figures were approximately within one percentage point of the region and nation, with a few exceptions. For instance, Illinois in 2013 had a slightly lower percentage of persons working in “manufacturing” than did the region, and slightly higher than the nation. The state had a somewhat higher percentage of workers in “professional, scientific, management, administrative, and waste management services” than the region, but a similar percentage compared to the nation.

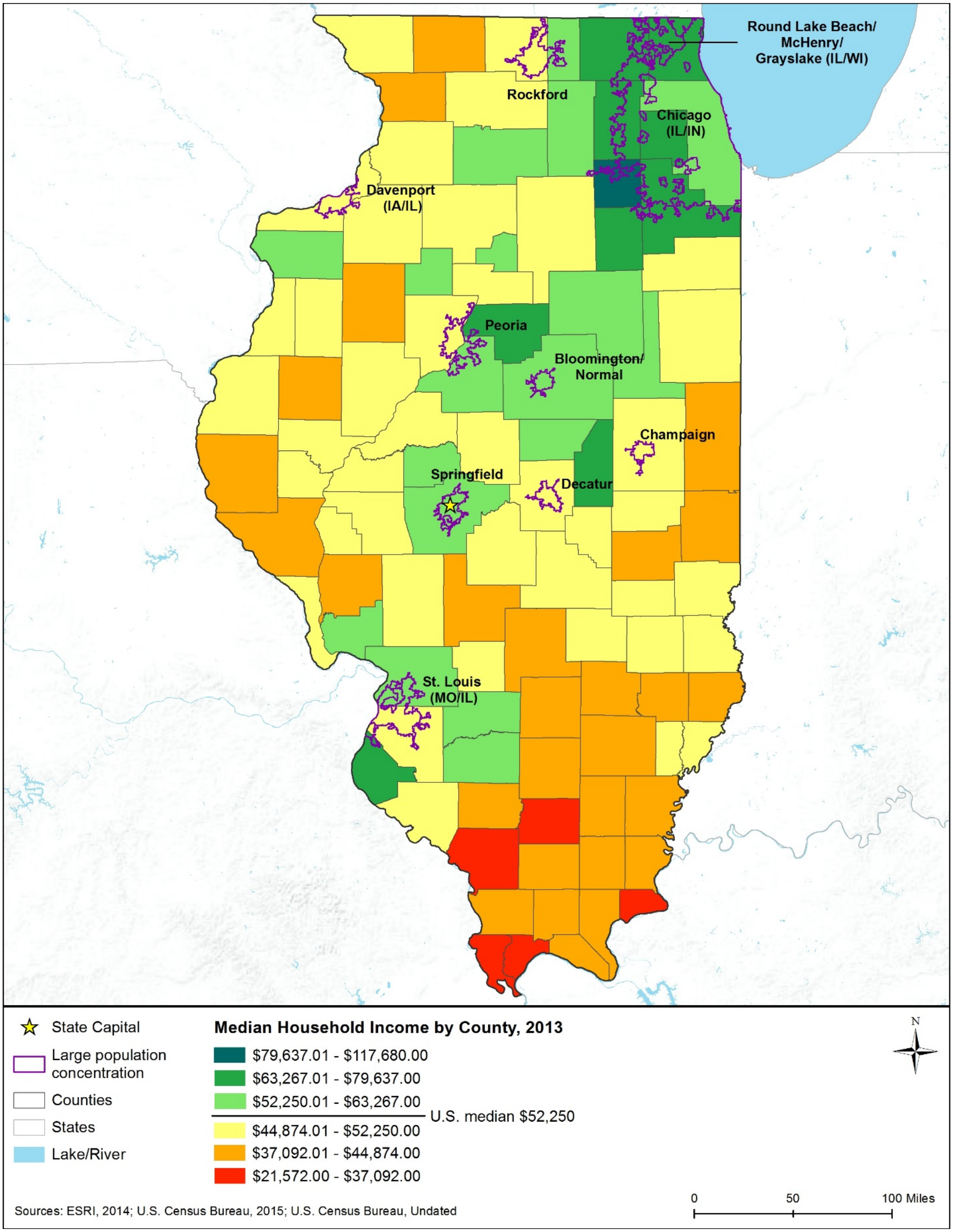


Figure 4.1.9-2: Median Household Income in Illinois, by County, 2013

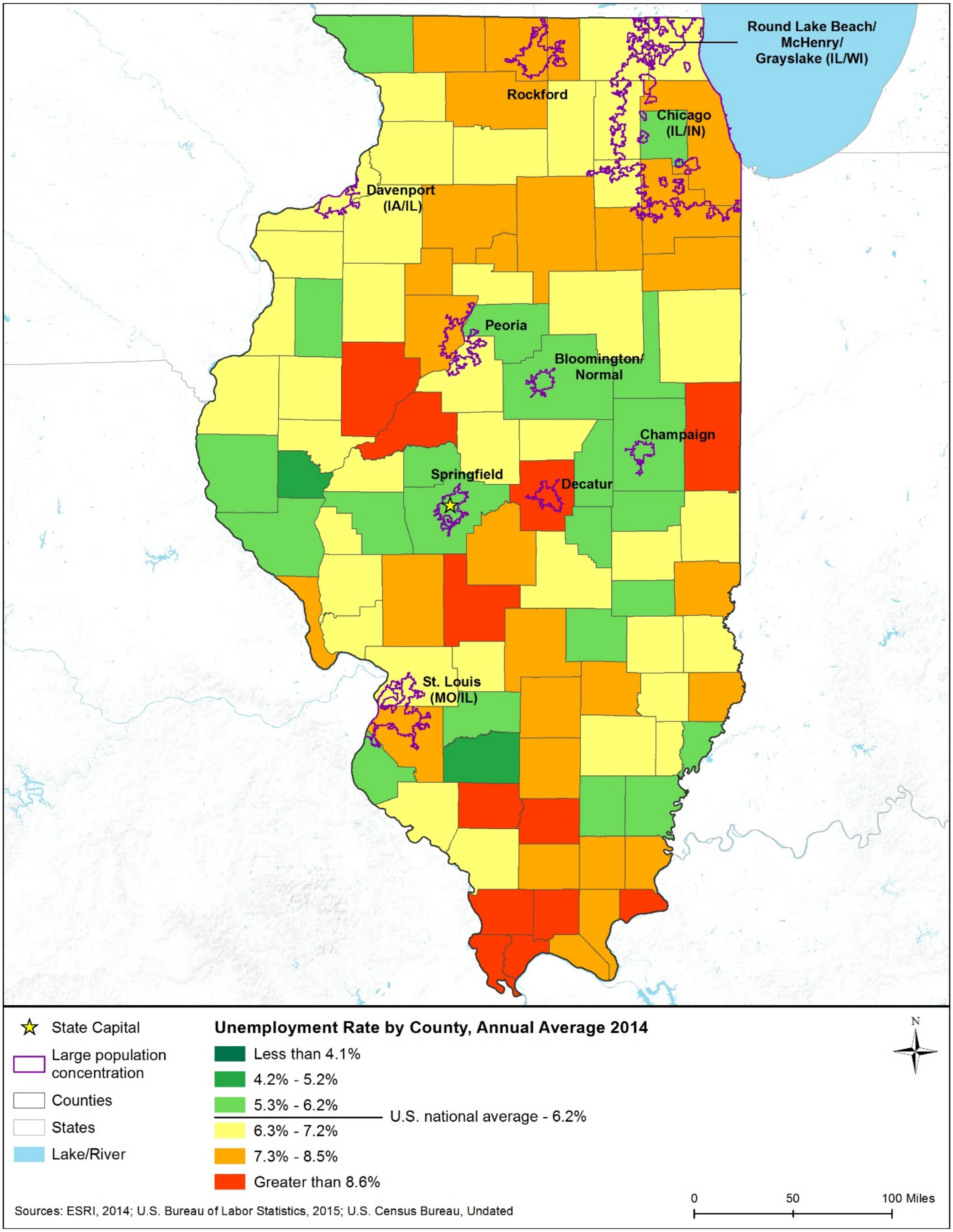


Figure 4.1.9-3: Unemployment Rates in Illinois, by County, 2014

Table 4.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Illinois, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Bloomington/Normal	$59,648	6.7%
Champaign	$40,382	7.5%
Chicago (IL/IN) (IL Portion)	$61,717	11.1%
Davenport (IA/IL) (IL Portion)	$46,154	8.5%
Decatur	$44,280	12.4%
Peoria	$50,271	8.8%
Rockford	$46,577	13.4%
Round Lake Beach/McHenry/Grayslake (IL/WI) (IL Portion)	$72,372	10.6%
Springfield	$52,646	8.9%
St. Louis (MO/IL) (IL Portion)	$50,809	9.5%
Illinois (statewide)	$56,797	10.5%

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

Table 4.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Illinois	Central Region	United States
Civilian Employed Population 16 Years and Over	6,074,089	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	82.8%	81.7%	79.7%
Government workers	12.3%	12.8%	14.1%
Self-employed in own not incorporated business workers	4.7%	5.3%	6.0%
Unpaid family workers	0.1%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	1.1%	2.2%	2.0%
Construction	5.1%	5.6%	6.2%
Manufacturing	12.8%	14.0%	10.5%
Wholesale trade	3.1%	2.7%	2.7%
Retail trade	10.9%	11.5%	11.6%
Transportation and warehousing, and utilities	5.8%	4.9%	4.9%
Information	2.0%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	7.3%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	11.4%	9.7%	11.1%
Educational services, and health care and social assistance	23.1%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	9.1%	9.1%	9.7%
Other services, except public administration	4.7%	4.6%	5.0%
Public administration	3.7%	3.9%	4.7%

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

Table 4.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the U.S. Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 4.1.9-7 for 2013.

Table 4.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Illinois, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Bloomington/Normal	3.3%	2.7%	1.5%	8.5%
Champaign	2.0%	3.1%	2.6%	8.5%
Chicago (IL/IN) (IL Portion)	4.7%	6.0%	2.3%	13.2%
Davenport (IA/IL) (IL Portion)	5.4%	6.0%	2.0%	8.1%
Decatur	5.2%	6.6%	1.9%	6.5%
Peoria	4.7%	4.0%	1.8%	9.5%
Rockford	5.0%	6.0%	1.8%	7.5%
Round Lake Beach/McHenry/Grayslake (IL/WI) (IL Portion)	6.6%	4.3%	2.3%	10.5%
Springfield	4.0%	3.8%	2.1%	8.6%
St. Louis (MO/IL) (IL Portion)	4.5%	6.5%	1.7%	11.0%
Illinois (statewide)	5.2%	5.8%	2.1%	11.1%

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

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 4.1.9-9 compares Illinois to the Central region and nation on several common housing indicators.

As shown in Table 4.1.9-9, in 2013, Illinois had a slightly higher percentage of housing units that were occupied (90.4 percent) than the region (88.4 percent) or nation (87.6 percent). Of the occupied units, Illinois had a somewhat lower percentage of owner-occupied units (65.9 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 Illinois in 2013 (58.1 percent) was lower than both the region (67.7 percent) and the nation (61.5 percent). The homeowner vacancy rate in Illinois (1.8 percent) matched the rate for the region (1.8 percent) and was close to the nation's rate (1.9 percent). This rate reflects, "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015m). The vacancy rate among rental units in Illinois (6.2

percent) was somewhat higher than the regional rate (6.0 percent) and slightly lower than the national rate (6.5 percent).

Table 4.1.9-9: Selected Housing Indicators for Illinois, 2013

Geography	Total Housing Units	Housing Occupancy and Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Illinois	5,289,653	90.4%	65.9%	1.8%	6.2%	58.5%
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, 2015q)

Table 4.1.9-10 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 4.1.9-10 shows that during this period the percentage of occupied housing units was very similar to the state average of 90.2 percent in all areas, ranging between 88.7 percent (St. Louis, Illinois portion) to 92.2 percent (Peoria area). The percentage of occupied housing units that were owner-occupied was equal to or below the state average of 67.5 percent in all areas, with the exception of the Illinois portions of the Davenport and the Round Lake Beach/McHenry/Grayslake areas, where the percentages were 68.7 percent and 80.2 percent, respectively. The homeowner vacancy rates ranged from 1.2 percent (Springfield area) to 2.8 percent (Champaign area), consistent with the state's rate (2.3 percent). The vacancy rate among rental units ranged from 4.6 percent (St. Louis area, Illinois portion) to 8.1 percent (Decatur area), consistent with the state average of 7.0 percent.

Table 4.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Illinois, 2009–2013

Area	Total Housing Units	Housing Occupancy and Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Bloomington/Normal	55,071	90.9%	62.1%	2.4%	7.8%	54.3%
Champaign	64,299	89.5%	47.4%	2.8%	7.3%	46.9%
Chicago (IL/IN) (IL Portion)	3,210,205	90.5%	64.7%	2.4%	7.3%	48.5%
Davenport (IA/IL) (IL Portion)	61,131	92.0%	68.7%	1.9%	6.4%	69.2%

Area	Total Housing Units	Housing Occupancy and Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Decatur	43,197	89.2%	66.4%	2.7%	8.1%	75.8%
Peoria	117,749	92.2%	66.8%	2.0%	7.1%	72.5%
Rockford	124,758	90.1%	66.6%	1.6%	5.4%	66.9%
Round Lake Beach/McHenry/Grayslake (IL/WI) (IL Portion)	99,623	92.0%	80.2%	2.5%	6.0%	74.6%
Springfield	74,811	91.5%	67.5%	1.2%	5.7%	66.8%
St. Louis (MO/IL) (IL Portion)	162,217	88.7%	66.3%	2.0%	4.6%	70.5%
Illinois (statewide)	5,291,704	90.2%	67.5%	2.3%	7.0%	58.6%

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

Property Values

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

Table 4.1.9-11 provides indicators of residential property values for Illinois and compares these values to values for the Central region and nation. The figures on median value of owner-occupied units are from the U.S. 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, 2015m).

The table shows that the median value of owner-occupied units in Illinois in 2013 ($169,600) was higher than the corresponding value for the Central region ($151,200) and slightly lower than the nation's ($173,900).

Table 4.1.9-11: Residential Property Values in Illinois, 2013

Geography	Median Value of Owner-Occupied Units
Illinois	$169,600
Central Region	$151,200
United States	$173,900

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

Table 4.1.9-12 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 exceeded the state value of $182,300 only in the Illinois portions of the Round

Lake Beach/McHenry/Grayslake area ($195,600) and the Chicago area ($238,500). The lowest median value was in the Decatur area, at $90,800, less than half the state median value.

Table 4.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Illinois, 2009–2013

Area	Median Value of Owner-Occupied Units
Bloomington/Normal	$160,200
Champaign	$151,400
Chicago (IL/IN) (IL Portion)	$238,500
Davenport (IA/IL) (IL Portion)	$108,300
Decatur	$90,800
Peoria	$121,300
Rockford	$121,500
Round Lake Beach/McHenry/Grayslake (IL/WI) (IL Portion)	$195,600
Springfield	$121,500
St. Louis (MO/IL) (IL Portion)	$123,100
Illinois (statewide)	$182,300

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

Government Revenues

State and local governments obtain revenues from many sources. FirstNet 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 4.1.9-13 presents total and selected state and local government revenue sources as reported by the U.S. 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 4.1.9-13 shows that the state government in Illinois received less total revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. Illinois local governments received more total revenue than their regional and national counterparts did. This pattern was the same for receipts of intergovernmental revenue[136] from the federal government. The state government in Illinois obtained lower levels of property taxes per capita than its counterparts in the region and nation, while local governments obtained higher levels of property taxes per capita than regional and national local governments. The Illinois state government reported lower revenue from general sales taxes on a per capita basis than other state governments in the region and nation. Illinois local government receipts of general sales taxes, per capita, exceeded those of other local governments regionally, and were less than those of other local governments nationally. Illinois state and local governments reported higher revenue from selective sales taxes, and public utility taxes specifically, on a per capita basis than their counterparts in the region and nation. The Illinois state government reported higher levels of individual and corporate income tax revenues, on a per capita basis, than the region and nation. Local governments in Illinois did not report any individual or corporate income tax revenues.

Table 4.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Illinois		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$68,902	$68,011	$463,192	$231,980	$1,907,027	$1,615,194
	Per capita	$5,351	$5,282	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal	($M)	$15,647	$3,439	$125,394	$9,383	$514,139	$70,360
	Per capita	$1,215	$267	$1,630	$122	$1,638	$224
Intergovernmental from State	($M)	$0	$17,796	$0	$76,288	$0	$469,147
	Per capita	$0	$1,382	$0	$992	$0	$1,495
Intergovernmental from Local	($M)	$353	$0	$2,721	$0	$19,518	$0
	Per capita	$27	$0	$35	$0	$62	$0
Property Taxes	($M)	$65	$25,466	$3,626	$61,015	$13,111	$432,989
	Per capita	$5	$1,978	$47	$793	$42	$1,379
General Sales Taxes	($M)	$8,034	$1,603	$58,236	$6,920	$245,446	$69,350
	Per capita	$624	$124	$757	$90	$782	$221
Selective Sales Taxes	($M)	$6,261	$2,437	$33,313	$2,191	$133,098	$28,553
	Per capita	$486	$189	$433	$28	$424	$91
Public Utilities Taxes	($M)	$1,750	$1,059	$3,627	$1,153	$14,564	$14,105
	Per capita	$136	$82	$47	$15	$46	$45
Individual Income Taxes	($M)	$15,512	$0	$72,545	$5,148	$280,693	$26,642
	Per capita	$1,205	$0	$943	$67	$894	$85
Corporate Income Taxes	($M)	$3,495	$0	$9,649	$310	$41,821	$7,210
	Per capita	$271	$0	$125	$4	$133	$23

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

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

[136] 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).

4.1.10 Environmental Justice

4.1.10.1 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 1.8.12, Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). The fundamental principle of environmental justice as stated in the EO is "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA, 2015f). 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, 2015f) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015g).

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)

4.1.10.2 Specific Regulatory Considerations

The IEPA is committed to promoting environmental justice in the administration of its programs. The state of Illinois defines environmental justice as "the protection of the health of the people of Illinois and its environment, equity in the administration of the state's environmental programs, and the provision of adequate opportunities for meaningful involvement of all people with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." (IEPA, 2015n)

Illinois' environmental justice policy, finalized in 2008, outlines the strategies and goals to promote environmental equity, including the facilitation of public participation during the environmental decision process, involvement of citizens in the environmental permitting process, and the education of IEPA staff to respond adequately to environmental justice concerns and developments. A designated IEPA "Environmental Justice (EJ) Officer" is responsible for continuing development of environmental justice programs, coordinating IEPA environmental justice activities, and serving as a citizen and community point of contact. (USEPA, 2015g) (University of California, Hastings College of Law 2010).

IEPA established an advisory group that includes individuals from environmental justice groups, different IEPA bureaus, and USEPA Region 5. The advisory group meets quarterly to discuss strategies for integrating environmental equity into government and community decisions. Other initiatives spearheaded by this group include the discussion of methods for incorporating environmental justice into the permitting processes within each IEPA bureau, and the development of an environmental justice database. (University of California, Hastings College of Law 2010). The advisory group is currently developing a policy handbook aimed at keeping IEPA personnel apprised of policy developments (IEPA, 2015n).

4.1.10.3 Environmental Setting: Minority and Low-Income Populations

Table 4.1.10-1 presents 2013 data on the composition of Illinois's estimated population by race and by Hispanic origin. The state's estimated population has considerably higher percentages of individuals who identify as Black/African American (14.2 percent), Asian (4.9 percent), or Some Other Race (5.7 percent) than the estimated population of the Central region. The regional percentages are, for Black/African American, 9.3 percent; for Asian, 2.8 percent; and for Some Other Race, 2.4 percent. Illinois' figures are closer to those of the nation (for Black/African American, 12.6 percent; for Asian, 5.1 percent, and for Some Other Race, 4.7 percent). The state's estimated population of persons identifying as White (72.7 percent) is smaller than that of the Central region (82.2 percent) or the nation (73.7 percent).

The percentage of the estimated population in Illinois that identifies as Hispanic (16.4 percent) is considerably higher than in the Central region (8.5 percent) and similar to that of the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. Illinois' All Minorities estimated population percentage (37.3 percent) is considerably higher than that of the Central region (23.3 percent) and nearly matches the nation's value (37.6 percent).

Table 4.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The percentage for Illinois (14.7 percent) matches the Central region value (14.7 percent) and is slightly lower than the figure for the nation (15.8 percent).

Table 4.1.10-1: Estimated Population by Race and Hispanic Status, 2013

Geography	Total Estimated Population	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Illinois	12,882,135	72.7%	14.2%	0.2%	4.9%	0.0%	5.7%	2.2%	16.4%	37.3%
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, 2015u)

"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 4.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Illinois	14.7%
Central Region	14.7%
United States	15.8%

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

4.1.10.4 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 4.1.10-1 visually portrays the results of the environmental justice population screening analysis for Illinois. The analysis used block group data from the U.S. Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x; U.S. Census Bureau, 2015y) and U.S. Census Bureau urban classification data (U.S. Census Bureau, 2015z) (U.S. Census Bureau, 2015d).

Figure 4.1.10-1 shows that Illinois has many areas with high and moderate potential for environmental justice populations. The distribution of these areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. Notable concentrations of high potential within the largest population concentrations occur in the southeastern Chicago area (Illinois portion) and the west side of the St. Louis area (Illinois portion).

It is important to understand how the data behind Figure 4.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 4.1.10-1 does not definitively identify environmental justice populations. It indicates degrees of likelihood of the presence of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to NEPA criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). The Environmental Consequences section (Section 4.2.10) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

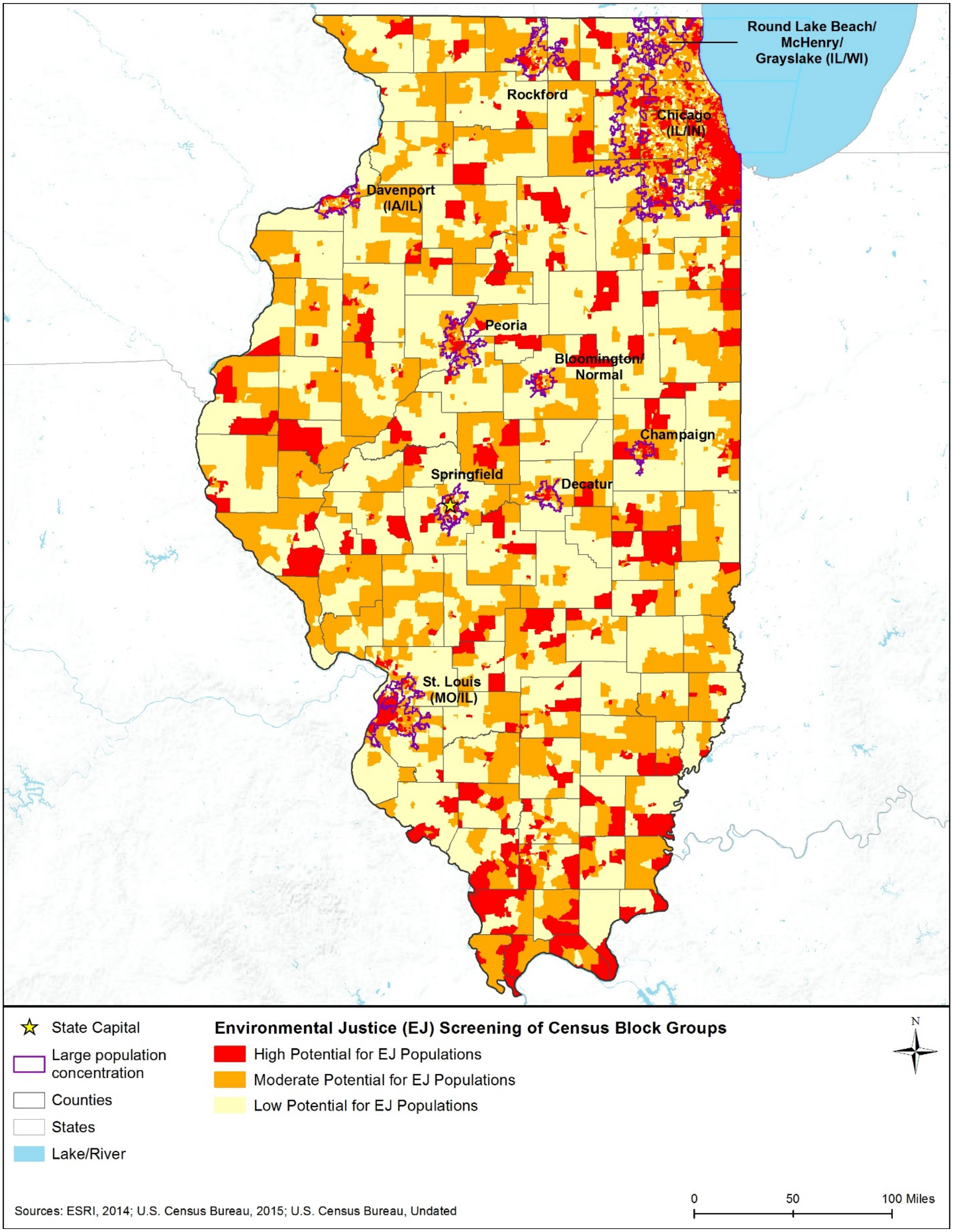


Figure 4.1.10-1: Potential for Environmental Justice Populations in Illinois, 2009–2013

4.1.11 Cultural Resources

4.1.11.1 Definition of the 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 National Historic Preservation Act (NHPA), 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, 2016b); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

4.1.11.2 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 Relevant Federal Laws and Executive Orders), the American Indian Religious Freedom Act (AIRFA), ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

Illinois has a state statute that is similar to the NHPA (refer to Table 4.1.11-1). However, federal statutes supersede this law. 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 4.1.11-1: Relevant Illinois Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Illinois State Agency Historic Resources Preservation Act (20 ILCS 3420)	Illinois State Historic Preservation Office (SHPO)	This act mirrors the NHPA for state actions, requiring agencies to consult with SHPO regarding potential impacts to historic properties.

4.1.11.3 Cultural and Natural Setting

Human beings have inhabited the Illinois region for more than 12,000 years (Haynes, Johnson, & Stafford, 1999; Pauketat, 2012). The majority of evidence of the state'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 70 archaeological site listed on the NRHP: 9 historic or military sites; 8 of historical, aboriginal, and prehistoric provenance; and 7 of historical and prehistoric provenance, and 53 prehistoric sites (NPS, 2015f).

Archaeologists typically divide large study areas into regions. Illinois is comprised of three Physiographic Regions: the Atlantic Plain, the Interior Highlands, and the Interior Plains. The Physiographic Regions are further divided into four separate Physiographic Provinces: Central Lowland, Coastal Plain, Interior Low Plateaus, and Ozark Plateaus (Figure 4.1.3-1).

Most archeological evidence in Illinois is found 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 1-10 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 (Harris, 1979).

The following sections provide additional detail about the prehistoric periods in Illinois (approximately 10000 B.C. – A.D. 1650) and the historic period since European contact in the late 1600s. Section 4.1.11.4 presents an overview of the initial human habitation in Illinois and the cultural development that occurred before European contact. Section 4.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 4.1.11.6 provides a current list of significant archaeological sites in Illinois and tools that the state has developed to ensure their preservation. Section 4.1.11.7 document the historic context of the state since European contact, and Section 4.1.11.8 summarizes the architectural context of the state during the historic period.

Archaeologists divide Illinois' prehistoric past into four periods: Paleoindian Period (10000 – 8000 B.C.), Archaic Period (8000 – 500 B.C.), Woodland (500 B.C. – A.D. 900), and Mississippian (A.D. 900 – 1650) (IHPA, 2015a). Figure 4.1.11-1 shows a timeline representing these periods of early human habitation of present day Illinois. 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 the state'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).

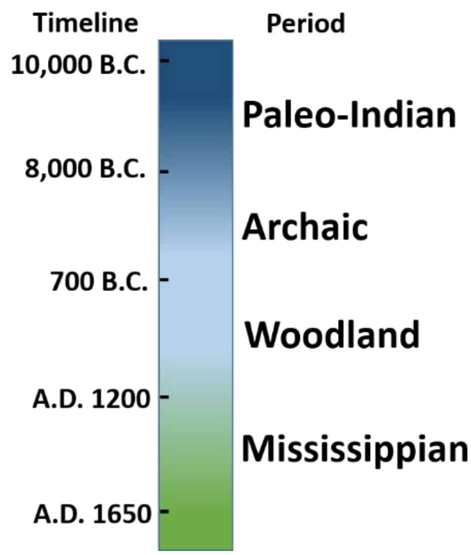


Figure 4.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (IMH, 2015; IHPA, 2015a)

Paleoindian Period (10000 – 8000 B.C.)

The Paleoindian Period represents the earliest human habitation Illinois. It is hypothesized that these settlers were decedents from 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) (Morrow, 1997). Paleoindians lived in small groups of nomadic hunters and gatherers that used chipped-stone tools, including the "fluted javelin head" arrow and spear points (referred to as the Clovis fluted point), found in surface and shallow deposits throughout the state. Studies show that this technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002).

Paleoindian people ranged across Illinois in small bands that followed migratory large game animals, including giant bison. Tools made by these people include end scrapers for the processing of meat and hides. The lithic materials used to make tools such as these were of high quality and not readily found around the state (Morrow, 1997). Bands of early Paleoindians established seasonal camps, some of which likely became permanent settlements (Kuehn, 1998; Bamforth, 2011; Evans, G, & Hajic, 1997).

Archaic Period (8000 – 500 B.C.)

The Archaic Period in Illinois is characterized by a climate that was becoming increasingly dryer and the adaptation by the area's inhabitants to changes in food availability by the development of a more varied assemblage of tools and hunting practices. By 2000 B.C, the Illinois region had become very dry, and the inhabitants shifted away from the pursuit of big game and to subsistence on other edible plants and smaller game. The hunting of large game, such as antelope, deer, and occasional bison, required development of new techniques, such as communal bison hunts, where large groups of people worked together to run herds of bison over a cliff to kill them. The hunting implements of the Early Archaic period were initially more crudely manufactured than either the Clovis or Folsom points made by the Paleoindians (Emerson, Walthall, Fortier, & McElrath, 2006; Kuehn, 1998; Evans, G, & Hajic, 1997).

During the latter part of the Archaic Period, tools were beginning to become more sophisticated in their materials, manufacturing techniques, and use, which differentiates this time from the Early and Middle Archaic. From studies along Interstate 270 in Illinois (known as the "I-270 Project"), there is evidence that Late Archaic Period people were transitioning to the Cahokia culture (typified by larger settlements and mound building), which would last throughout the Woodland and into the Mississippian Periods (Emerson, Walthall, Fortier, & McElrath, 2006).

Woodland Period (500 B.C. – A.D. 900)

In the Early Woodland Period (500 – 100 B.C), the Cahokia people spread across the Interior Uplands of the state (Emerson, Walthall, Fortier, & McElrath, 2006). Although it appears that the people of this period were living similar lifestyles across the region, there are many subtle differences between the various cultures (Emerson, Walthall, Fortier, & McElrath, 2006).

By the Middle Woodland Period (100 B.C. – A.D. 300), there is evidence of elaborate funerary practices being used within the culture of this region. Funerary masks, some of which painted with red and black ochre, are present in the Hopewellian region of Illinois (generally the Illinois and Mississippi River valleys) (Cook & Farnsworh, 1981) (King, Buikstra, & Charles, 2011). Mound building for ceremonial purposes (civic functions, burials, etc.) became a common practice during the Middle Woodland period in the Lower Illinois Valley. Initially constructed on prominent bluffs or ridges, and then later in more obscure places these mounds became one of the defining attributes of the cultures that lived in this region during this period (King, Buikstra, & Charles, 2011).

During the late Woodland Period (A.D. 300 - 900), there were large settlements and villages inhabited by the Cahokia people. Many of these settlements in southern Illinois were close to the large St. Louis Mound Center, near St. Louis, MO. The St. Louis Mound Center provides evidence of an elaborated hierarchical societal structure, where there was a division of labor and the provisioning of food sources (Emerson, Walthall, Fortier, & McElrath, 2006). Along with the bow and arrow, ceramics are considered one of the great advancements of this period. More than 6000 features have been excavated in the Lower Bottomlands of Illinois (near St. Louis, MO), which show the evolutionary stages of the Mississippian period (Schroeder, 2004).

Near Joliet, IL, there is evidence of palisaded enclosures. "The function of these enclosures appears to have been ceremonial rather than defensive, suggesting an avenue of symbolic linkage between proto- and early historic Midewiwin ceremonialism and the Late Woodland Effigy Mound Tradition." Stone tool manufacturing and evidence of daily chores, such as the processing of food and cooking were found at several sites around the palisaded enclosures, but not inside the enclosures to keep day-to-day functions separate from ceremonial functions (Kullen, 1994).

Mississippian Period (A.D. 900 – 1650)

The Mississippian Period in Illinois is distinguished by advancements in agricultural techniques and construction of temple mounds and large fortified villages. By the time of European contact, most of the villages were abandoned due to overhunting and deforestation (Blitz, 2010).

Mississippian people lived throughout the state, with evidence of occupation in the south, east, and west central regions. There are 2,379 documented Mississippian sites in Illinois, to date (Museum Link Illinois, 2000); examples include a village on a bluff in southern Illinois, large towns near the mouth of the Spoon River, and the Dickenson Mounds near Lewiston, IL, which are some of the most prominent burial sites in the state. "Near East St. Louis, Mississippian people built Cahokia, one of the largest American Indian cities in North America – larger, in fact, than many European cities at the time. Cahokia was a political and religious center of Mississippian life" (Museum Link Illinois, 2000). The Monks Mound, along the Mississippi River floodplain at Cahokia, IL, is one of the largest burial mounds in the state, approximately 1000 feet long, 800 feet wide, and 100 feet tall. (Museum Link Illinois, 2000).

4.1.11.4 Federally Recognized Tribes of Illinois

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are no federally recognized tribes in Illinois (NCSL, 2015; GPO, 2015b). Figure 4.1.11-2 shows the general locations of tribes that have existed in this region of the United States, but are no longer present.

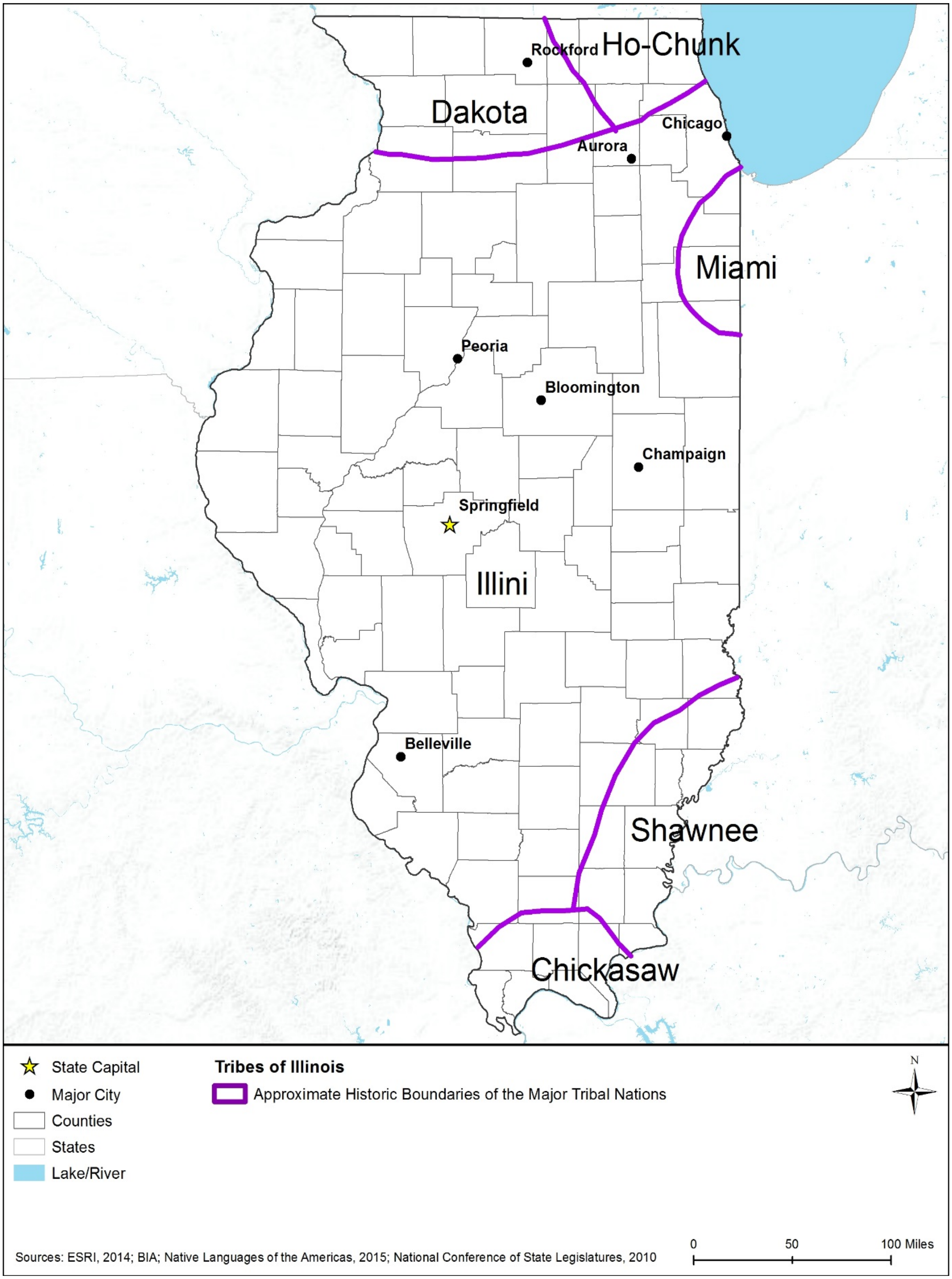


Figure 4.1.11-2: Approximate Historic Boundaries of Tribes in Illinois

4.1.11.5 Significant Archaeological Sites of Illinois

As previously mentioned in Section 11.14.3 there are 70 archaeological sites in Illinois listed on the NRHP. Table 4.1.11-2 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 is on the NPS NRHP website (http://www.nps.gov/nr/research/) (NPS, 2015f).

Table 4.1.11-2: Archaeological Sites on the National Register of Historic Places in Illinois

Closest City	Site Name	Type of Site
Albany	Albany Mounds Site	Prehistoric
Alton	Alton Military Prison Site	Historic
Apple River	Millville Town Site	Historic
Barry	New Philadelphia Town Site	Historic
Bourbonnais	Windrose Site	Historic - Aboriginal
Brookport	Kincaid Site	Prehistoric
Brussels	Golden Eagle-Toppmeyer Site	Prehistoric
Campbell Hill	Piney Creek Site	Prehistoric
Campbell Hill	Piney Creek South Site	Prehistoric
Campbell Hill	Piney Creek West Site	Prehistoric
Campbell Hill	Tegtmeyer Site	Prehistoric
Canton	Orendorf Site	Prehistoric
Carrier Mills	Carrier Mills Archeological District	Prehistoric
Channahon	Briscoe Mounds	Prehistoric
Chillicothe	Marshall Site	Prehistoric
Clayton	Roy, John, Site	Prehistoric
Columbia	Lunsford-Pulcher Archeological Site	Prehistoric
Danville	Collins Archeological District	Prehistoric
Edwardsville	Kuhn Station Site	Prehistoric
Eldred	Koster Site	Prehistoric
Elizabeth	Apple River Fort Site	Historic, Military
Ellsworth	Bane, Warren, Site	Historic - Aboriginal
Equality	Saline Springs	Historic - Aboriginal, Prehistoric
Glendale	Millstone Bluff	Prehistoric
Gorham	Cleiman Mound and Village Site	Prehistoric
Grafton	Duncan Farm	Prehistoric
Grand Tower	Grand Tower Mining, Manufacturing and Transportation Company Site	Historic
Granite City	Horseshoe Lake Mound and Village Site	Prehistoric
Griggsville	Naples Mound 8	Prehistoric
Hamburg	Schudel No. 2 Site	Prehistoric
Hanover	Chapman, John, Village Site	Prehistoric
Havana	Rockwell Mound	Prehistoric
Hillview	Mound House Site	Prehistoric

Closest City	Site Name	Type of Site
Kampsville	Kamp Mound Site	Prehistoric
Lebanon	Emerald Mound and Village Site	Prehistoric
Lerna	Civilian Conservation Corps Camp Shiloh Encampment Site	Historic
Lewistown	Larson Site	Prehistoric
Lewistown	Ogden-Fettie Site	Prehistoric
Lewistown	Sheets Site	Prehistoric
Liverpool	Sleeth Site	Prehistoric
Makanda	Giant City Stone Fort Site	Prehistoric
Manito	Clear Lake Site	Prehistoric
Maples Mills	Tampico Mounds	Prehistoric
Maunie	Hubele Mounds and Village Site	Prehistoric
Maunie	Wilson Mounds and Village Site	Prehistoric
Metropolis	Fort Massac Site	Military
Mitchell	Mitchell Archeological Site	Prehistoric
Modoc	Modoc Rock Shelter	Prehistoric
Morris	Morris Wide Water Canal Boat Site	Historic
Naples	Naples Archeological District	Historic, Historic - Aboriginal, Prehistoric
New Haven	Duffy Site	Prehistoric
New Haven	Bieker-Wilson Village Site	Prehistoric
Newark	Evelyn Site	Prehistoric
Nutwood	Nutwood Site	Prehistoric
Old Shawneetown	Marshall, John, House Site	Historic
Ottawa	Old Kaskaskia Village	Historic - Aboriginal
Palestine	Riverton Site	Prehistoric
Palestine	Swan Island Site	Prehistoric
Prairie du Rocher	Kolmer Site	Historic, Historic - Aboriginal
Robinson	Stoner Site	Prehistoric
Rosiclare	Orr-Herl Mound and Village Site	Prehistoric
Sims	Mayberry Mound and Village Site	Prehistoric
Sterling	McCune Mound and Village Site	Prehistoric
Sterling	Sinnissippi Site	Prehistoric
Utica	Corbin Farm Site	Prehistoric
Utica	Hotel Plaza Site	Historic - Aboriginal, Prehistoric
Utica	Little Beaver Site	Prehistoric
Utica	Shaky Shelter Site	Prehistoric
Ware	Ware Mounds and Village Site	Prehistoric
Willard	Dogtooth Bend Mounds and Village Site	Historic - Aboriginal, Prehistoric

Source: (NPS, 2015f)

Illinois State Cultural Resources Database and Tools

Historic Architectural Resources Geographic Information System (HARGIS)

The Historic Architectural Resources Geographic Information System is a database of historic and potentially historic sites. HARGIS is maintained by the Illinois Historic Preservation Agency (IHPA) and is available to the public through its website (http://gis.hpa.state.il.us/hargis/). The IHPA website also has an event calendar, photo galleries, and publications (IDNR, 2015a).

Digital Research Library of Illinois History

The Digital Research Library of Illinois History serves as a repository for documents, books and other items relating to Illinois History (http://livinghistoryofillinois.com/). The site was originally created in support of a Facebook group titled, "Living History of Illinois and Chicago." Resource links on the site direct users to sources of additional Illinois cultural resource information (Digital Research Library of Illinois History, 2015).

Illinois Digital Archives (IDA)

The Illinois Digital Archives is a repository for the digital media collection of the Illinois State Library, along with other cultural institutions in Illinois (http://www.idaillinois.org/). The IDA provides access to culturally important photographs, manuscripts, maps, and related materials. Most of the content on the site is in the public domain and access is to open to the general public (ISGS, 2015c).

4.1.11.6 Historic Context

The first European know to visit the Illinois region was in 1673 by the French Jesuit missionary, Father Jacques Marquette, and a French-Canadian fur trapper, Louis Jolliet, who made their way south from Canada, explored the upper reaches of the Mississippi River, and camped in the area of Chicago on their return trip. In 1680, Rene-Robert Cavelier, Sieur de la Salle, also explored Illinois. In 1696, the Jesuit priest, Father Francois Pinet, constructed a mission in the Chicago area; however, the mission was eventually abandoned in 1700. The first permanent settlement was Cahokia (1699), in southwestern Illinois across the Mississippi River from St. Louis. The French-built Cahokia Courthouse is the last remaining French-era structure in that area. While the building was dismantled and moved multiple times during the early 20th century, it was eventually returned to its original location during the 1920s (IHPA, 2015b).

Control of Illinois was contested during the French and Indian War, and the French ultimately relinquished their claim following the conflict. While Illinois was removed from most action during the American Revolution, minor revolutionary activity did occur. "On July 4, George Rogers Clark seize(d) Kaskaskia from the British without firing a shot, one of the westernmost military actions of the American Revolution" (IHPA, 2015b). Following the American Revolution, Illinois became a part of the Northwest Territory, and in 1779, a trading post was established near present day Chicago. This was followed shortly by Fort Dearborn in 1803, and in 1818, Illinois became the 21st state. During the early 19th century, lead mining became an important industry, and "by 1845 (Galena) was producing 80 percent of the nation's lead, according to some estimates" (IHPA, 2015b).

In 1830, Abraham Lincoln relocated to Illinois, eventually beginning his political career as a member of the Illinois House of Representatives (IHPA, 2015b). The cabin where his father and stepmother lived "was reconstructed on the original cabin site in 1935-1936 as a Civilian Conservation Corps (CCC) project" (Lincoln Log Cabin State Historic Site, 2015). In 1832, Sauk and Fox Indians attempted to take back previously ceded lands, with most of the Indians who took part in this conflict (Black Hawk War) being killed or dying of disease or other causes after a few months of fighting. Illinois also has a history of Mormon conflict, culminating in the death of Joseph Smith in 1844 (IHPA, 2015b).

Rail travel came to Illinois during the mid-19th century, with the Illinois Central Railroad (1856) at the time being the world's longest railroad. No Civil War battles occurred in Illinois; however, the state supplied a great number of Union soldiers. In 1867, the University of Illinois was founded (originally Illinois Industrial University at Urbana-Champagne). In 1871, Chicago was devastated by a fire that destroyed a large portion of the building stock and killed several hundred people. The growth experienced as a result of the rebuilding effort helped develop Chicago into the city that it is today (IHPA, 2015b). The Home Insurance Building (1884), the world's first skyscraper, is an example. In 1893, Chicago hosted the World's Columbian Exposition, which served as the catalyst for a major change with regard to architecture and urban planning. The City Beautiful movement, which posited the benefits of beautifying city spaces for benefit of the citizenry, stemmed largely from this exposition (Zukowsky, et al., 1987).

During the late 19th and early 20th centuries, Chicago experienced violence related to labor strikes and organized crime. At the same time, architects and planners such as Louis Sullivan, Frank Lloyd Wright, and Daniel Burnham worked to define their respective styles, using Chicago and the surrounding suburbs as their canvas. Residents of Illinois suffered during the Great Depression, with many participating in New Deal programs such as the CCC. During World War II (WWII), the work done at the University of Chicago was central to the birth of the nuclear age (IHPA, 2015b).

Illinois has 1,819 NRHP listed sites, as well as 88 NHLs (NPS, 2014e). Illinois contains two National Heritage Areas (NHA), the Abraham Lincoln National Heritage Area and the Illinois and Michigan Canal National Heritage Corridor (NPS, 2015g). Figure 4.1.11-3 shows the location NHA and NRHP sites within the state of Illinois.[137]

[137] See Section 4.1.7 for a more in-depth discussion of additional historic resources as they relate to Recreational Resources.

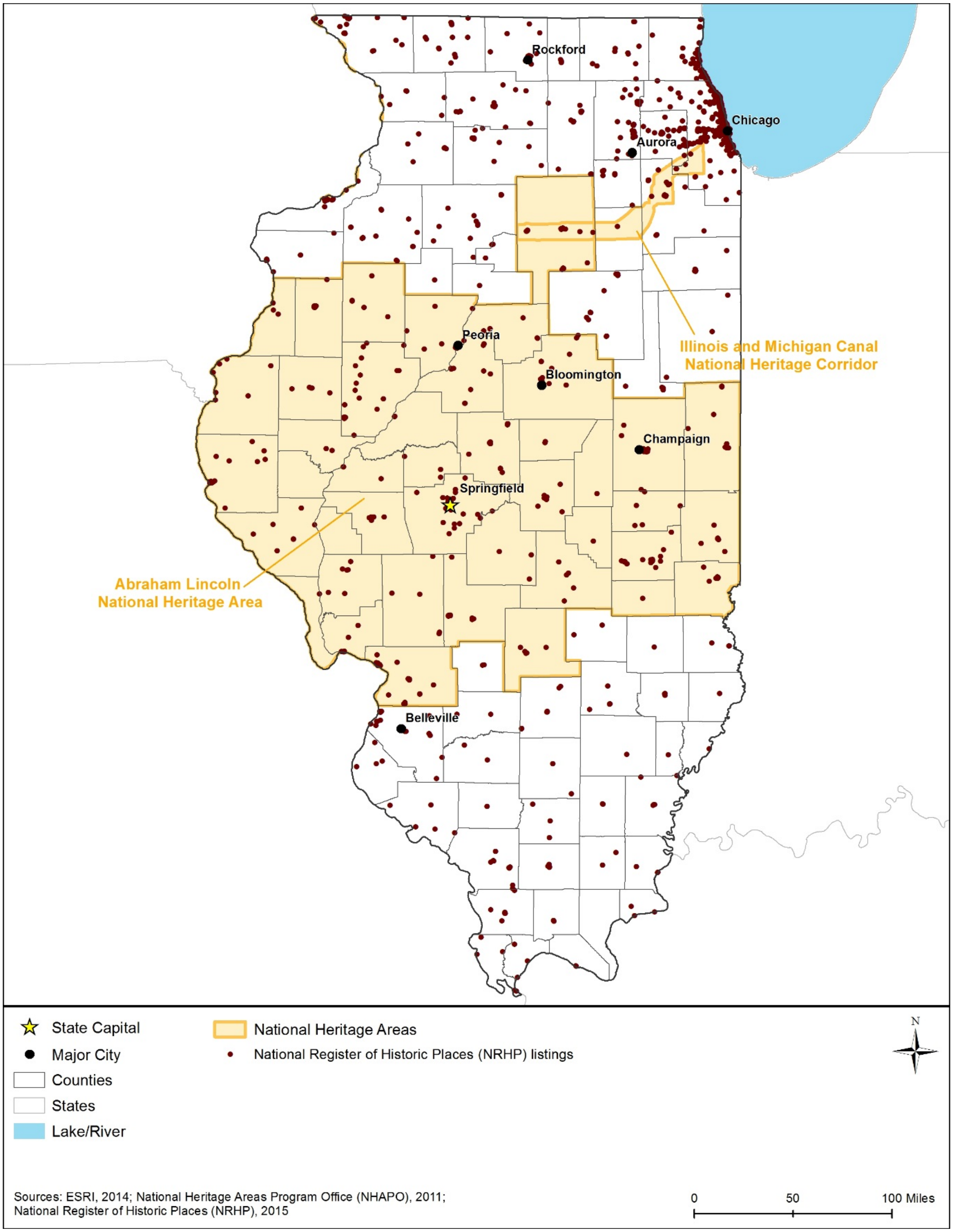


Figure 4.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Illinois

4.1.11.7 Architectural Context

The earliest European architecture in Illinois was built by the French towards the end of the 17th century, and while no 17th century buildings exist, early-to-mid 18th century examples do. The Cahokia Courthouse (1740) in the southwestern portion of the state illustrates the French method of log construction common in the Midwest during the time. "Post-on-Foundation" construction consists of logs arranged vertically on a horizontal foundation with mud and stones being used to fill the gaps. Large porches on three of four sides of the building, covered by double-pitched roofs, were common (IHPA, 2015c).[138] While the French relinquished their claim to Illinois following the French and Indian War, French architectural traits could be seen into the early 19th century, particularly in the south. "The Pierre Menard house (1802) near Chester and the Rose Hotel (1814) at Elizabethtown are examples" (Koeper, 1968). Chicago was settled permanently in the late 18th century, and early architecture included Fort Dearborn (1803), which was destroyed and rebuilt multiple times during the 19th century (IHPA, 2015b).

As settlers began to populate the region during the early 19th century, settlement moved away from rivers towards inland farmland. Early dwellings were built primarily of logs, and as settlements progressed, civic and institutional buildings appeared as well. Log construction was replaced by heavy timber framing, especially in more developed areas, with Greek Revival structures being common. While some Federal architecture can be found, the style was waning by the time mature buildings were being constructed in Illinois. Greek Revival was common in residential architecture, as well as civic, institutional, and commercial buildings (Koeper, 1968). The Old Shawneetown Bank (1839) is one example that still exists today (Landmarks Illinois, 2015). The construction technique of "balloon framing" was invented in Chicago, and eventually spread nationwide (Zukowsky, et al., 1987).[139]

The middle of the 19th century brought about Gothic Revival and Italianate architecture, and eventually the full complement of Victorian Era styles. Among others, these included Second Empire, Queen Anne, Stick, and Richardsonian Romanesque as the century progressed (Koeper, 1968). An existing example of Richardsonian Romanesque architecture is Altgeld Hall (1896 to 1897), on the campus of the University of Illinois Urbana-Champagne (University of Illinois Urbana-Champagne, 2015).

In the early-to-mid 19th century, Chicago began to emerge as a transportation hub due to proximity of the Michigan and Illinois Canal, and later to railways. In 1871, Chicago suffered a devastating fire that destroyed a large portion of the city, and the rebuilding effort included many of America's most advanced architectural designs. The world's first skyscraper, the Home Insurance Building (1884), was built in Chicago. Louis H. Sullivan continued to evolve and perfect the skyscraper, which soon spread throughout the country. Chicago hosted the 1893 World's Columbian Exposition, which sparked the Classical Revival movement of the early 20th century (Zukowsky, et al., 1987). The Museum of Science and Industry in Chicago is housed in one of the last remaining building from the exposition (Museum of Science and Industry, 2015).

[138] The Cahokia Courthouse has been moved multiple times over the years, including to St. Louis and Chicago, but was moved back to Cahokia in the 1920s.

[139] "Balloon-framing" relied on a system of milled lumber and machine cut nails, instead of using heavy timber held together with mortise and tenon joints. Balloon framing is essentially how houses are constructed today.

The City Beautiful movement also arose from this and was influential in city planning. With the help of Daniel Burnham, City Beautiful principles soon reshaped Chicago, Washington, D.C., Detroit, and other cities (Zukowsky, et al., 1987).

Early 20th century Chicago saw the construction of Frank Lloyd Wright's first Prairie style houses (Zukowsky, et al., 1987). Chicago contains many notable engineering achievements, including the Michigan Avenue Bridge (1920), a drawbridge that is in use today (Zukowsky, et al., 1993). During the Great Depression Illinois saw the rise of Modernism, which evolved from styles such as Art Deco and Art Moderne, to International following WWII (Koeper, 1968). Following WWII, large cities such as Chicago experienced suburban development related to the expansion of military and commercial production. Suburban residential and commercial architecture expanded to house and service factory workers. This style of development was made possible by the proliferation of the automobile (Zukowsky, et al., 1993). Popular housing styles in suburban neighborhoods include Revival styles during the early 20th century, minimal traditional houses during and immediately after WWII, and Ranch and modern styles during the Mid-Century Era.

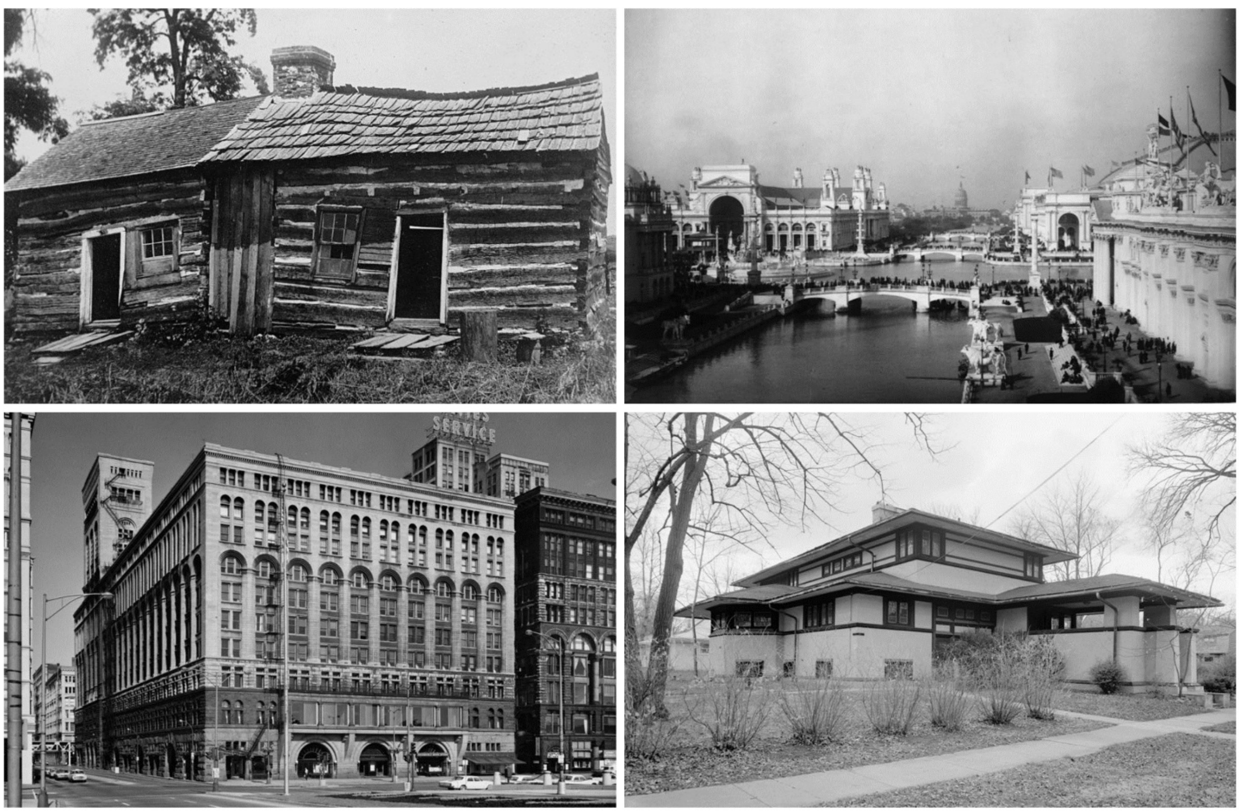


Figure 4.1.11-4: Representative Architectural Styles of Illinois

Top Left – Log Cabin Belonging to Parents of Abraham Lincoln (Charleston, IL) – (National Photo Company, 1908)
Top Right – 1893 World's Columbian Exposition (Chicago, IL) – (Johnston, 1893)
Bottom Left – Louis Sullivan's Auditorium Building (Chicago, IL) – (Historic American Buildings Survey, 1933a)
Bottom Right – Frank Lloyd Wright's Henderson House (Elmhurst, IL) – (Historic American Buildings Survey, 1933b)

4.1.12 Air Quality

4.1.12.1 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[140] 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)[141] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[142] This section discusses the existing air quality in Illinois. USEPA designates areas within the United States as attainment,[143] nonattainment,[144] maintenance,[145] or unclassifiable[146] 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.

4.1.12.2 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[147] or secondary,[148] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E, National Ambient Air Quality Standards. Under Title 35, Part 243.102, of the Illinois Administrative Code, the state of Illinois adopted the NAAQS. (IPCB, 2015a) Illinois does not maintain additional state-specific ambient air quality standards.

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

[140] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[141] Equivalent to 1 milligram per liter (mg/L).
[142] 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, 2015h).
[143] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015i).
[144] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015i).
[145] 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, 2016a).
[146] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015i).
[147] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014a).
[148] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014a).

(hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2016e). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

Title V Operating Permits/State Operating Permits

Illinois has authorization to issue CAA Title V operating permits on behalf of the United States Environmental Protection Agency (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, 2015j). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015j). Section 39.5.2 of the IEPA describes the applicability of Title V operating permits. Illinois Administrative Code Title 35, Part 201.143, also describes the applicability of state operating permits for new sources. Illinois requires Title V operating permits for major sources if the source emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 4.1.12-1). The permits issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 4.1.12-1: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014b)

Exempt Activities

Under Illinois Administrative Code Title 35, Part 201.146, Illinois identifies the following activities as exempt from obtaining state construction or operating permits:

- “Internal combustion engines or boilers (including the fuel system) of motor vehicles, locomotives, air craft, water craft, lifttrucks and other vehicles powered by non-road engines;
- Any stationary internal combustion engine with a rated power output of less than 1118 kW (1500 bhp) or stationary turbine, except that a permit [is] required for the following:
    - Any internal combustion engine with a rating at equal to or greater than 500 bhp output that is subject to the [NO_X] control requirements of [Part 217.388]; or
    - Any stationary gas turbine engine with a rated heat input at peak load of 10.7 gigajoules/hr (10 mmbut/hr) or more that is constructed, reconstructed or modified after October 3, 1977 and [therefore] is subject to the [Standards of Performance for Stationary Gas Turbines] requirements of 40 CFR 60, subpart GG;

- Activities associated with the construction, onsite repair, maintenance or dismantlement of buildings, utility lines, pipelines, wells, excavations, earthworks and other structures that do not constitute emission units; and
- Activities associated with the construction, repair, or maintenance of roads or other open areas…" (IPCB, 2015b).

Major sources are "not required to obtain an air pollution control construction permit for the construction or modification of an emission unit or activity that is an insignificant activity" listed below:

- "Emission units with emissions that never exceed [0.1 lbs/hr or 0.44 tons/year] of any regulated air pollutant in the absence of air pollution control equipment and that do not emit any air pollutant listed as hazardous pursuant to section 112(b) of the Clean Air Act; and
- Gas turbines and stationary reciprocating internal combustion engines of less than 112 kW (150 hp) power output, [or]…between 1118 and 112 (1500 and 150 hp) power output that are emergency or standby units." (IPCB, 2015b)

Temporary Emissions Sources Permits

Non-major, portable emission units can obtain special provisions for operating permits in accordance with Illinois Administrative Code Title 35, Part 201.170. The unit must apply for construction and operating permits, however the unit may change location "without obtaining a new construction or operating permit" (IPCB, 2015b).

State Preconstruction Permits

Illinois Administrative Code Title 35, Part 201.142 requires construction permits for "any new source or any new air pollution control equipment, or … the modification of any existing emission source or air pollution control equipment…" (IPCB, 2015b).

General Conformity

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

The estimated pollutant emissions are compared to *de minimis* levels.[149] These values are the minimum thresholds for which a conformity determination must be performed (see Table

[149] De minimis: "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, 2016h).

4.1.12-2). As a result, lower *de minimis* thresholds for volatile organic compounds (VOCs) and NO_X could apply depending on the attainment status of a county.

Table 4.1.12-2: *De Minimis* Levels

Pollutant	Area Type	Tons Per Year (TPY)
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an Ozone Transport Region (OTR)	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
Carbon Monoxide (CO), Sulfur Dioxide (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: (GPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 4.1.12-2, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 4.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity,[150] 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, 2010b).

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

State Implementation Plan Requirements

The Illinois SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Illinois' SIP is a conglomeration of separate actions taken for each of the pollutants. All of Illinois' SIP actions are codified under 40 CFR Part 52 Subpart O. All state environmental rules and regulations approved by USEPA to comply with the SIP can be found on the Illinois Environmental Protection Agency at http://www.epa.illinois.gov/about-us/rules-regs/index.

4.1.12.3 Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 4.1.12-1 and Table 4.1.12-3, below, present the nonattainment areas in Illinois as of January 30, 2015. Table 4.1.12-3 contains a list of the counties and their respective current nonattainment status of each criteria pollutant. The year(s) listed in the table for each pollutant indicate the date(s) when USEPA promulgated the standard for that pollutant; note that, for $PM_{2.5}$, O_3, and SO_2, these standards are in effect. Unlike Table 4.1.12-3, Figure 4.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ merge in the figure to count as a single pollutant.

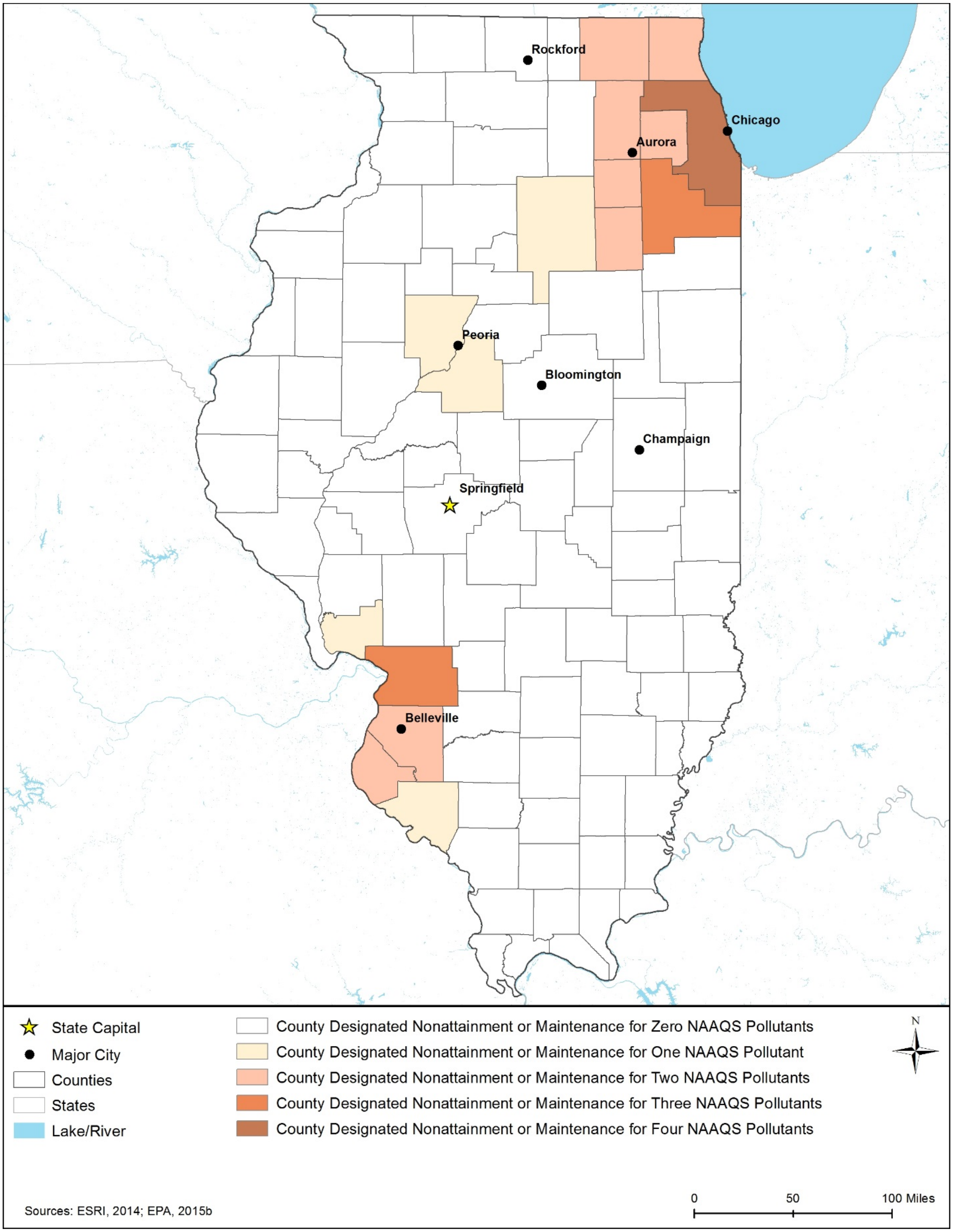


Figure 4.1.12-1: Nonattainment and Maintenance Counties in Illinois

Table 4.1.12-3: Illinois Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
	1971	1978	2008	1971	1987	1997	2006	1997	2008	1971	2010
Cook			X-6		M	M		M	X-5		X-6
Du Page						M		M	X-5		
Grundy						M		M	X-5		
Jersey								M			
Kane						M		M	X-5		
Kendall						M		M	X-5		
La Salle					M						
Lake						M		M	X-5		
Madison			X-6		M	X-4		M	X-5		
McHenry						M		M	X-5		
Monroe						X-4		M	X-5		
Peoria										M	X-6
Randolph						X-4					
St Clair						X-4		M	X-5		
Tazewell										M	X-6
Will						M		M	X-5		X-6

Source: (USEPA, 2015k)

X-1 = Nonattainment Area (Extreme)

X-2 = Nonattainment Area (Severe)

X-3 = Nonattainment Area (Serious)

X-4 = Nonattainment Area (Moderate)

X-5 = Nonattainment Area (Marginal)

X-6 = Nonattainment Area (Unclassified)

M = Maintenance Area

Air Quality Monitoring and Reporting

The Illinois Environmental Protection Agency measures air pollutants at over 60 different monitoring sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (IEPA, 2015o). Annual Illinois Air Quality Reports are prepared, containing pollutant data summarized by region. Illinois Environmental Protection Agency reports near "real-time" pollution levels of O_3 and particulate matter on their website (http://www.epa.state.il.us/air/aqi/index.html).

Throughout 2013, Illinois Environmental Protection Agency measured exceedances of four NAAQS across the state: O_3, $PM_{2.5}$, SO_2, and NO_2. Table 4.1.12-4 provides the number of exceedances in each county, per pollutant. No other criteria pollutants exceed federal standards.

Table 4.1.12-4: Calendar Year 2013 Exceedances of NAAQS in Illinois Counties

County	O_3 Exceedances	$PM_{2.5}$ Exceedances	SO_2 Exceedances	NO_2 Exceedances
Madison	7	-	-	-
Cook	4	1	3	1
Lake	2	-	-	-
Jerseyville	2	-	-	-
McHenry	1	-	-	-
Tazewell	-	-	26	-
Wabash	-	-	2	-
Total	**16**	**1**	**31**	**1**

Source: (IEPA, 2013b)

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). 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. 7472).

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

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the USEPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[152] (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).

Illinois does not contain any Federal Class I areas. All land within the state is classified as Class II (USEPA, 2012a). If an action is considered major source and consequently subject to PSD

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

requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Missouri does have a Class I area where the 100 kilometer buffer intersects Illinois counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 4.1.12-2 provides a map of Illinois highlighting the relevant Class I area and the area within the 100-kilometer radius. The number next to the highlighted Class I area in Figure 4.1.12-2 corresponds to the number and Class I area listed in Table 4.1.12-5.

Table 4.1.12-5: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Mingo Wilderness Area	8,000	MO

Source: (USEPA, 2012a)

[a] The numbers correspond to the shaded regions in Figure 4.1.12-2.

4.1.13 Noise

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

4.1.13.1 Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2016b). 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.

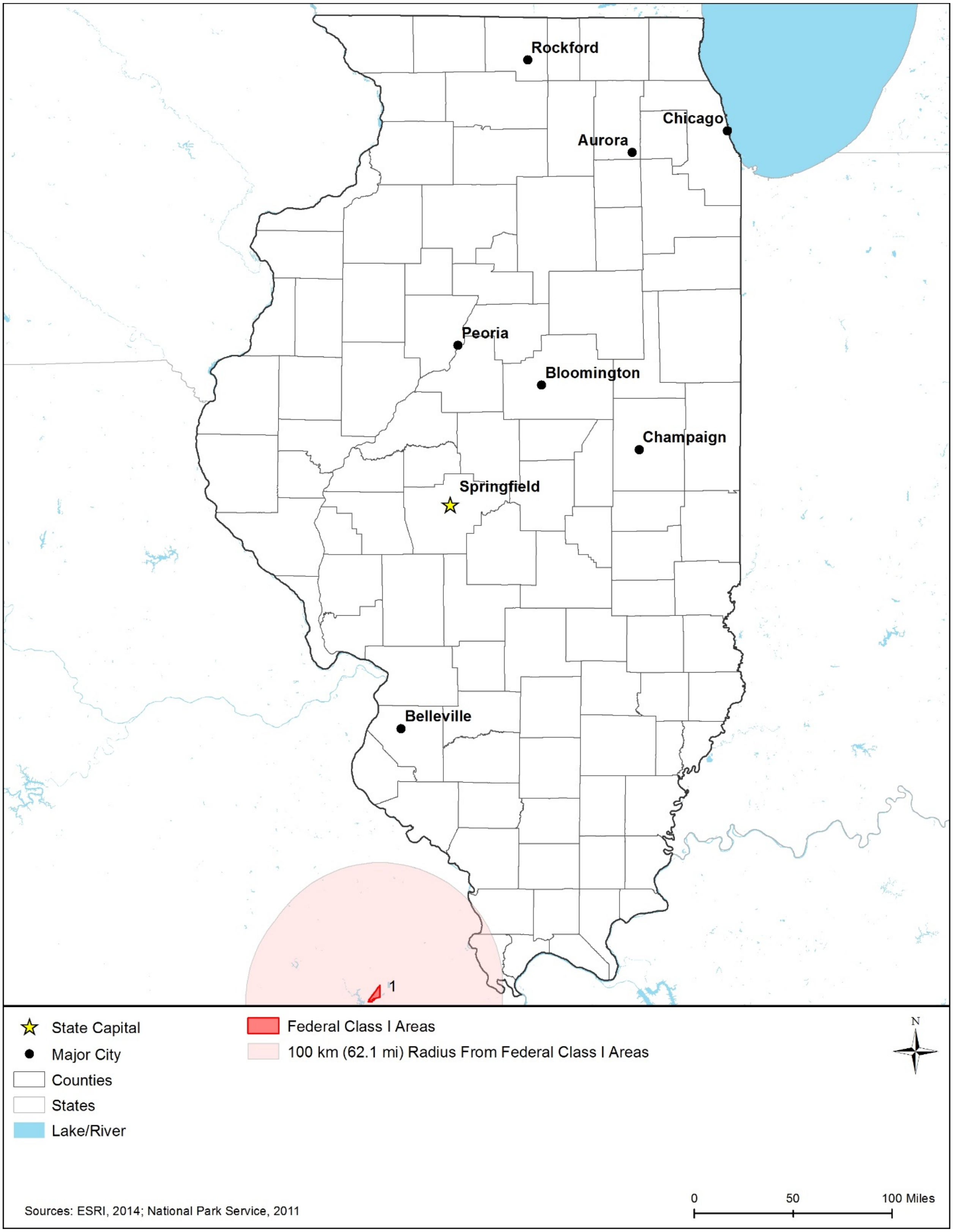


Figure 4.1.12-1: Federal Class I Areas with Implications for Illinois

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, 2015g). 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).

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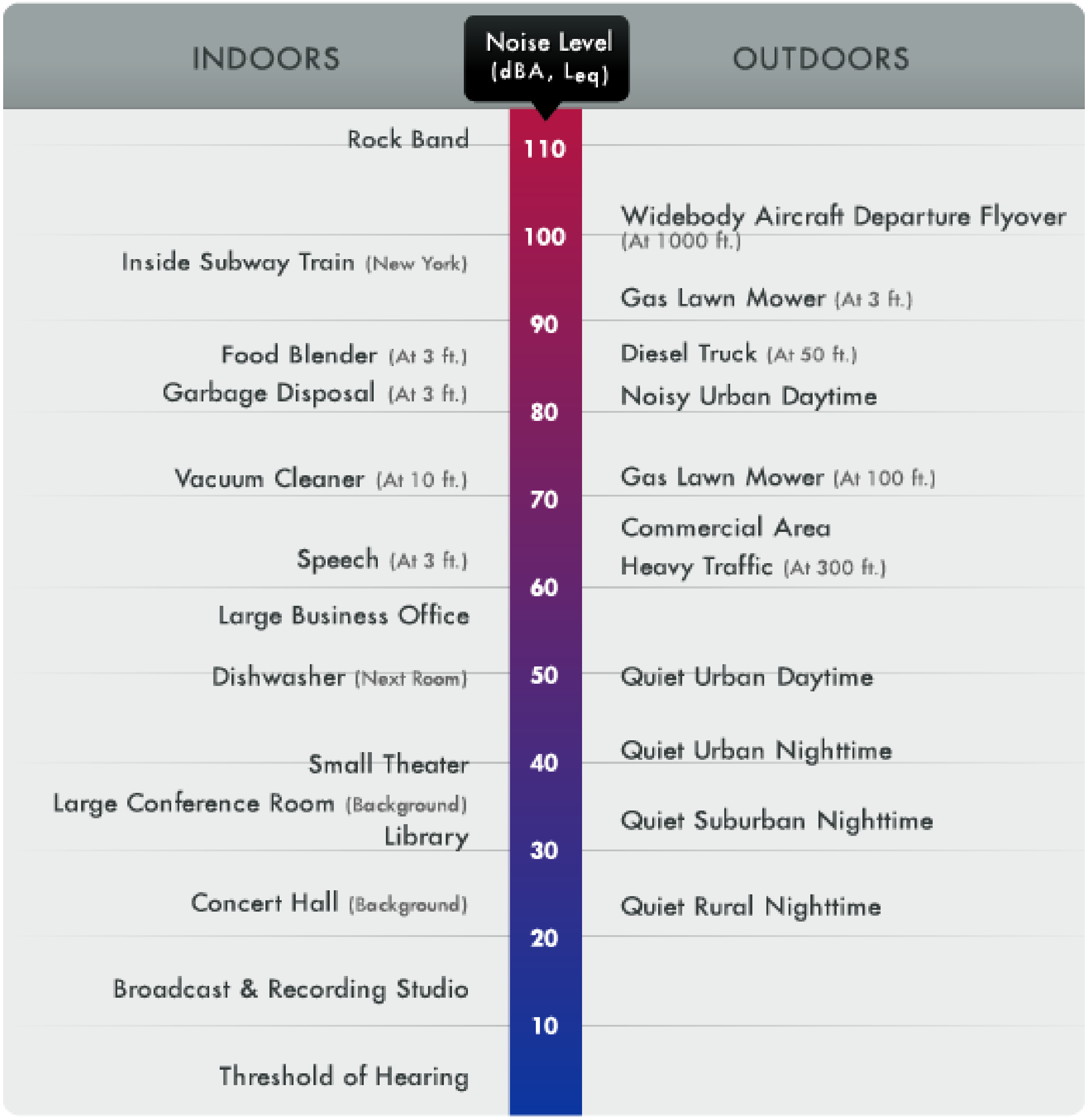
Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 2006):

- 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; and
- The changes in frequency characteristics or pressure levels through time.

Figure 4.1.13-1 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.



Prepared by: Booz Allen Hamilton

Figure 4.1.13-2: Sound Levels of Typical Sounds

Source: (Sacramento County Airport System, 2015)

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels is categorized as follows (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.

4.1.13.2 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.

Illinois has several statewide noise regulations, which are under the Illinois Compiled Statutes (ILCS) and Illinois Administrative Code. The Illinois General Assembly included noise in a list of sources of environmental damage that harms public welfare in Chapter 20 of the ILCS (3515/2). Table 4.1.13-1 provides a brief summary of specific regulations that may affect the Proposed Action.

Table 4.1.13-1: Relevant Illinois Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Administrative Code: Title 35, Section 901	Illinois General Assembly	Establishes maximum noise limits for the daytime and nighttime for property line noise sources.
Administrative Code: Title 35, Section 902	Illinois General Assembly	Establishes maximum noise limits for motor vehicles, including requirements for horns (902.124) and limitations on tire noise (902.125).

Source: (IPCB, 2013)

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 Chicago, Peoria, and Rockford, 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).

4.1.13.3 Environmental Setting: Ambient Noise

The range and level of ambient noise in Illinois varies widely based on the area and environment of the area. The population of Illinois can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 4.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Illinois may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Illinois. As such, this section describes the areas where the population of Illinois 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 Chicago, Peoria, and Rockford.
- **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 50 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 Illinois, Chicago O'Hare International Airport (ORD), Chicago Midway International Airport (MDW), General Downing-Peoria International Airport (PIA), and Quad City International Airport (MLI) have combined annual operations of more than 1,200,00 flights; ORD and MDW account for 1,100,000 of these annual flights (FAA, 2015h). These operations result in increased ambient noise levels in the surrounding communities. See Section 4.1.1, Infrastructure, and Figure 4.1.7-5 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. 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, 2015j). See Section 4.1.1, Infrastructure, and Figure 4.1.1-1 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 (FRA, 2015b). Illinois has multiple rail corridors with high levels of commercial and commuter rail traffic. Chicago serves as the hub for passenger rail services, with spoke routes extending from Chicago to Glenview,

Galesburg, Alton, and Carbondale. There are also a number of other rail corridors that join these major rail lines and connect with other cities (IDOT, 2015d). See Section 4.1.1, Infrastructure, and Figure 4.1.1-1 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, 2013b). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014c). Illinois has 1 national park and 18 National Natural Landmarks (NPS, 2014e). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 4.1.8, Visual Resources, and Figure 4.1.8-5 for more information about national and state parks for Illinois.

4.1.13.4 Sensitive Noise Receptors

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

4.1.14 Climate Change

4.1.14.1 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, 2012b). 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 (MT) of CO_2-equivalent (MT CO_2e[153]), which equalizes

[153] 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, 2015d).

for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the 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 4.2, 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 (including tropical storms, tropical cyclones, and hurricanes).

4.1.14.2 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. Illinois and the city of Chicago have established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 4.1.14-1, one executive order and the climate change action plan drafted by the City of Chicago are the primary policy drivers on climate change preparedness and GHG emissions.

Table 4.1.14-1: Relevant Illinois Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Executive Order 2006-11: EO on Climate Change and Greenhouse Gas Reduction (2006)	State of Illinois	On October 5, 2006, Governor Blagojevich announced a new global warming initiative, EO 2006-11, which created the Illinois Climate Change Advisory Group. The Group was tasked with creating the "Report of the Illinois Climate Change Advisory Group." The Report recommended a full range of policies and strategies to reduce GHG emissions in Illinois and made recommendations to the Governor. (IEPA, 2015p)
Chicago Climate Action Plan (2010)	City of Chicago	The Chicago Climate Action Plan describes the major effects of climate change on the city of Chicago, and suggests ways the city can address these challenges. The Plan outlines Chicago's GHG emission reductions by reducing 1) GHG emissions by 25 percent below 1990 levels by 2020 and 2) GHG emissions by 80% below its 1990 GHG emissions level by 2050. (Chicago Climate Task Force, 2015)

4.1.14.3 Illinois Greenhouse Gas Emissions

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, 2015e). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015l). 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, Illinois emitted a total of 230.2 million metric tons (MMT) of CO2 in 2013, with electric power being the highest emitter, consisting almost entirely of emissions from coal at 96.9 MMT. The transportation sector was the next-highest emitter at 61.6 MMT, almost entirely emissions from petroleum products with a small proportion of natural gas (Table 4.1.14-2) (EIA, 2015f). Annual emissions between 1980 and 2013 are presented in Figure 4.1.14-1 (EIA, 2015f). Illinois' CO_2 emissions from fossil fuels declined from 1980 to 1992 and then began to increase to a maximum of 243.0 MMT in 2005. After 2005, they began to fall gradually and intermittently until 2012, then increased in 2013 by almost 15 MMT. Emissions declines occurred in all sectors except industrial, where they have increased slightly in the last three years. The 2013 increase occurred in all sectors and in all fuel types. In 2013, Illinois was the fourth highest emitter of CO_2 in the U.S. (EIA, 2015g), and in 2013, Illinois was ranked 23rd in the U.S. for per capita emissions (EIA, 2015f).

Table 4.1.14-2: Illinois CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	96.9	Residential	25.8
Petroleum Products	76.9	Commercial	13.5
Natural Gas	56.4	Industrial	40.3
		Transportation	61.6
		Electric Power	89.0
TOTAL	**230.2**	**TOTAL**	**230.2**

Source: (EIA, 2015h)

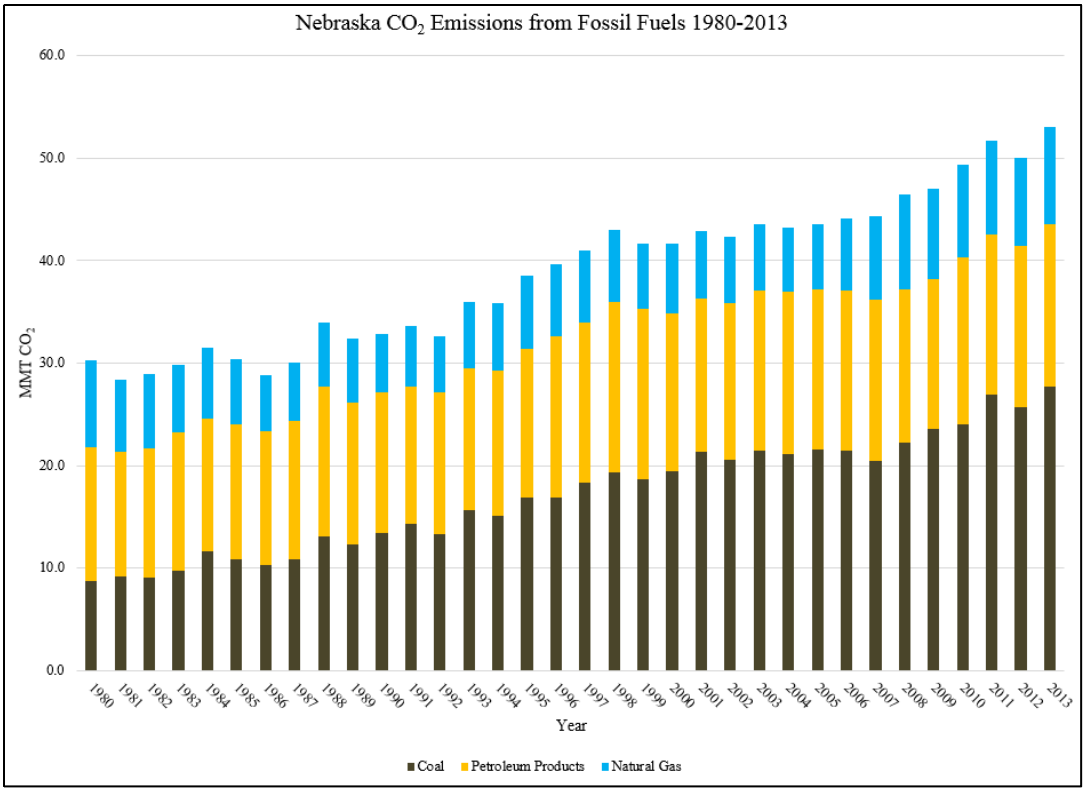


Figure 4.1.14-1: Illinois CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015h)

The majority of Illinois GHG emissions is CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly coal and a growing proportion of natural gas for heat and hot water in residential and commercial buildings. Other major GHGs emitted in Illinois are CH_4, hydrofluorocarbons, NOx, sulfur hexafluoride (SF_6) and perfluorocarbons. (EIA, 2015i)

Total U.S. GHG greenhouse were 6,673 million metric tons (14.7 trillion pounds) in 2013 (EPA 2015). Illinois does not maintain a statewide GHG inventory. However, in 2009, the Chicago Metropolitan Agency for Planning (CMAP) conducted a regional GHG inventory. The CMAP inventory focuses on Chicago, Illinois's largest city and one of the largest cities in the United States (CMAP, 2009). Electricity consumption emissions are based on "average emissions from all power plants in the North American Electric Reliability Council Region, as the Chicago area buys and sells its electric power in a regional power pool that includes plants outside the region."

In 2001, energy related emissions accounted for 65.7 percent of GHG emissions and then increased by 12.4 percent by 2005. A majority of these emissions were from electricity consumption at 43.4 percent and natural gas at 22.1 percent. However, because of new policies during this time period, natural gas emissions decreased, and electricity emissions increased. Changing policies and fluctuating weather patterns will continue to effect emission data. (CMAP, 2009)

The transportation sector continues to have a large impact on GHG emissions in Chicago. In 2005, on-road automobile emissions accounted for 95.2 percent of emissions in Chicago, which is a 3.4 increase from 2000. This trend also is seen with Chicago's vehicle miles traveled (VMT) where there was a 7.2 increase during the same period. This is likely a result of the continuously growing suburban population, particularly in Cook County. When including aviation emissions, the transportation sector accounts for 30.5 percent of total GHG emissions in 2005. (CMAP, 2009)

By 2040, Chicago emissions are estimated to increase 148.0 MMT CO2e. Policy changes and fluctuating weather patterns will continue to effect emission data. (CMAP, 2009)

4.1.14.4 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 characteristics (NWS, 2011a).

The majority of Illinois falls into climate group D (see Figure 4.1.14-2). Climates classified as D are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011b). In D climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NWS, 2011b). Winter months in D climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011b) (NWS, 2011c). Whereas the majority of Illinois falls into climate group D, areas of southern Illinois are within climate group C. Climates classified as C are generally warm, with "humid summers and mild winters" (NWS, 2011b). "During the winter, the main weather feature is the mid-latitude cyclone" (NWS, 2011b). There are also frequent thunderstorms during summer months. Illinois has two sub-climate categories, which are described in the following paragraphs.

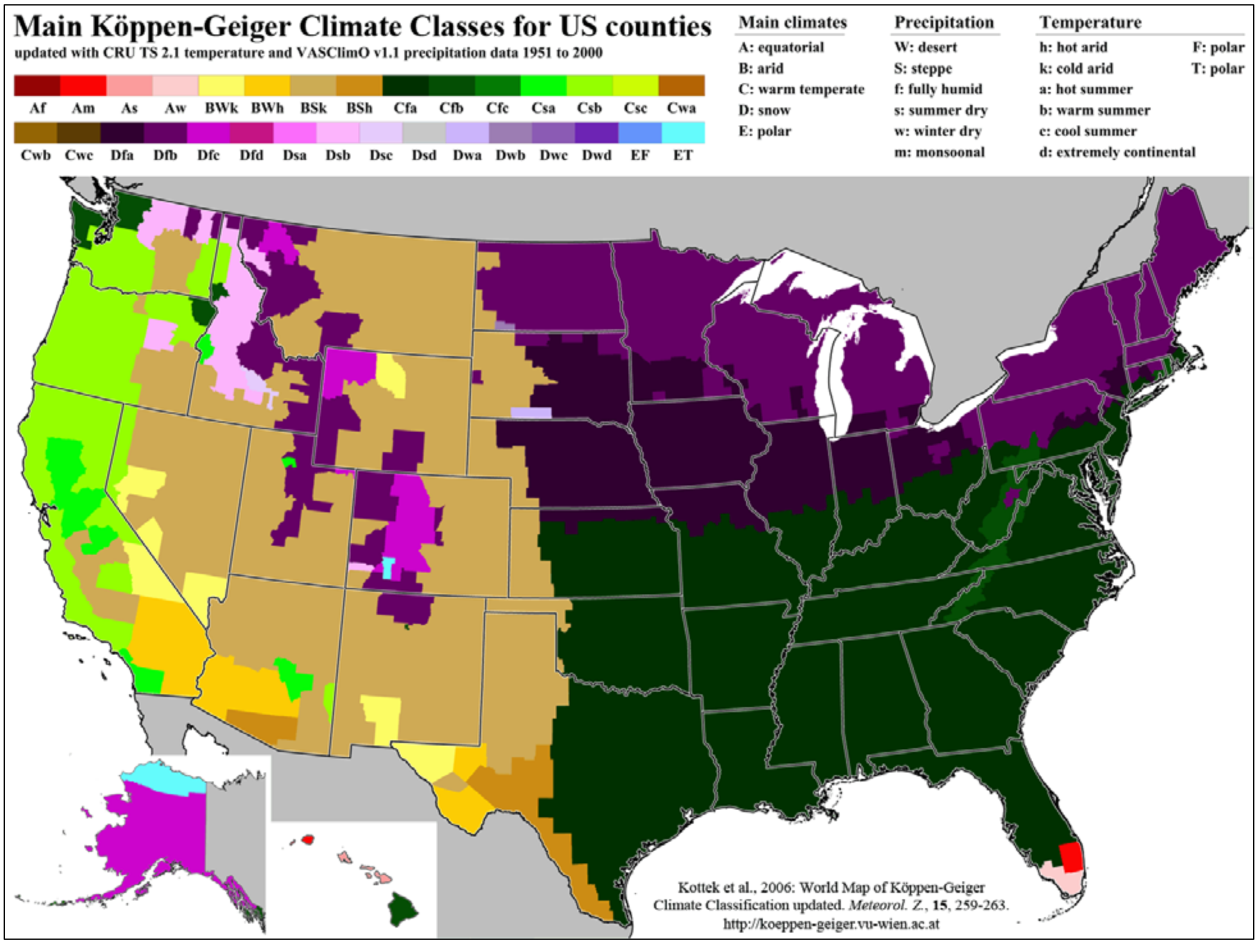


Figure 4.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, World Map of the Köppen-Geiger Climate Classification, 2006).

Cfa – The Köppen-Geiger climate classification system classifies areas of southern Illinois, such as Carbondale, as Cfa. Cfa climates are generally warm, with humid summers and mild winters. In this climate classification zone, the secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. In this climate classification zone, the tertiary classification indicates mild, hot summers with average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F. (NWS, 2011b) (NWS, 2011c)

Dfa – The Köppen-Geiger climate classification system classifies portions of northern and central Illinois, such as Chicago and Springfield, as Dfa. Climates classified as Dfa are characterized by warm and humid temperatures, with hot summers and precipitation occurring regularly throughout the year. In this climate classification zone, the secondary classification indicates substantial precipitation during all seasons. In this climate classification zone, the tertiary classification indicates hot summer months, with warmer temperatures averaging above 71.6 °F. (NWS, 2011b) (NWS, 2011c)

This section discusses the current state of Illinois' climate with regard to air temperature, precipitation, and extreme weather events (e.g., thunderstorms, flooding, and tornados) in Illinois' two climate regions, Cfa and Dfa.

Air Temperature

The climate in Illinois is controlled by five factors: weather systems, the sun, topography, Lake Michigan, and urban areas (Angel, 2015). Solar energy in Illinois is approximately three to four times greater in early summer months than in early winter months, resulting in warm summers and cold winters (Angel, 2015). The climate effects from varying topography, urban areas, and Lake Michigan "are of lesser significant because they influence local climate conditions, rather than conditions statewide" (Angel, 2015). Generally, the climate of Illinois is continental, "with cold winters, warm summers, and frequent short fluctuations in temperature, humidity, cloudiness, and wind direction" (Angel, 2015).

Average temperatures in Illinois range from 48 °F in northern regions of the state, to 58 °F in southern regions of the state. Temperature highs in Illinois range from 57 °F in northern regions of the state, to 67 °F in southern regions of the state. During winter months, temperatures range from 30 °F in the north, to the mid-40s in the south. During summer months, average high temperatures are in the 80s, while average low temperatures are in the 60s across Illinois. Spring and fall temperatures in Illinois are more moderate. (Angel, 2015)

In northern Illinois, 10 days out of the year typically average 90 °F or higher, compared to over 40 days in southern Illinois. Illinois rarely experiences days with temperatures that exceed 100 °F. In northern Illinois, 140 days out of the year typically average 32 °F or below, compared to 80 days in southern Illinois. Temperatures dropping to 0 °F or below occur approximately 16 days out of the year in northern Illinois, and only 2 days in southern Illinois. (Angel, 2015)

The highest temperature to occur in Illinois was on July 14, 1954 with a record of 114 °F (SCEC, 2015). The lowest temperature to occur in Illinois was on January 5, 1999 with a record of negative 36 °F (SCEC, 2015).

Cfa – Carbondale, located within southern Illinois, is within the climate classification zone Cfa. The average temperature in Carbondale is approximately 56.5 °F; 35.3 °F during winter months; 76.5 °F during summer months; 56.3 °F during spring months; and 57.4 °F during autumn months (NOAA, 2015b).

Dfa – Chicago, located in northern Illinois and along Lake Michigan, is within the climate classification zone Dfa. The average temperature in Chicago is approximately 49.9 °F; 26.4 °F during winter months; 71.8 °F during summer months; 48.6 °F during spring months; and 52.5 °F during autumn months (NOAA, 2015b). Springfield, located within central Illinois, is also within the climate classification zone Dfa. The average temperature in Springfield is approximately 53.0 °F; 29.4 °F during winter months; 74.2 °F during summer months; 53.1 °F during spring months; and 55.0 °F during autumn months (NOAA, 2015b).

Precipitation

Weather systems are the second leading factor to affect Illinois' climate. These systems create a wide "variety of weather conditions that occur almost daily as a result of varying air masses and passing storm systems" (Angel, 2015). For example, the polar jet stream is generally located in close proximity or over Illinois, particularly during fall, winter, and spring months. This area is generally the "focal point for the creation and movement of low-pressure systems characterized by clouds, winds, and precipitation" (Angel, 2015). Topography in Illinois also affects precipitation across the state. For example, "the Shawnee Hills extend across southern Illinois and have elevations 500 to 900 feet higher than the surrounding terrain (Angel, 2015). This slight topographic variation "is enough to increase annual precipitation by about 10 to 15 percent" (Angel, 2015).

Lake Michigan also influences precipitation in Illinois. For example, Lake Michigan increases cloudiness in the area and suppresses precipitation during summer months (Angel, 2015). In addition, "winter precipitation is enhanced by lake-effect snows that occur when winds blow from the north or northeast" (Angel, 2015). Winds generated over the lake "allow air to pass over the relatively warm lake, boosting storm system energy, and water content," leading to an increase in snowfall (Angel, 2015).

Average precipitation accumulations vary slightly across the state of Illinois. In southern Illinois, the average annual precipitation typically exceeds 48 inches, whereas the north typically receives less than 32 inches. In comparison, snowfall averages approximately 36 inches a year in the north and less than 10 inches in southern Illinois. Snowfall is heaviest in Chicago and the surrounding area due to the cities close proximity to Lake Michiana, and the "Lake Effect." (Angel, 2015)

In northern Illinois, measurable precipitation accumulation ranges from 110 days in the north, to under 100 days in the south. Northern Illinois typically receives an inch or more of precipitation 8 days out of the year, while southern Illinois receives an inch or more of precipitation 13 days out of the year. With regard to snowfall, northern Illinois typically receives an inch or more of snow 12 days out of the year, while southern Illinois receives an inch or more of snow only four days out of the year. The first inch of snow can fall typically occurs in November in northern areas, such as Chicago; southern areas typically do not see snowfall until December (Angel, 2015). The "average number of days with a measureable snow depth (1 inch or more) range from 60 days" in northwest Illinois, to 10 days in southwest Illinois (Angel, 2015). The greatest 24-hour precipitation accumulation to occur was on July 18, 1996 with a total of 16.91 inches (SCEC, 2015). The greatest 24-hour snowfall accumulation to occur was on February 28, 1900 with a total of 36 inches (SCEC, 2015). The greatest winter snowfall was in Antioch, between 1978 and 1979, with a total accumulation of 105.1 inches (Angel, 2015).

Cfa – Carbondale, located within southern Illinois, is within the climate classification zone Cfa. The average annual precipitation accumulation in Carbondale is approximately44.57 inches; 9.33 inches during winter months; 10.46 inches during summer months; 13.24 inches during spring months; and 11.54 inches during autumn months (NOAA, 2015b).

Dfa – Chicago, located in northern Illinois and along Lake Michigan, is within the climate classification zone Dfa. The average annual precipitation accumulation in Chicago is approximately 36.89 inches; 5.77 inches during winter months; 12.05 inches during summer months; 9.56 inches during spring months; and 9.51 inches during autumn months (NOAA, 2015b). Springfield, located within central Illinois, is also within the climate classification zone Dfa. The average annual precipitation accumulation in Springfield is approximately 37.43 inches; 6.15 inches during winter months; 11.64 inches during summer months; 10.38 inches during spring months; and 9.26 inches during autumn months (NOAA, 2015b).

Severe Weather Events

On average, Illinois experiences approximately 29 tornadoes annually, with roughly 63 percent of the annual average occurring during April and June. An average of four tornado-related fatalities occurs per year in Illinois (Angel, 2015). In addition to yearly tornadoes, Illinois also experienced "one of the worst tornadoes in U.S. history," the Tri-State tornado, which occurred on March 18, 1925 (Angel, 2009). This tornado passed through three states, including Missouri, Illinois, and Indiana, killing 695 and injuring 2,000 (Angel, 2009).

Severe thunderstorms also occur in Illinois, accounting for roughly 50 to 60 percent of the annual precipitation received in Illinois. In northeastern regions of Illinois, approximately 60 storms occur on average each year, while approximately 80 storms occur in southwestern regions of Illinois. Approximately half of all thunderstorms in Illinois occur between June and August (Angel, 2015). Severe cloud to ground lightning strikes also occur frequently in Illinois, with roughly five occurring per year in the northwest and 11 occurring per year in the southwest. In addition to heavy precipitation, thunderstorms produce severe hailstorms and large hailstones.

Flooding is the most damaging natural hazard that occurs Illinois (Angel, 2015). Since 1983, flood losses in Illinois amount to approximately $257 million, "the third highest in the nation". "Over a 45-year period (1955 to 1999), Illinois had $5.195 billion in flood losses; 74 percent of those loses have occurred since 1985." Furthermore, weather records indicate that precipitation has been increasing steadily since the 1940s, leading to increased flooding and flood peaks on the Illinois River (Angel, 2015). Approximately 20 to 30 deaths are attributed to floods, tornadoes, winter storms, and lightening each year in Illinois (Angel, 2015).

Varying precipitation patterns also extend clearly over time (Angel, 2015). For example, Illinois experienced "major multi-year droughts in the 1930s and 1950s," followed by "major prolonged wet periods during the 1970s and 1980s" (Angel, 2015). May and June are generally the wettest months in Illinois, while January and February are the driest. In addition, Illinois experiences rainstorms each year that produce 40 or more flash floods, each with four to eight inches of precipitation "in a few hours in localized areas" (Angel, 2015).

In 2013, record flooding occurred in areas along the Des Plaines and Illinois River. This flooding event was the result of "an unseasonably warm and moist air mass," which "brought widespread showers and thunderstorms to parts of northern and central Illinois from the later afternoon of April 17 through morning of April 18" (NWS, 2015a). Several thunderstorms "produced torrential rainfalls, major flash flooding and subsequent river flooding" (NWS, 2015a). In some of the most heavily impacted areas, between four and eight inches of rain was recorded, with "rates of up to 2 inches per hour" (NWS, 2015a). Illinois estimated approximately $375 million in damages (NWS, 2015a).

During another unprecedented flooding event, rainfall totals 300 to 400 percent greater than normal fell "during the spring and summer of 1993" (NWS, 2015a). This additional rainfall "over already saturated soils from the previous springs resulted in record flooding along the Mississippi River and many of its tributaries" (NWS, 2015a). Approximately $20 billion in damages we estimated in damages across nine states, including Illinois (NWS, 2015a).

Severe heat and cold waves are two other Illinois climate hazards with high death tolls. During the 1990s, Illinois "experienced two of its most deadly heat waves," which lead to 753 deaths (Angel, 2015). "Annually, 74 deaths are attributed to heat, and 18 deaths are attributed to cold, far exceeding deaths due to tornadoes, lightning, and floods" (Angel, 2015).

4.1.15 Human Health and Safety

4.1.15.1 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 vehicle traffic. Vehicle traffic and the transportation of hazardous materials and waste are evaluated in Section 4.1.1, Infrastructure.

4.1.15.2 Specific Regulatory Considerations

Federal organizations, such as the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (USEPA), the U.S. Department of Health and Human Services, and others protect human health and the environment. In Illinois, this resource area is regulated by the Illinois Department of Labor, Safety, Inspection, and Education Division (IDOL-SEID), and the IEPA. Federal occupational safety and health (OSH) regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. Illinois does not have an OSHA-approved "State Plan," so state and local government worker regulations are enforced at the state level by IDOL-SEID and at the federal level and private sector by OSHA. IDOL-SEID has adopted all OSHA standards, except for unique recordkeeping standards. (OSHA, 2015a) Public health is regulated by the Illinois Department of Public Health (IDPH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations. Table 4.1.15-1 below summarizes the major Illinois laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 4.1.15-1: Relevant Illinois Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Illinois Compiled Statutes (ILCS): Chapter 415, Part 5	Illinois Environmental Protection Agency (IEPA)	Establishes a statewide program under the Illinois Environmental Protection Act to prevent environmental harm that negatively affects public health and safety.
ILCS: Chapter 415, Part 75	Illinois Department of Public Health (IDPH)	Establishes the Environmental Toxicology Program to investigate potential threats to public health related to environmental exposure to hazardous substances, and assess associated effects.
ILCS: Chapter 430, Part 100	Illinois Emergency Management Agency (IEMA)	Establishes a comprehensive program for the disclosure of information about hazardous substances in the workplace and the community, and identifies IEMA as the authority for administering the Superfund Program.
ILCS: Chapter 820, Part 219	Illinois Department of Labor (IDOL)	Establishes the Division of Occupational Safety and Health, and identifies requirements under OSHA, including recordkeeping for all occupational injuries and illnesses.

4.1.15.3 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 waterbodies, and on communication towers. Tasks may also be performed at dangerous heights or in confined spaces while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring. 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, 2015b). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, the general public who may be observing the work or transiting the area (IFC, 2007).

Trenches and confined spaces – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work in trenches or confined spaces. Installation and maintenance of underground utilities in urban areas or utility manholes[154] are examples of when trenching or confined space work could occur. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width) would occur. Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics.

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.

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.

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 (IFC, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation 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 4.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and affect the public living in the vicinity, observing the work, or transiting through the area.

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

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

compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require use of potentially hazardous products (e.g., herbicides). Secondary hazardous materials (e.g., exhaust fumes) may be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. 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.

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.

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.

Telecommunication Worker Occupational Health and Safety

The U.S. Department of Labor, Bureau of Labor Statistics (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. Both telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), or 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 7,940 telecommunication equipment installers and repairers, and 3,450 telecommunication line installers and repairers (Figure 4.1.15-1) working in Illinois (BLS, 2015c). In 2013, the most recent year data are available, Illinois had 4 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013b).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). Illinois had two fatalities in the telecommunications equipment installers and repairers occupation in 2013 (BLS, 2015d). In the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 118 total fatalities in Illinois between 2003 and 2013, and 11 fatalities in 2014, with the highest fatality year being 2008, with 15 fatalities (BLS, 2015e).

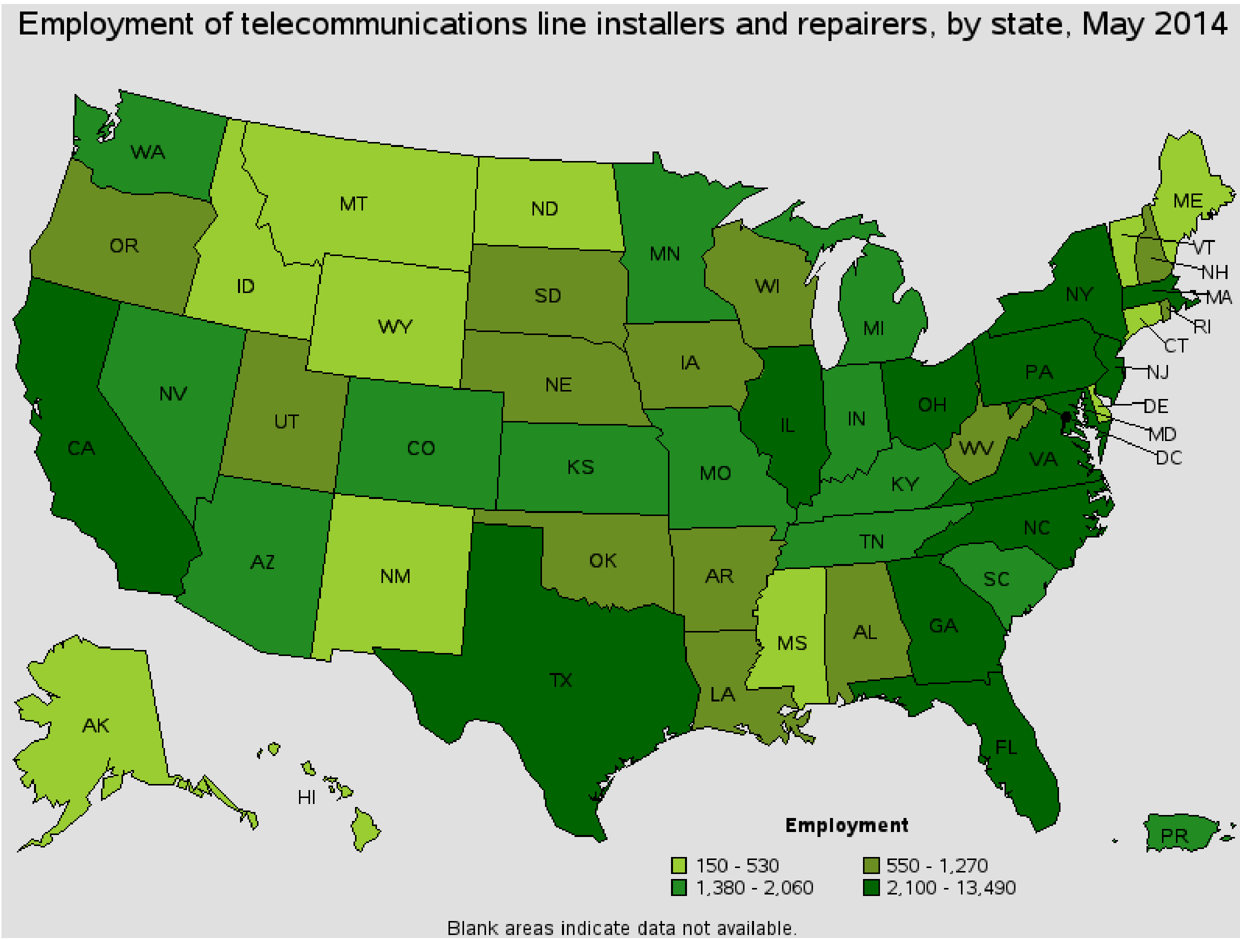


Figure 4.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015f)

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. IDPH collects aggregate mortality data among the general public through the Emergency Medical Services (EMS) Data Reporting System. While the EMS Data Reporting System cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with potential risks present during FirstNet deployment activities. For example, in 2007, the most recent data available, there were 692 unintentional fatal injuries due to falls, 135 due to exposure to smoke, fire, and flames, and 116 due to drownings (IDPH, 2007). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

4.1.15.4 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[155] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

In Illinois, the Federal Site Remediation Section (FSRS) administers the Superfund Program, and is managed by the IEPA Bureau of Land, Division of Remediation Management (IEPA, 2015q). As of October 2015, Illinois had 120 RCRA Corrective Action sites,[156] 1,053 brownfield sites, and 48 proposed or final Superfund/NPL sites (USEPA, 2015m). Based on a October 2015 search of USEPA Cleanups in My Community (CIMC) database, Illinois had five Superfund sites (Hegeler Zinc in Danville, IL; Matthiessen and Hegeler Zinc Company in La Salle, IL; Mobil Mining and Minerals Co. in Depue, IL; Outboard Marine Corporation (OMC) Waukegan in Waukegan, IL; and Ottawa City Landfill in Ottawa, IL) and no RCRA Corrective Action sites where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists (USEPA, 2015n).

Municipalities and private parties may enroll in a variety of programs administered by the IEPA Office of Brownfields Assistance (OBA), including the Municipal Brownfields Grant Program, the Illinois Brownfields Redevelopment Loan Program, the Brownfields Cleanup Revolving Loan Fund, the Underground Storage Tank Fund, and the Environmental Remediation Tax Credit, to fund brownfield site assessments and cleanup activities (IEPA, 2015r). One example of a brownfield redevelopment site is the 18-acre CMC Heartland site, located along the Pecatonica River in Freeport, IL. This former railroad yard was leased for a variety of land uses since the late 1800s, including lumber yards, coal businesses, stockyards, and bulk petroleum distributors. The site received $600,000 in USEPA grants to fund cleanup activities, which were completed in 2007, removing 6 underground storage tanks and 1,425 cubic yards of

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

[156] Data gathered using USEPA's CIMC search on October 14, 2015, for all sites in Illinois, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013c).

contaminated soils. CMC Heartland is now part of a 28.3-mile trail development project, enhancing pedestrian, and bicycle connections within the community. (USEPA, 2010c)

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 October 2015, Illinois had 1,109 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2013, the most recent data available, Illinois released 124.0 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from utilities, hazardous waste/solvent recovery, and metals industries. This accounted for 3.03 percent of nationwide TRI releases, ranking Illinois 8 of 56 states and territories based on total releases per square mile. (USEPA, 2014c)

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 12, 2015, Illinois had 282 major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015o).

The National Institute of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 4.1.15-2 provides an overview of potentially hazardous sites in Illinois.

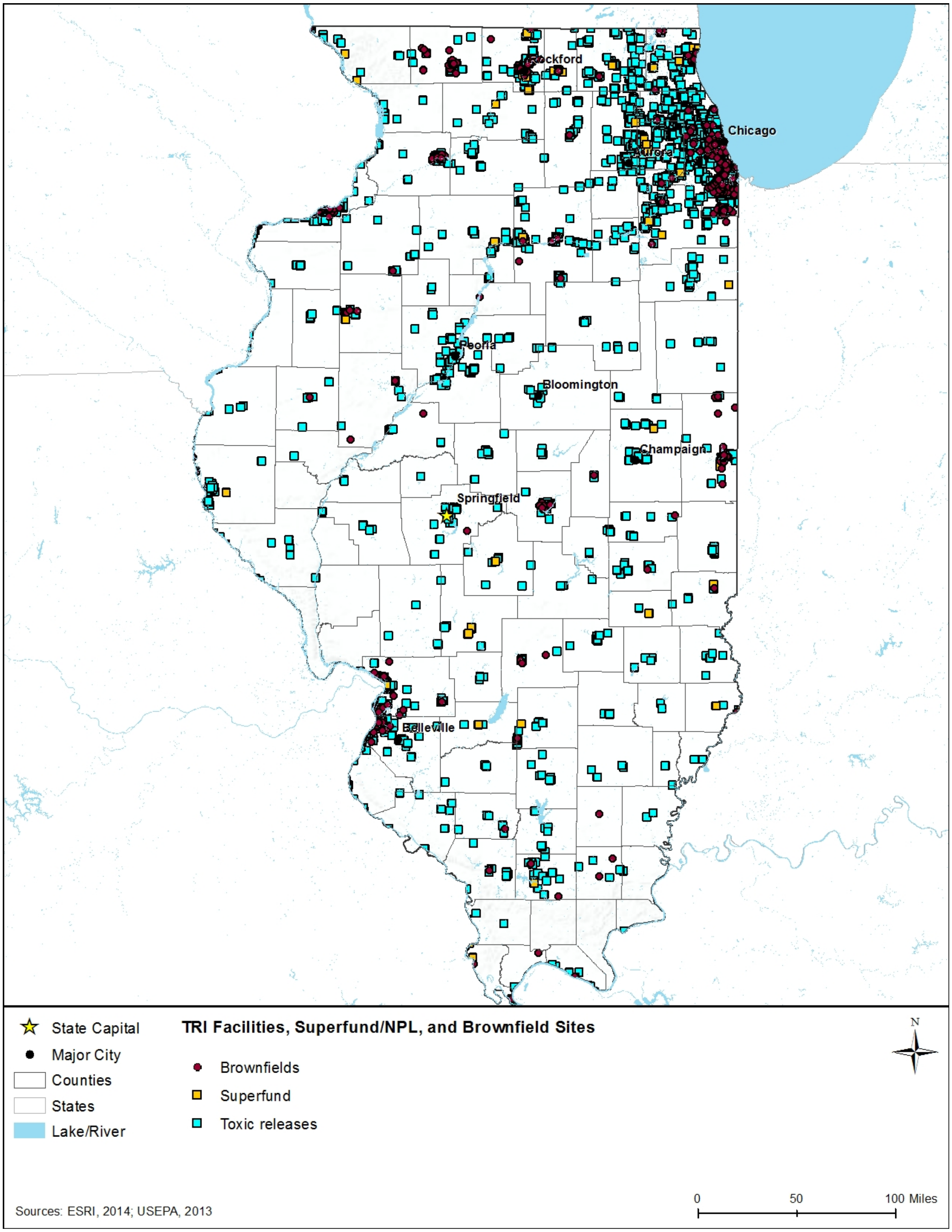


Figure 4.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Illinois (2013)

Source: (NIH, 2015b)

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 waterbodies. 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 are 89 USEPA-regulated telecommunications sites in Illinois (USEPA, 2015p). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, Illinois had two occupational fatalities in 2013 within the telecommunications equipment installers and repairers occupation (SOC code 49-2022), both from fires and explosions, and no fatalities within the telecommunications industry or telecommunications occupations from exposure to "harmful substances or environments" (BLS, 2015d). By comparison, the BLS reported three fatalities in 2011 and three fatalities[157] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015g). In 2014, BLS also reported four 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).

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 IDPH partners with the federal Agency for Toxic Substances and Disease Registry (ATSDR) and USEPA as part of the Toxicology Program to provide health assessments and consultations that identify and assess human exposure risks at contaminated sites (IDPH, 2015b). Public health assessments, consultations, and advisories that have been developed under the IDPH Toxicology Program for Illinois waste sites are publicly available through the ATSDR website (CDC, Agency for Toxic Substances & Disease Registry, 2015). At the federal level, the Center for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical

[157] 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).

contaminants, chronic diseases, and conditions based on geography. As of September 2015, Illinois had no reported injuries or fatalities due to reported acute toxic substance release incidents (CDC, 2015).

Spotlight on Illinois Superfund Sites: Outboard Marine Corporation (OMC) Waukegan

OMC Waukegan is a 100-acre site on the shore of Lake Michigan in Waukegan, IL, used to manufacture outboard boat motors. The site was also used by EJ&E Railway to treat railroad ties and by North Shore Gas Company for coal gasification and coke production. Primary contaminants from OMC include PCBs from hydraulic fluids in Waukegan Harbor, and trichloroethylene (TCE) from degreasers in the groundwater. Railroad and coal activities added tars, creosote, arsenic, ammonia, and phenol to the soil and groundwater. In 2002, the City of Waukegan purchased the property after OMC declared bankruptcy and abandoned the site. (NSF, 2015)

Cleanup at the site is divided into four parcels: Waukegan Harbor, the former Waukegan Manufactured Gas and Coke Plant (WCP), three PCB soil containment cells, and the 1,000,000-square-foot OMC Plant 2 building. In 2013, USEPA completed dredging in Waukegan Harbor to remove 124,244 cubic yards of PCB-contaminated sediments (Figure 4.1.15-3). At WCP, thousands of tons of contaminated soil were removed in 2005, and groundwater monitoring remains in effect since 2008. The PCB containment cells were filled in 1992, and are routinely monitored for leaching. Demolition at the OMC Plant 2 building was completed in 2010, and contaminated soil was either excavated or contained. An air-sparge groundwater treatment system was installed in 2011 to remove TCE contamination with continual operation for at least 15 years. Health and safety risks at the site include ingestion or contact with contaminated soil, sediment, and groundwater. (NSF, 2015)

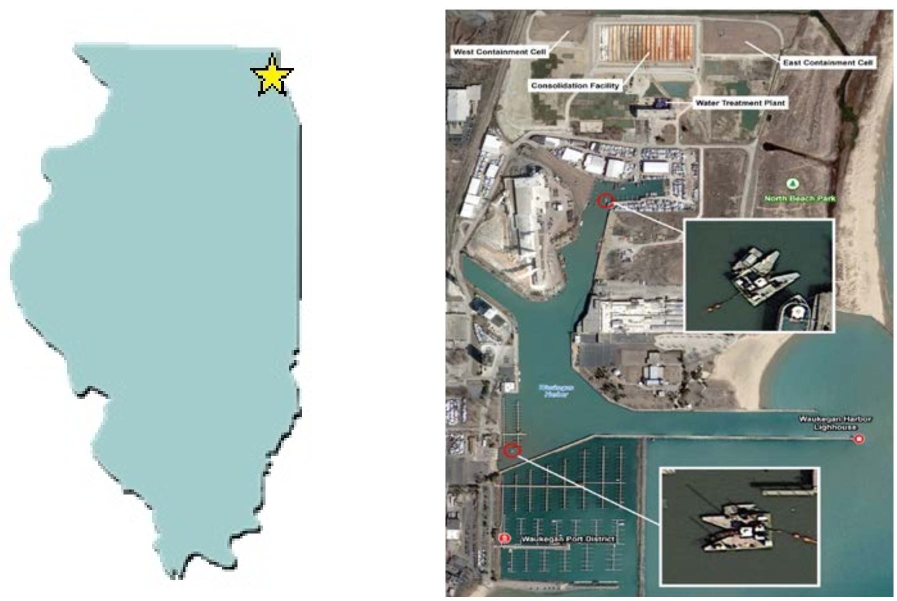


Figure 4.1.15-3: Active Harbor Dredging Operations at OMC Waukegan

Source: (NSF, 2015)

4.1.15.5 Environmental Setting: Abandoned Mine Lands at or near Telecommunications Sites

Another health and safety hazard in Illinois includes surface and subterranean mines. In 2015, the Illinois mining industry ranked 14th for non-fuel minerals (primarily sand and gravel, crushed stone, Portland cement, and tripoli), generating a value of $1.22M (USGS, 2014h). In 2013, the most recent data available, Illinois ranked 8th in coal production in the United States, behind Indiana, with 33 coal mining operations (20 underground and 13 surface) (EIA, 2013). Health and safety hazards at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015).

At the state level, the Illinois Department of Natural Resources (IDNR), Office of Mines and Minerals, Abandoned Mined Land Reclamation Division administers the Abandoned Mine Reclamation Program, and is responsible for managing AML health and safety hazards resulting from pre-1977 coal mining operations. As of 2015, an estimated 7,780 acres of AML-eligible lands and waters still exist in Illinois, which contain significant problems and are in need of reclamation (IDNR, Office of Mines and Minerals, Abandoned Mined Land Reclamation Division, 2015). Figure 4.1.15-4 shows the distribution of High Priority (Priority 1, 2, and adjacent Priority 3) AMLs in Illinois, 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, Illinois had 1,323 Priority 1 and 2 AMLs, with 358 unfunded problem areas. (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015a)

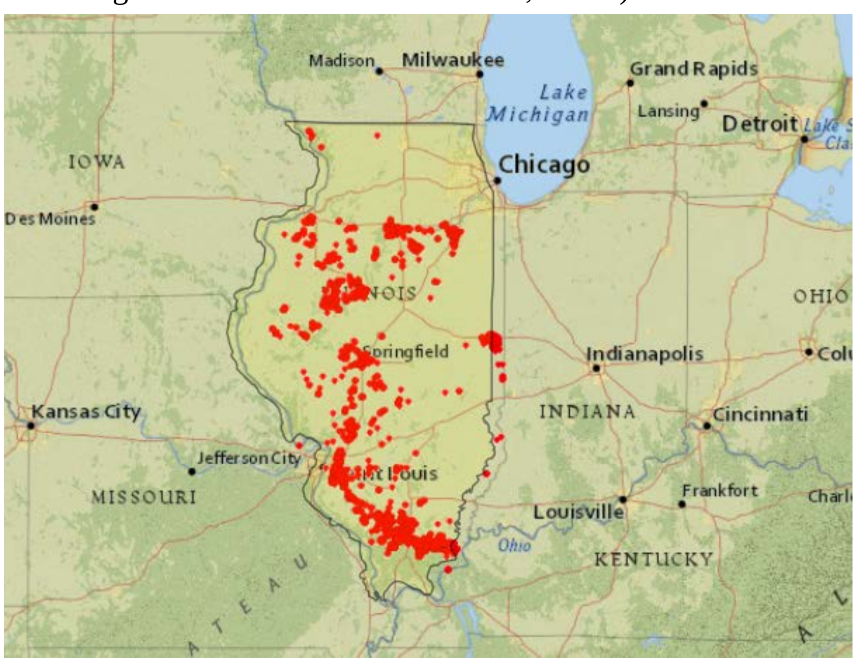


Figure 4.1.15-4: High Priority Abandoned Mine Lands in Illinois (2015)

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

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.

Additionally, telecommunications sites may be on or near AMLs or coalmine 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

Subterranean coalmines 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, coalmine 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, 2015c).

4.1.15.6 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.

Currently, IDOL-SEID 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 469 NRC-reported incidents for Illinois in 2015 with known causes, seven incidents were attributed to natural disaster (e.g., natural phenomenon), while 462 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). For example, during the February 2014 winter weather, the extreme cold froze a sensor line at a compressor station, releasing natural gas near Tuscola, IL (USCG, 2014). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural and manmade disasters.

Spotlight on Illinois Natural Disasters: 2013-2014 Winter Weather

Illinois experienced 11 major winter storms during the 2013-2014 season, nearly double the amount in average winters. By the end of the season, Illinois had 28 fatalities due to extreme cold exposure, ranking it the deadliest winter in 25 years and the fourth coldest winter on record. Snowfall amounts were 2 to 3 times above average, ranging from 20 to 80 inches statewide. (IEMA, 2014a) On January 6, 2014, statewide low temperatures created one of the coldest days of the season, averaging around 15º below, with wind chills of 44º below in Bloomington, IL (NWS, 2015c). Emergency crews responding to heavy snowfall and extreme cold in early January included 3,700 full- and part-time Illinois Department of Transportation (IDOT) employees, 400 Illinois Tollway employees, 58 IDNR Conservation Police Officers, more than 30 Illinois Army National Guard mechanics, and countless police, fire, emergency medical technicians, and volunteers (IEMA, 2014b).

On February 20, 2014, a powerful storm system compounded existing winter conditions, generating several tornadoes in central Illinois, with an EF-2 (111 to 135 miles per hour [mph]) impacting Montgomery, Christian, and Shelby Counties. The tornado recorded wind speeds of 115 mph and wind gusts of 45 to 55 mph during this cold front. Flooding from rapid snowmelt further affected the area (NWS, 2015c).

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. Between 2008 and 2014, Illinois had more extreme cold weather fatalities than any other state. In 2014, Illinois had 21 extreme cold fatalities of 23 total weather-related fatalities (NWS, 2014). By comparison, 384 weather-related fatalities were reported nationwide the same year, 43 from extreme cold (NWS, 2015b).

4.2 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action Alternative provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance 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.

4.2.1 Infrastructure

4.2.1.1 Introduction

This section describes potential impacts to infrastructure in Illinois associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 19, Best Management Practices and Mitigation Measures, discusses Best Management Practices (BMPs) and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.1.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 4.2.1-1. As described in Section 4.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

4.2.1.3 Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., Illinois Departments of Transportation, airport authorities, and railway companies) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 4.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Table 4.2.1-1: Impact Significance Rating Criteria for Infrastructure

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

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

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

NA = Not Applicable

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

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of 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 4.2.1-1, 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 4.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to 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

Public safety network communications in Illinois reflect a combination of legacy VHF, UHF, and radios operating across multiple frequencies bands as well as a statewide digital P25 network called STARCOM21 (State of Illinois, 2014b). There are approximately 3,800 commercial towers in Illinois (FCC, 2015b). Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would likely 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.[158] Anticipated impacts would be less than significant due to the limited extent and temporary nature of the deployment. Commercial telecommunication systems, communications, or level of service are anticipated to be less than significant, per the impact significance criteria presented in Table 4.2.1-1.

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

The Illinois Commerce Commission oversees public utilities such as electric, water, and sewage companies. Among their responsibilities are the activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. In addition, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States.

4.2.1.4 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.

[158] 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.

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, 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.

  - 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: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shore 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 that could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities 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 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, and 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: Deployable technologies such as Cell on Wheels (COWs), Cell on Light Trucks (COLTs), and System on Wheels (SOWs) are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that 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 rights-of-way (ROWs) and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

- In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 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 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 result as explained above, although these potential impacts would be expected to be minor and temporary.

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.

4.2.1.5 Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[159]

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 if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. 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 avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other

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

infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. These impacts are expected to be less than significant.

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 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 inspection occurs off of established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts could occur to transportation systems or utility services.

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 4.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

4.2.2 Soils

4.2.2.1 Introduction

This section describes potential impacts to soil resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.2.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 4.2.2-1. As described in Section 4.1.2, 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 4.2.2-1: 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

4.2.2.3 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 Illinois and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Soils with the highest erosion potential in Illinois include those in the Aqualfs, Aquepts, Aquolls, Arents, Psamments, Saprists, Udalfs, Udepts, and Udolls suborders, which are found throughout most of the state (see Section 4.1.2.6, Soil Erosion and Figure 4.1.2-23).

Based on the impact significance criteria presented in Table 4.2.2-1, building of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. Furthermore, deployment sites that are large-scale or adjacent to other construction sites (i.e., cumulatively large-scale sites) could result in long-term erosion that might not be reversed for several years.

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 as practicable and feasible, to avoid or minimize impacts and minimize the periods when exposed soil is open to precipitation and wind.

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 4.2.2-1, and due to the relatively small scale (less than 1 acre) of most FirstNet project sites. Potential impacts could be further minimized by implementing BMPs and Mitigation Measures (see Chapter 19).

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Heavy equipment could cause perceptible compaction and rutting of susceptible soils. Implementation of BMPs and mitigation measures could help to minimize any impacts.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 4.1.2.4, Soil Suborders). The most compaction susceptible soils in Illinois are Aqualfs, Aquolls, Psamments, and Saprists. These suborders constitute approximately 17 percent of Illinois' land area,[160] and are found primarily in northeastern parts of the state (Figure 4.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 4.2.2-1, 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.

4.2.2.4 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 development 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 Points of Presence (POPs), 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 likely 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

[160] 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 NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. 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 due to the temporary and small-scale 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.

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 small-scale nature of operation 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.

4.2.2.5 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. 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 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 due to the small-scale nature of operation 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 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 4.1.2, Soils.

4.2.3 Geology

4.2.3.1 Introduction

This section describes potential impacts to Illinois geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.3.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 4.2.3-1. As described in Section 4.2, 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.

4.2.3.3 Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

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 4.1.3.8, areas of greatest seismicity in Illinois are concentrated in the southern portions of the state (Figure 4.1.3-5). However, Illinois is at risk to damaging earthquakes (greater than magnitude 6.3 on the Richter scale) due to its proximity to the New Madrid Seismic Zone, which includes portions of Illinois, Missouri, Kentucky, Tennessee, and Arkansas, and the Wabash Valley Seismic Zone in southeastern Illinois (IEMA, 2013b). Given the potential for minor to moderate earthquakes in parts of Illinois, some amount of infrastructure be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts. Based on the impact significance criteria presented in Table 4.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones.

Volcanic Activity

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

Table 4.2.3-1: 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	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**
Resources impacts	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 4.1.3.8, the potential for widespread landslides in Illinois is minimal, with the exception of areas along the Illinois and Mississippi Rivers. Based on the impact significance criteria presented in Table 4.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts; 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 disturbances[161] to the landscape or heavy precipitation events both increase the likelihood of landslide events in Illinois. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Illinois's major cities, including Peoria, are in an area that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts. Based on the impact significance criteria presented in Table 4.2.3-1, potential impacts to landslide potential from deployment or operation of the Proposed Action would have less than significant impacts; 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.

Land Subsidence

As discussed in Section 4.1.3.8 and shown in Figure 4.1.3-7, portions of Illinois vulnerable to land subsidence due to karst topography include the southwestern portion of the state. Based on the impact significance criteria presented in Table 4.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts, however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography or located in mining areas. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas of karst topography or where mine collapse is possible. However, given that karst topography exists in many counties throughout the state, some amount of infrastructure may subject to landslide hazards, in which case BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

As discussed in Section 4.1.3.7, the state is ranked second nationwide in the production of sand and gravel. Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these

[161] Large-scale human disturbances.

resources. Based on the impact significance criteria presented in Table 4.2.3-1, impacts to mineral and fossil fuel resources are unlikely as the Proposed Action could only be potentially significant if the FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would likely avoid construction in areas where these resources exist.

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 4.2.3-1 impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 4.1.3.6., fossil-bearing formations of note in Illinois are predominantly found in the Mazon Creek Area Deposits, south of Chicago (Figure 4.1.3-4). Potential impacts to fossil resources should be considered on a site-by-site basis, and BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 4.2.3-1, 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 less than significant, because they are not likely to require removal of significant volumes of terrain. When ground disturbance is required, BMPs and mitigation measures (see Chapter 19) could be implemented to help avoid or minimize the potential impacts.

4.2.3.4 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 geological resources, 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 disturbing activity.
- 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 POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic resources including marine paleontological resources. However, where landings and/or facilities on shore or the banks of water bodies that accept the 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 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 removal of bedrock or mineral and fuel resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale. These impacts are expected to be less than significant due to the small-scale 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.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant. 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.

4.2.3.5 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 temporary and small-scale 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.

Operation Impacts

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

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant. 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 4.2.3, Geology.

4.2.4 Water Resources

4.2.4.1 Introduction

This section describes potential impacts to water resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.4.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 4.2.4-1. As described in Section 4.2, 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.

Table 4.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, (Safe Drinking Water Act (SDWA).	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		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
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.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	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

4.2.4.3 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 403(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.

More than half of Illinois's rivers and streams that were evaluated are impaired (see Table 4.2.4-1 and Figure 4.1.4-2). Lake Michigan is an area of concern according, due mainly to contamination from polychlorinated biphenyls, mercury and pathogens, and exceedances for total phosphorus from stormwater and wastewater discharges and urban development of the Chicago area (IEPA, 2014a).

Deployment activities could contribute to water quality impacts, including increased sediment in surface waters. Vegetation removal onsite 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 NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would likely not violate applicable state, federal (e.g., CWA, SDWA), or 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 4.2.4-1, water quality impacts would likely be less than significant and could be further reduced if BMPs and mitigation measures (see Chapter 19) 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[162] or tower construction 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 or as required by a dewatering permit may need to be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most Illinois aquifers, there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking water quality violation, or otherwise substantially degrade groundwater quality in an aquifer, and based on the impact significance criteria presented in Table 4.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance of flooding. Some Proposed Action activities 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 4.2.4-1, 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

[162] 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).

deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[163] 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.

Implementation of BMPs and mitigation measures could reduce any 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 4.2.4-1, 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 onsite 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 and mitigation measures could be implemented to further reduce any potentially significant impacts.

[163] 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, 2016d).

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 4.2.4-1. 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 but 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 offsite or into surface waterbodies 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 and mitigation measures could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 4.1.4.7, over one billion gallons of groundwater is used in Illinois each day for drinking water, power generation, agriculture, and industry. Generally, the water quality of aquifers in east central Illinois are suitable for drinking and daily water needs. Groundwater availability is most prevalent in Illinois' major river valleys and northern third of the state where one or more principal aquifers reside. 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 in groundwater or aquifer characteristics include:

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

- Use of pesticides, herbicides, or insecticides during or after construction of commercial, industrial, or recreational use.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities would likely have less than significant impact as 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.

4.2.4.4 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, attached to satellites launched for other purposes, or 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 not impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. If trenching were 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 and mitigation measures 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. 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.

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 could include water quality impacts, which would be less than significant due to the temporary and small-scale nature of deployment activities. BMPs that could help mitigate or reduce any potential impacts are described in Chapter 19.

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. 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.

4.2.4.5 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 those activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of potential impact depends on the land area affected, installation technique, and location. Implementing the BMPs and mitigation measures identified in Chapter 19 could further avoid or reduce potential impacts. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be less than significant impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.4, Water Resources.

4.2.5 Wetlands

4.2.5.1 Introduction

This section describes potential impacts to wetlands in Illinois associated with deployment and operation of the Proposed Action and alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.5.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 4.2.5-1. As described in Section 4.2, 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.

Table 4.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
degradation (spills or sedimentation)	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect effects:[2] change in function(s)[3] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (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.

4.2.5.3 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).

The main type of wetlands in Illinois is palustrine (freshwater) wetlands found across the state. There are more than 1.2 million acres of palustrine wetlands throughout Illinois (USFWS, 2015a), as shown in Figure 4.1.4-4 and Figure 4.1.4-5.

Based on the impact significance criteria presented in Table 4.2.5 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.

As discussed in Wetlands, Section 4.1.5.4, Illinois contains four sites designated as Wetlands of International Importance under the Ramsar Convention. If any of the proposed deployment activities were to occur in these high quality wetlands, potentially significant impacts could occur. High quality wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands. To assist with avoidance, all wetlands (as shown in Figure 4.1.4-4 and Figure 4.1.4-5 in Water Resources, Section 4.1.4.3), are high quality wetlands. BMPs and mitigation measures (see Chapter 19) could be implemented to help 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 4.2.5-1, 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) could cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality 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, 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 Illinois 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:[164] Changes in Function(s)[165] 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, 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 Illinois that could potentially be impacted from construction-related deployment activities include:

- Flood Attenuation: Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they can lower flood peaks by providing detention of storm flows. Correspondingly, 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 can 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.

[164] 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.

[165] 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.

According to the significance criteria defined in Table 4.2.5-1, 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 there are only four sites designated as Wetlands of International Importance in Illinois, deployment activities could have less than significant indirect impacts on wetlands in the state. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands.

In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that could be analyzed on a case-by-case basis. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to wetlands.

4.2.5.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

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

Activities Likely to Have No Impacts

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

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

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures 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 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 wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and/or indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, 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, or blimps, piloted aircrafts could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. See Chapter 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 further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing other potential direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are not expected to be significant as it is anticipated that such herbicide applications would be intermittent and likely use a minimal amount of herbicides. 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 further avoid or minimize potential impacts.

4.2.5.5 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. 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 further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance 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. Site maintenance, including mowing or herbicides, I anticipated to result in less than significant effects to wetlands, depending on the proximity to, wetland type, and amount of herbicides used. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on wetlands, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.5, Wetlands.

4.2.6 Biological Resources

4.2.6.1 Introduction

This chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Illinois associated with deployment and operation of the Proposed Action and its alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.6.2 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 4.2.6-1. As described in Section 4.2, 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 4.2.6.3, 4.2.6.4, and 4.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 4.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Illinois.

Table 4.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct 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 Illinois for at least one species. Anthropogenic[a] 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 Illinois 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances 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 Illinois 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	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: 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 Illinois 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 Illinois 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 Illinois.		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

[a] 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, 2016f)

NA = Not Applicable

4.2.6.3 Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Illinois 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 4.2.6-1, 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. Areas near Chicago and Lake Michigan have experienced extensive land use changes from urbanization, while the remaining portions of the state have experienced land use changes from agriculture.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, if proposed sites with sensitive or rare regional vegetative communities are unavoidable, BMPs and mitigation measures help to minimize 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 Illinois Noxious Weed Law (505 ILCS 100/1) stipulates that the IDA be responsible for the establishment of the statewide noxious weed list and updates to that list, as necessary. In addition, the Act further stipulates that each county is responsible for implementing and enforcing noxious weed management through a county control authority. The state of Illinois also regulates exotic weeds under the Exotic Weed Law (525 ILCS 10/1-10/5).

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. Illinois regulates and attempts to control more than 25 invasive plant species under the state's Noxious Weed Law (505 ILCS 100/1) and Exotic Weed Act (525 ILCS 10/1-10/5), including invasive terrestrial forbs, grasses, and scrubs, and one aquatic species. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse (USFWS, 2012d).

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 and mitigation measures could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including 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, 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,[166] 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

[166] 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. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
  - 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. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
  - 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 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 or the banks of water bodies that accept the submarine cable 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. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
  - 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 abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the small-scale 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.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects to terrestrial vegetation from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant. 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.

<u>Deployment Impacts</u>

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, management, and monitoring 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 be 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 4.1.6.3, Terrestrial Vegetation.

4.2.6.4 Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Illinois (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 4.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Illinois. 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, 2015k). 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 the amount of 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, 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 Illinois 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 potentially 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

Illinois' amphibian and reptile species occur in a wide variety of habitats throughout the state. Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Illinois 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 Chicago and Lake Michigan have experienced extensive land use changes from urbanization, while the remainder of the state has experienced land use changes.

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 Illinois' wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Illinois and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., 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., foxes, woodchuck, beaver) 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 protected under the MBTA. The USFWS and the IDNR 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 locations, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[167] 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 stopovers (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Illinois' amphibians and reptiles typically consist of wetlands and, in some cases the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 19) could help to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 4.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on Illinois' amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[168]

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 4.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

[167]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.
[168] See Section 4.2.5, 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, et al., 1997).

The majority of FirstNet deployment activities would be short-term in nature; therefore, repeated disturbances would likely not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, 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 Illinois' amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals (e.g., white-tailed deer) 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 (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[169] 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. Implementation of 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 Illinois undertake some of the longest-distance migrations of all animals. Illinois is within the Mississippi Flyway. Covering the entire state of Illinois, the Mississippi Flyway spans from the Gulf of Mexico to the Canadian boreal forest. According to the Illinois chapter of the National Audubon Society (NAS), a total of 91 IBAs have been identified in Illinois. These IBAs, which cover approximately 885,000 acres, are widely distributed throughout the state, although the largest concentrations of IBAs in the Chicago region around Lake Michigan and the southern tip of Illinois near the confluence of the Ohio and Mississippi Rivers (NAS, 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 Illinois. 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 (IDNR, 2015z). Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, Berven and Grudzien (Berven & Grudzien, 1990) found that a small percentage of juvenile wood frogs could 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 and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

[169] A location chosen by an animal for hibernation.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Illinois' 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 white-tailed deer, has the potential to negatively affect body condition and reproductive success of mammals in Illinois. For example, white-tailed deer 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, 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 spotted turtle leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. Illinois has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select terrestrial wildlife species. IDNR maintains a list of injurious species presented in IAR 805. Invasive insects also pose a large threat to Illinois' forest and agricultural resources. Insect pests and plant diseases are regulated under the 505 ILCS 90.

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 species are not expected to be introduced at project sites from machinery or laborers during deployment operations.

Potential invasive species effects to Illinois' wildlife are described below.

Terrestrial Mammals

As noted in Section 4.1.6.4, Terrestrial Wildlife, feral swine adversely impact several native large and small mammals in Illinois (IDNR, 2015aa). They also feed on reptiles and amphibians, destroy native vegetation, and could carry/transmit disease to livestock and humans. 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. 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 plant or pest species are not expected to be introduced at project sites from machinery or laborers during deployment operations.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in Illinois; 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 in particular pose a large threat to Illinois' forest and agricultural resources. Species such as the gypsy moth, hemlock woolly adelgid, Asian longhorn beetle, and emerald ash borer are of particular concern in Illinois and are known to cause irreversible damage to native forests (USDA, 2015b). 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) could help to avoid or minimize 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 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.

<u>Activities with the Potential to Have Impacts</u>

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. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 shore or the banks of water bodies that accept the submarine cable could potentially impact wildlife (see Section 4.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and/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. For a discussion of radio frequency emissions and potential impacts, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews. Impacts are anticipated to be less than significant due to the small-scale 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.

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. Impacts are anticipated to be less than significant due to the small-scale nature of operation 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 wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

<u>Deployment Impacts</u>

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 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

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 due to the temporary and small-scale nature of operation 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 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 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 4.1.6.4, Terrestrial Wildlife.

4.2.6.5 Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Illinois 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, 2012c).

Based on the impact significance criteria presented in Table 4.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

BMPs and mitigation measures 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 under the Manguson-Stevens Fisheries Conservation Management Act (MSFCMA) or other 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 due to the small-scale nature of deployment activities, and BMPs and mitigation measures to protect water resources (see Section 4.2.4, 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. 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 plant species are not expected to be introduced at project sites from machinery or laborers during deployment operations, 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.

<u>Activities Likely to Have No Impacts</u>

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to 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 if 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 development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 could, 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 on shore or the banks of water bodies that accept the submarine cable could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. 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 fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation, indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the temporary and small-scale 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.

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 invertebrates 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 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.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant due to the temporary and small-scale 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.

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, management, and monitoring. The impacts could vary greatly among species and geographic region but they are still expected to remain less than significant due to the small-scale nature of operation 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 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 4.1.6.5, Fisheries and Aquatic Habitats.

4.2.6.6 Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Illinois 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. 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.

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 4.2.6-2. 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 4.2.6-2: 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.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	No Effect
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012c).

Based on the impact significance criteria presented in Table 4.2.6-2, any direct injury or mortality of a listed species at the individual-level could be potentially significant as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Illinois are described below.

<u>Terrestrial Mammals</u>

Direct mortality or injury to the federally listed Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and Northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to these species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (NYSDEC, 2015). 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.

<u>Birds</u>

Three federally listed birds are known to occur within Illinois; they include the piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and least tern (*Sterna antillarum*). All three are found along shorelines and are rare in Illinois. Depending on the project type and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. If proposed project sites are unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed amphibians or reptiles occur in Illinois. Therefore, no injury or mortality effects to federally threatened and endangered reptiles or amphibian species are expected as a result of the Proposed Action.

Fish

The pallid sturgeon (*Scaphirhynchus albus*) may be found in the Mississippi River. Direct mortality or injury to the endangered pallid sturgeon species from entanglements resulting from the Proposed Action are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

There are 15 invertebrate federally listed species in Illinois, 14 listed as endangered and 1 listed as threatened. Additionally, Illinois has 1 candidate invertebrate species, the Rattlesnake-master Borer Moth. Ten of these species are mussels found in rivers in various parts of the state; they include clubshell mussel (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), Higgin's eye pearlymussel (*Lampsilis higginsii*), Hine's emerald dragonfly (*Somatochlora hineana*), Illinois cave amphipod (*Gammarus acherondytes*), Iowa Pleistocene snail (*Discus macclintocki*), Karner blue butterfly (*Lycaeides melissa samuelis*), orange-foot pimpleback (*Plethobasus cooperianus*), pink mucket pearlymussel (*Lampsilis abrupta*), and rabbitsfoot (*Quadrula cylindrica cylindrical*). The remaining species include Hine's emerald dragonfly (*Somatochlora hineana*), Illinois cave amphipod (*Gammarus acherondytes*), Iowa Pleistocene snail (*Discus macclintocki*), Karner blue butterfly (*Lycaeides melissa samuelis*), and rattlesnake-master borer moth (*Papaipema eryngii*). Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Distribution of these species is varied throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

Nine federally listed plants occur in Illinois; they are decurrent false aster (*Boltonia decurrens*), Eastern prairie fringed orchid (*Platanthera leucophaea*), lakeside daisy (*Hymenoxys herbacea*), leafy prairie-clover (*Dalea foliosa*), Mead's milkweed (*Asclepias meadii*), Pitcher's thistle (*Cirsium pitcher*), prairie bush-clover (*Lespedeza leptostachya*), Price's potato-bean (*Apios priceana*), and small whorled pogonia (*Isotria medeoloides*). Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. In general, distribution of these species is very limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Illinois are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Birds

The piping plover is the only federally listed bird species that could nest in Illinois. The piping plover nests on open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers (USACE, 1988). The majority of FirstNet deployment activities would not occur on beaches or saltmarshes; therefore, impacts to these bird species are not anticipated. Noise, light, or human disturbance within nesting areas could cause piping plovers to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed amphibians or reptiles occur in Illinois. Therefore, no reproductive effects to federally threatened and endangered reptiles or amphibian species are expected as a result of the Proposed Action.

Fish

Deployment activities in the Mississippi 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 4.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality could cause stress resulting in lower productivity for federally listed mollusks known to occur in Illinois. Impacts to wild lupine, the staple food for Karner blue butterflies (*Lycaeides melissa samuelis*) when they are caterpillars (USFWS, 2008a), 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Illinois are described below.

Terrestrial Mammals

Noise associated with the installation of cables could affect mammal migration patterns, though impacts are likely to be short-term. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, the red knot 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 Illinois. 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, may affect, but are not likely to adversely affect federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed reptiles or amphibians are found in Illinois. Therefore, no behavioral effects to federally threatened and endangered reptile or amphibian species are expected as a result of the Proposed Action.

Fish

Changes in water quality could impact food sources for the pallid sturgeon. Further, increased human disturbance, noise, and vessel traffic could cause stress to pallid sturgeon causing them to abandon spawning locations or altering migration patterns. 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.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mollusks resulting in lower productivity. Disturbances to wild lupine, especially during the breeding season, in areas known to have Karner blue butterflies could impact survival. 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.

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. In some cases, although unlikely to occur, large-scale impacts could diminish the functions and values of the habitat, while in other cases small-scale changes could lead to potential adverse effects. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in Illinois are described below.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Illinois. 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 Illinois. 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.

Reptiles and Amphibians

No designated critical habitat occurs for reptiles or amphibians in Illinois. 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 Illinois. 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

Of the 15 federally listed invertebrates, 2 of them have designated critical habitat in Illinois, the Hine’s emerald dragonfly and rabbitsfoot mussel. Almost 3,000 acres of critical habitat for the Hine’s emerald dragonfly has been designated along the Des Plains River in Will, Cook, and DuPage counties in the northeastern part of Illinois (USFWS, 2010a). Critical habitat for rabbitsfoot mussel is in the Ohio River, North Fork Vermillion River, and Middle Branch North Fork Vermillion River. In addition, critical habitat designation was recorded in 2015 at 31 stream segments where the mussels are known to occur (USFWS, 2015v).

Land clearing, excavation activities, and other ground disturbing activities in these regions of Illinois could lead to habitat loss or degradation, which could lead to adverse effects to the Hine’s emerald dragonfly and rabbitsfoot 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

No designated critical habitat occurs for plants in Illinois. 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 affect 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 impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened 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 impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of effects that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential 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 shore or the banks of water bodies that accept the submarine cable could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 4.2.4, 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, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely to adversely affect protected species, due to the temporary and small-scale nature of deployment activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 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.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further 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.

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

<u>Operational Impacts</u>

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that operational activities are not likely to adversely effect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. The impacts can vary greatly among species and geographic region. 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.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 4.1.6.6, Threatened and Endangered Species and Species of Concern.

4.2.7 Land Use, Recreation, and Airspace

4.2.7.1 Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.7.2 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 4.2.7-1. As described in Section 4.2, 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 4.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation 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 Mitigation 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 Mitigation 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

4.2.7.3 Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of 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 4.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 4.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale and 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 4.2.7-1, 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 4.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 4.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage as drones, balloons, and piloted aircrafts would likely only be deployed in an emergency and for a short period of time. FirstNet would not likely impact airspace resources.

4.2.7.4 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.
        - Land Use: See Activities Likely to Have Impacts below.
        - Recreation: See Activities Likely to Have Impacts below.
        - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on Federal Aviation Regulations (FAR) 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 4.1.7.5 Obstructions to Airspace Considerations).
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
        - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
        - Recreation: See Activities Likely to Have Impacts below.
        - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace.
    - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
        - Land Use: See Activities Likely to Have Impacts below.
        - Recreation: See Activities Likely to Have Impacts below.

    - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
    - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
    - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore or the banks of water bodies that accept the 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 or near 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 4.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 4.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: See Activities Likely to Have Impacts below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COWs, COLTs, SOWs) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet AGL or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 4.1.7.5 Obstructions to Airspace Considerations.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact 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.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: Installation of fiber optic cable in existing conduits occurs in previously disturbed areas, which may include areas used for recreational purposes. It is possible that access to recreational lands or activities may be restricted during the deployment phase or a portion of the operations 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 rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.

    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in bodies of water and the constructing landings and/or facilities on shore or the banks of water bodies that accept the submarine cable.
    - Land Use: Deployment activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore or the banks of water bodies that accept the submarine cable could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: No impacts are anticipated – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
    - Airspace: No impacts are anticipated – see previous section.
- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration

of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.

- Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets 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 in proximity to one of Illinois'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.

- 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 Illinois 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, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace could include obstructions to airspace or affect flight profiles and operating parameters of SUAs/MTRs. 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 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 4.2.8, 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. Impacts are anticipated to be less than significant due to the temporary and small-scale nature of operation 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.

4.2.7.5 Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected. Also, implementation of deployable technologies could result in less than significant impacts to airspace if deployment does trigger any obstruction criterion or result in changes to flight patterns and airspace restrictions. 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 and small-scale nature of operation 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 4.10, Land Use, Recreation, and Airspace.

4.2.8 Visual Resources

4.2.8.1 Introduction

This section describes potential impacts to visual resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.8.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 4.2.8-1. As described in Section 4.2, 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 4.2.8-1: 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.

4.2.8.3 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 Illinois, residents and visitors travel to Chicago 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 4.2.8-1, 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 4.2.8 1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term could 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, as defined in Chapter 19, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

4.2.8.4 Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure.

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of 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 in or 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 or the banks of water bodies that accept the submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime 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, although certain discrete locations could have potentially greater impacts to night skies or as a result of new towers. 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 no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the National Park Service (NPS) to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit.

4.2.8.5 Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant. 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 4.1.8, Visual Resources.

4.2.9 Socioeconomics

4.2.9.1 Introduction

This section describes potential impacts to socioeconomics in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.9.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 4.2.9-1. As described in Section 4.2, 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 4.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to spending, income, industries, and public revenues.
	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

4.2.9.3 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 Tax 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 Affected Environment, property values vary considerably across Illinois. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $238,000 in the greater Chicago area, to just over $90,000 in the Decatur area. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to Changes in pending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet 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 contractors 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 Illinois. The average unemployment rate in 2014 was 7.1 percent, higher than the national rate of 6.2 percent. County-level unemployment rates were highly variable across the state. Most of the greater Chicago area had unemployment rates above the national rate. Rates above and below the national rate were fairly evenly distributed across counties through the remainder of Illinois.

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 4.2.9-1 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.

4.2.9.4 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 they 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 4.2.9-1.

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 – 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.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas.

Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:

    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts could be avoided or mitigated through the BMPs and mitigation measures described in Chapter 19.

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 are also potential concerns 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 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.

4.2.9.5 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 of 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, but important at a larger scale, although less than significant based on the significance criteria table.

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. The potential adverse impacts of new wireless communication towers on property values would be avoided under the Deployable Technologies Alternative. 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 while small individually, would be important at a larger scale, although 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. 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 4.1.9, Socioeconomics.

4.2.10 Environmental Justice

4.2.10.1 Introduction

This section describes potential impacts to environmental justice in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.10.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 4.2.10-1. As described in Section 4.2, 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 4.2.10-1: 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

4.2.10.3 Description of Environmental Concerns

Effects Associated with Other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, “Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment” (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). See Socioeconomics Environmental Consequences for additional discussion. The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are both “adverse” and “disproportionately high” in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences.

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 4.1.10.4) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 4.1.10.3, Environmental Setting:

Minority and Low-Income Populations, the population of Illinois has higher percentages of minorities than the region, and similar percentages to the nation. The state's poverty rate is the same as that of the region, and lower than that of the nation. The distribution of areas with moderate potential or high potential for environmental justice populations is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. Notable concentrations of high potential within the largest population concentrations occur in the southeastern Chicago area (Illinois portion) and the west side of the St. Louis area (Illinois portion). Further analysis using the data developed for the screening analysis in Section 4.1.10.4, 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, 2015g; USEPA, 2016c).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

4.2.10.4 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 on shore or the banks of water bodies that accept the submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise, and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. 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.

4.2.10.5 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. 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. 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 4.1.10, Environmental Justice.

4.2.11 Cultural Resources

4.2.11.1 Introduction

This section describes potential impacts to cultural resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.11.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 4.2.11-1. As described in Section 4.2, 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 4.2.11-1: 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 area of potential effect (APE).		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect**[1]	**Effect, but Not Adverse**	**No Effect**
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[1] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/Tribal Historic Preservation Office (THPO) and other consulting parties, including Indian tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's 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.

4.2.11.3 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 4.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout Illinois, some deployment activities may be in these areas, in which case BMPs (see Chapter 19) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 19, BMPs and Mitigation Measures).

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.

4.2.11.4 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 POPs, 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 result of the construction of landings and/or facilities on shore or the banks of water bodies that accept the submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits are frequently associated with bodies of water), 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 Illinois City 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. 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.

4.2.11.5 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. 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 not adverse to historic properties associated with implementation/running of the deployable technology because effects to access or the viewshed could occur, depending on the length of deployment. 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.

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 4.1.11, Cultural Resources.

4.2.12 Air Quality

4.2.12.1 Introduction

This section describes potential impacts to Illinois's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.12.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Illinois's air quality were evaluated using the significance criteria presented in Table 4.2.12-1. As described in Section 4.2, 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 Illinois's air quality addressed in this section are presented as a range of possible impacts.

Table 4.2.12-1: Impact Significance Rating Criteria for Illinois

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

4.2.12.3 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. Areas exist in Illinois that are in maintenance or nonattainment for one or more criteria pollutants (Figure 4.1.12-1) (see Section 4.1.12, Air Quality).

Based on the significance criteria presented in Table 4.2.12-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Illinois; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout Illinois (Figure 4.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

4.2.12.4 Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points; however, this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with 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 or the banks of water bodies that accept the submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If 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. 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.

4.2.12.5 Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

4.2.13 Noise

4.2.13.1 Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Illinois. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.13.2 Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 4.2.13-1. As described in Section 4.2, 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 Illinois addressed in this section are presented as a range of possible impacts.

Table 4.2.13-1: 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.

4.2.13.3 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 4.2.13-1, 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.

4.2.13.4 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 increases in noise levels from the use of heavy equipment and machinery.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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 or the banks of water bodies that accept the submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft) 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. 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 similar to several of the deployment activities related to 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 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.

4.2.13.5 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 have a cumulative impact of potential significance. 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 would likely be deployed to areas with low amounts of existing facilities, so noise impacts would be minimal in these 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 to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

4.2.14 Climate Change

4.2.14.1 Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Illinois associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.14.2 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 4.2.14-1. 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, 2015q), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the Proposed Action is more general. In addition to the consideration of climate change’s effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 4.2.14-1: 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

4.2.14.3 Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high). By mid-century under a high emissions scenario, the total number of hottest days (days above 95 ºF) is projected to increase by mid-century (2041 – 2070) as compared to a 1971 – 2000 baseline in the Midwest with the number of hottest days increasing by 5 to 25 plus days per year in Illinois depending on the region of the state. Additionally, much of the Midwest is projected to observe a longer frost-free season by mid-century as compared to a 1971 – 2000 baseline, where a frost-free season is defined as the period between the last occurrence of 32 °F in the spring and the first occurrence of 32 °F in the fall. In Illinois, the frost-free season under a high emissions scenario may extend greater than 25 days longer than the baseline years. (USGCRP, 2014a)

The northeast corner of Illinois borders Lake Michigan. The Great Lakes have recorded higher water temperatures and less ice cover as a result of changes in regional climate. Lake surface temperatures are projected to rise by as much as 7 °F by 2050 and 12.1°F by 2100. Higher temperatures, increases in precipitation, and lengthened growing seasons favor production of blue-green and toxic algae that could harm water quality and aquatic life. (USGCRP, 2014a)

Air Temperature

Figure 4.2.14-1 and Figure 4.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Illinois from a 1969 to 1971 baseline.

Dfa **–** Figure 4.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the entire state of Illinois under a low emissions scenario would increase by approximately 4 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of Illinois would increase by approximately 6 °F. (USGCRP, 2009a).

Figure 4.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F in the entire state. Under a high emissions scenario for the period (2080 to 2099) in the majority of the Dfa region of Illinois, temperatures would increase by 10 °F with a smaller portion of the region’s temperatures increasing by approximately 9 °F. (USGCRP, 2009a).

Cfa **–** Temperatures in this region are expected to increase under a low emissions scenario by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Dfa region under both low and high emissions scenarios.

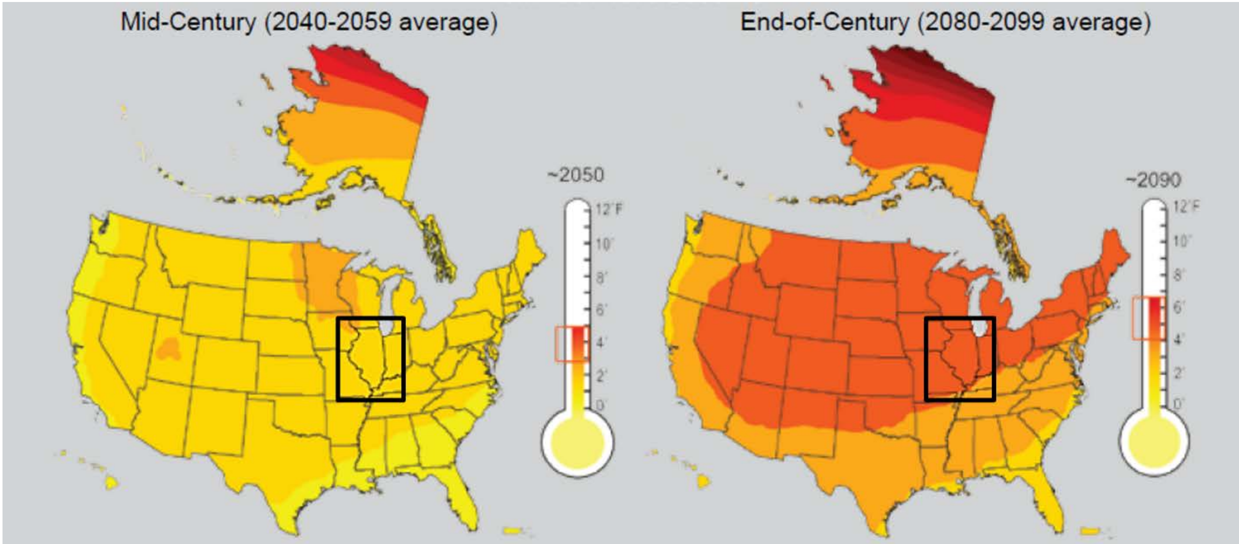


Figure 4.2.14-1: Illinois Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009a)

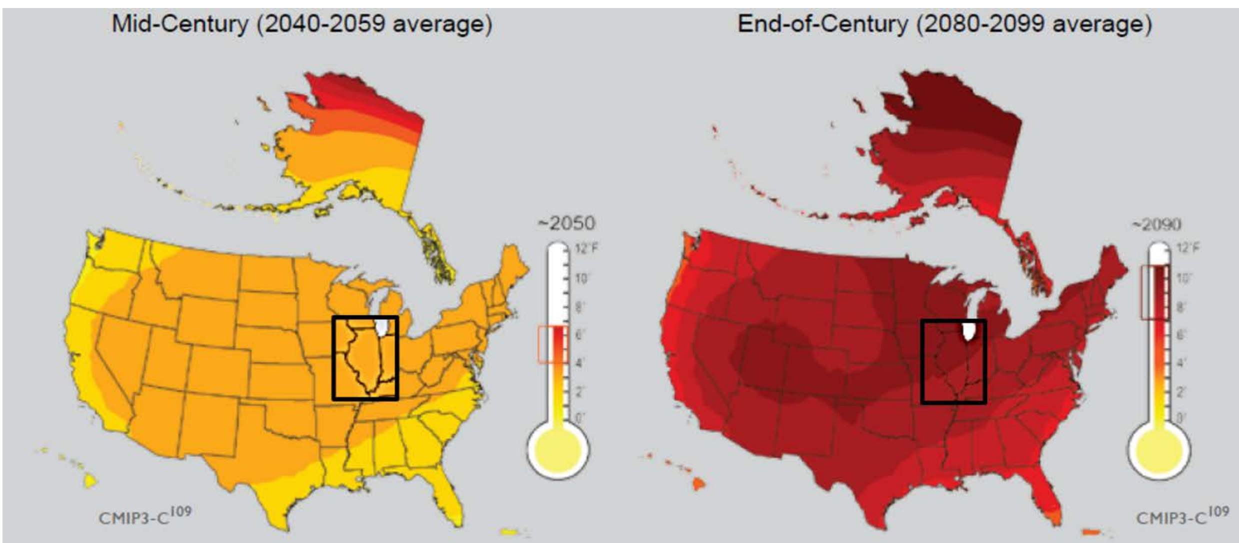


Figure 4.2.14-2: Illinois High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009a)

Precipitation

Precipitation in the Midwest is greatest in the east, declining towards the west. Precipitation occurs about once every seven days in the western part of the region and once every three days in the southeastern part. The 10 rainiest days could contribute as much as 40 percent of total precipitation in a given year. Annual precipitation increased in the Midwest during the past century, with much of the increase driven by intensification of the heaviest rainfalls. This tendency towards more intense precipitation events is projected to continue in the future. (USGCRP, 2014a)

Snowfall varies across the region, comprising less than 10 percent of total precipitation in the southern portion of the Midwest, to more than half in the northern portion of the Midwest, with as much as two inches of water available in the snowpack at the beginning of spring melt in the northern reaches of the river basins. When this amount of snowmelt is combined with heavy rainfall, catastrophic, widespread flooding could occur. Trends towards a decline in the frequency of high magnitude snowfall, but an increase in lake effect snowfall have been observed. These divergent trends and their inverse relationships with air temperatures make overall projections of regional impacts of the associated snowmelt extremely difficult. Flooding could also occur due to extreme precipitation in the absence of snowmelt. These warm-season events are also projected to increase in magnitude in the future. (USGCRP, 2014a)

Figure 4.2.14-3 and Figure 4.2.14-4 present 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 4.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 4.2.14-4 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).

Dfa - Figure 4.2.14-3 shows the low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in spring for the entire state. In winter in the majority of the region, precipitation will increase by 10 percent and in the southern most portion of the region, there is no expected increase in precipitation. However, there are no expected increases in precipitation in summer or fall other than fluctuations due to natural variability for the entire state of Illinois (USGCRP, 2014b).

Figure 4.2.14-4 shows that if emissions continue to increase, winter precipitation could increase as much as 20 percent over the period 2071 to 2099. In spring, precipitation in this scenario could increase as much as 20 percent in the majority of the region with an increase of up to 30 percent in the northernmost portion of the Dfa region of Illinois. Summer precipitation is anticipated by 10 percent. There is no significant change to fall precipitation is anticipated over the same period (USGCRP, 2014b).

Cfa – Precipitation changes for the Cfa region in spring, summer, and fall are consistent with projected changes for the Dfa region of Illinois in a low GHG emissions scenario.

Under a high emissions scenario, precipitation will increase in winter and spring at the same rate as the Dfa region. In summer for the Cfa region, precipitation will decrease by 10 percent. There are no anticipated changes in fall precipitation in a high emissions scenario.

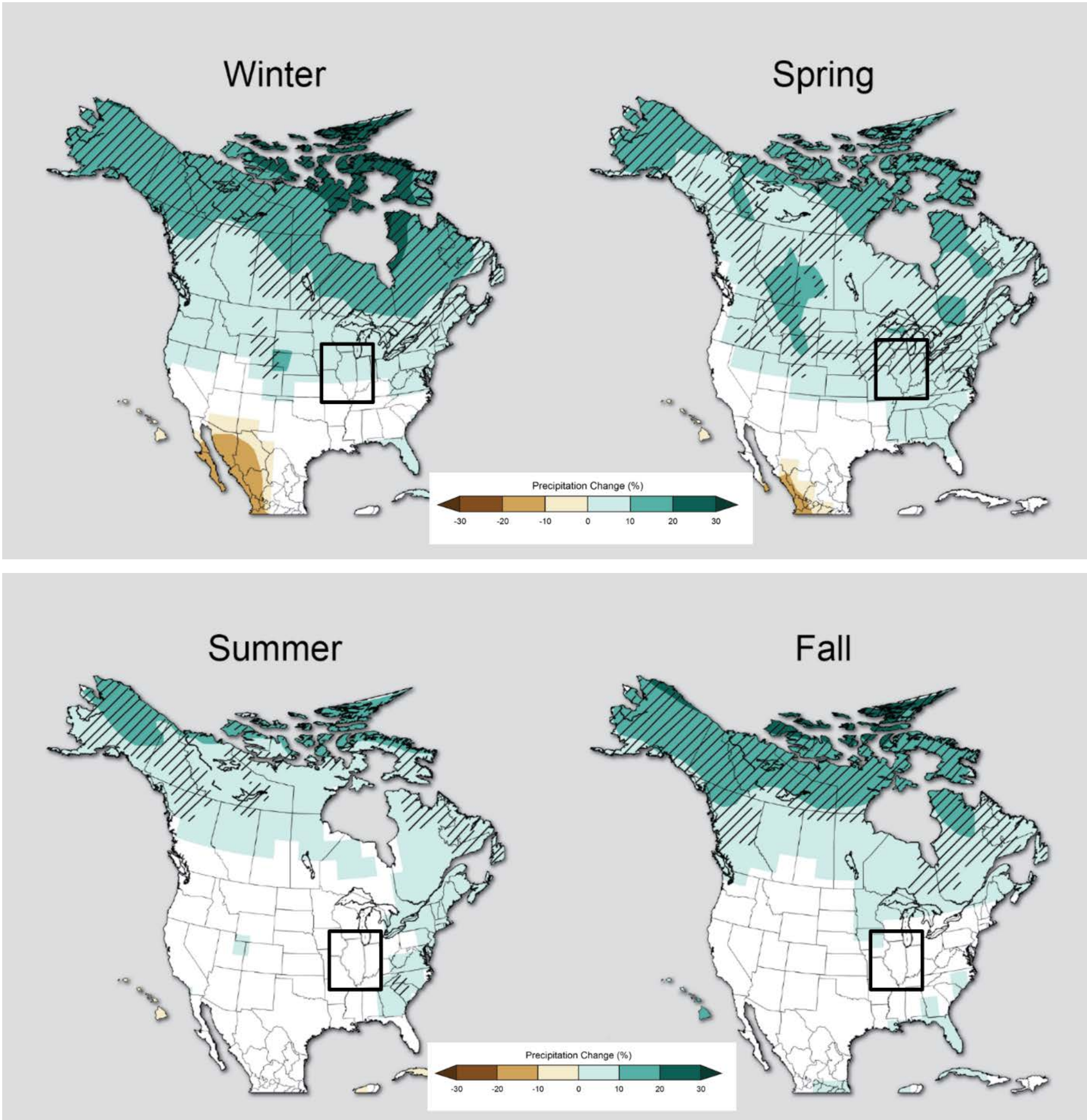


Figure 4.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

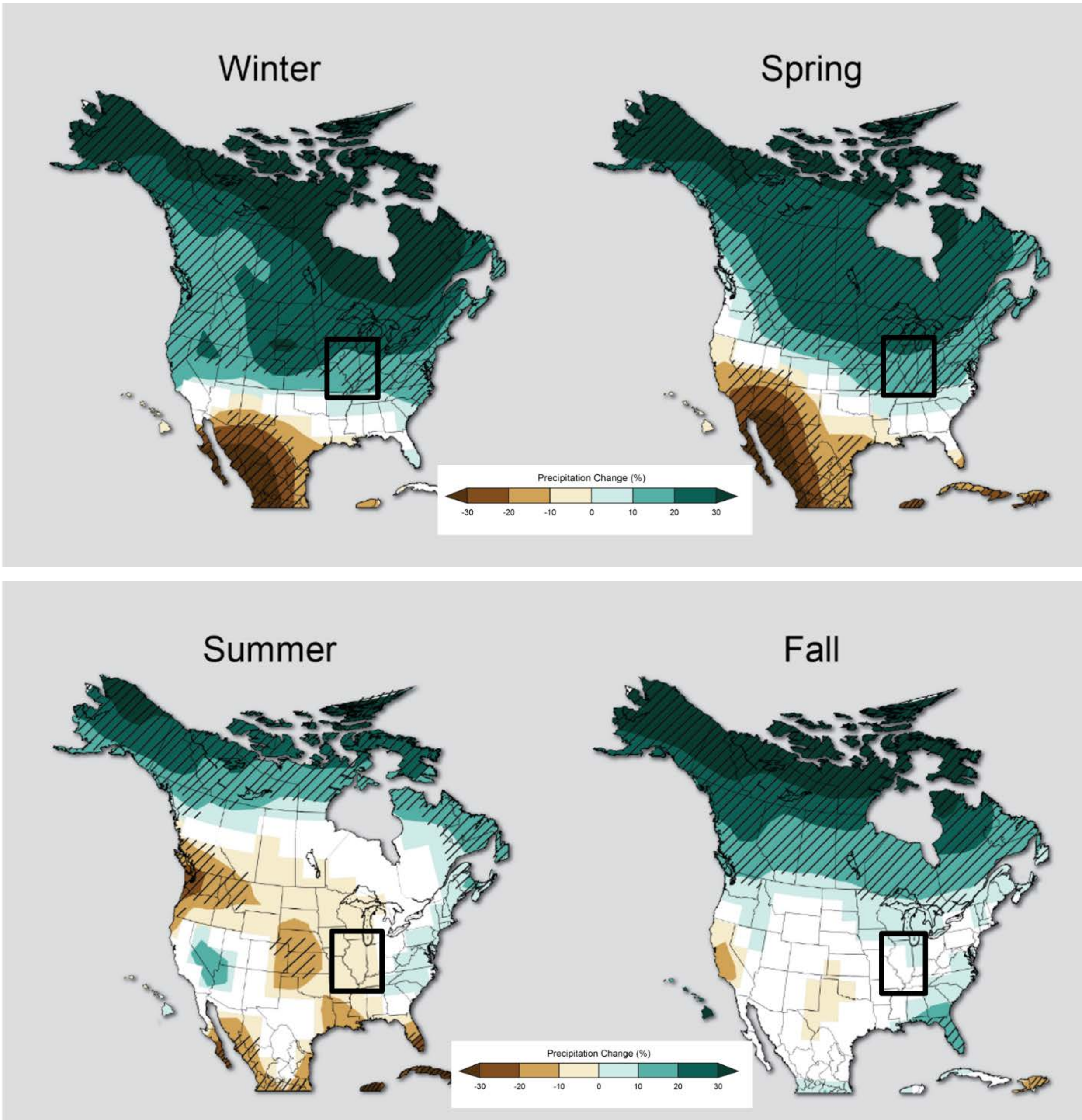


Figure 4.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

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)

4.2.14.4 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 4.2.14-1, 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, 2015i). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than on-site provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs/MWh (USEPA, 2015r), the same transmitter would be responsible for approximately 271 MT of CO2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison, optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may expose areas of Illinois increased intensity and duration of heat waves (USGCRP, 2014d) particularly in large population centers with the significant urban heat islands such as Chicago that would greatly magnify these effects and increase the morbidity and mortality associated with these events (Chicago Climate Task Force, 2015). Climate change is also expected to raise the temperature of the Great Lakes and other water bodies, making them more vulnerable to harmful algal blooms (USEPA, 2015e).

Impact of Climate Change on FirstNet Installations and Infrastructure

For areas of Illinois at risk for flooding, climate change is projected to increase the frequency and severity of torrential downpours, which in turn may increase the potential for flash floods (USGCRP, 2014d). This could negatively impact FirstNet infrastructure as well as magnify the extent and gravity of flood-related disasters. Extended periods of extreme heat may increase general demand on the electric grid, impede the operation of the grid in the Midwest region (DOE, 2015), and overwhelm the capacity on-site equipment needed to keep microwave and other transmitters cool.

4.2.14.5 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 Illinois, 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:

- Wired Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with

these projects would arise from use of machinery and vehicles to complete these activities. .

  - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and backup), 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 backup), 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.

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. Land use emissions occur as a result of soil disturbance and loss of vegetation. 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.

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 from the project, while adaptation refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

4.2.14.6 Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Potential Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Potential Operations Impacts

Implementing land-based deployable technologies (COW, COLT, and SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet 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. 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 4.1.14, Climate Change.

4.2.15 Human Health and Safety

4.2.15.1 Introduction

This section describes potential impacts to human health and safety in Illinois associated with deployment of the Proposed Action and Alternatives. Chapter 19 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

4.2.15.2 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 4.2.15-1. As described in Section 4.2, 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 are presented as a range of possible impacts.

Table 4.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, Toxic Substances Control Act (TSCA), EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And 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

4.2.15.3 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 4.2.15-1 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, the OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015c).

1. Engineering controls;
2. Work practice controls;
3. Administrative controls; and then
4. Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[170] 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

[170] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (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, 2015c). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015c). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure.

The Illinois Department of Labor and Industry (IDOL) is authorized by U.S. OSHA to administer the state program, which oversees employee safety in all state and local government workplaces. The FirstNet Proposed Action and site work will not be performed by state or local employees. The involvement of state and local employees will be limited to emergency responders (e.g., police, fire, emergency medical transporters, etc.) and local government permitting authorities. IDOL is authorized by OSHA to administer the state program, which oversees employee safety in all state and local government workplaces. The FirstNet Proposed Action and site work will not be performed by state or local employees. The involvement of state and local employees will be limited to emergency responders (e.g., police, fire, emergency medical transporters, etc.) and local government permitting authorities.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. 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 4.2.15-1, 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, through the Illinois Environmental Protection Agency (IEPA), or through an equivalent commercial resource.

By screening sites for environmental contamination and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable Illinois 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, IEPA 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 4.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

4.2.15.4 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 could require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines would require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore or the banks of water bodies that accept the 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 dangerous environments (road ROW, work over water, historic environmental contamination, and mine lands), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of this infrastructure could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure to hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 19, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 19, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

4.2.15.5 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 be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 19, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. 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 4.2.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AERO	Illinois Division of Aeronautics
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
ATSDR	Agency for Toxic Substances and Disease Registry
BCCS	Bureau of Communication and Computer Services
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BTOP	Broadband Technologies Opportunity Program
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CDA	Chicago Department of Aviation
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	Methane
CIMC	Cleanups in My Community
CIO	Chief Information Officer
CMAP	Chicago Metropolitan Agency for Planning
CMS	Illinois Department of Central Management Services
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
COW	Cell On Wheels
CRS	Community Rating System
CTA	Chicago Transit Authority
CWA	Clean Water Act
DoD	Department of Defense
DOE	Department of Energy
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EJ	Environmental Justice
EJSCREEN	USEPA Environmental Justice Screening Tool
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act

Acronym	Definition
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highways Administration
FLM	Federal Land Manager
FR	Federal Register
FRA	Federal Railroad Administration
FSRS	Federal Site Remediation Section
FSDO	Flight Standards District Office
FSS	Flight Service Station
FTA	Federal Transit Authority
GAO	Government Accountability Office
GHG	Greenhouse Gas
GPO	Government Printing Office
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IAC	Illinois Accessibility Code
IAR	Illinois Administrative Rule
IBA	International Birding Area
ICC	Illinois Commerce Commission
ICS	Illinois Compiled Statutes
IDA	Illinois Digital Archives
IDCEO	Illinois Department of Commerce and Economic Opportunity
IDNR	Illinois Department of Natural Resources
IDOL	Illinois Department of Labor
IDOL-SEID	Illinois Department of Labor, Safety, Inspection, and Education Division
IDOT	Illinois Department of Transportation
IDPH	Illinois Department of Public Health
IDPR	Illinois Department of Parks and Recreation
IEMA	Illinois Emergency Management Agency
IEPA	Illinois Environmental Protection Agency
IFC	International Finance Corporation
IFERN	Interagency Fire Emergency Radio Network
IFR	Instrument Flight Rules
IHPA	Illinois Historic Preservation Agency
IIPD	Illinois International Port District
IL	Illinois
ILCS	Illinois Compiled Statutes
IMH	Institute of Maritime History
INAI	Illinois Natural Area Inventory
INHS	Illinois Natural History Survey
IOS	Illinois Ornithological Society
IPCB	Illinois Pollution Control Board
IPCC	Intergovernmental Panel On Climate Change
IPPDA	Illinois Insect Pest and Plant Disease Act
ISGS	Illinois State Geological Survey
ISP	Illinois State Police
ISPERN	Illinois State Police Emergency Radio Network
ITECS	Illinois Transportable Emergency Communications System

Acronym	Definition
IWAP	Illinois Wildlife Action Plan
LBS	Locations-Based Services
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MDIC	METCAD Digital Interoperable Communications Environment
MDW	Midway International Airport Code
MHI	Median Household Income
MLI	Quad City International Airport Code
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
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NICTD	Northern Indiana Commuter Transportation District
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
NSF	National Science Foundation
NTFI	National Task Force On Interoperability
NTIA	National Telecommunications and Information Administration
NWF	National Wildlife Federation
NWI	National Wetlands Inventory
NWP	Nationwide Permits
NWR	National Wildlife Refuges
NWS	National Weather Service

Acronym	Definition
OBA	Office of Brownfields Assistance
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OMC	Outboard Marine Corporation
ORD	O'Hare International Airport Code
OSH	Occupational Safety and Health
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
PIA	Downing-Peoria International Airport Code
PM	Particulate Matter
POP	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetland
PUB	Palustrine Unconsolidated Bottom
R&D	Research and Development
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
SCIP	Statewide Communications Interoperability Plan
SCUBA	Self-Contained Underwater Breathing Apparatus
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SDS	Safety Data Sheets
SGNC	Species in Greatest Need of Conservation
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SOX	Oxides of Sulfur
SPL	Sound Pressure Level
SRS	Statewide Radio System
SSL	South Shore Line
STARCOM21	State Radio Communications for the 21^{st} Century
SUA	Special Use Airspace
SWPPP	Storm Water Pollution Prevention Plan
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TPY	Tons Per Year
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act

Acronym	Definition
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UCP	Unified Command Post
UHF	Ultra High Frequency
UIE	University of Illinois Extension
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USDOI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
WCS	Wetlands Classification Standard
WWII	World War II

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